DALTONIANA

NEWSLETTER
OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

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LITERATURE SURVEY

Color vision mechanisms in monkey striate cortex : dual-opponent cells with concentric receptive fields, by Ch. R. MICHAEL (Department of Physiology, Yale University School of Medicine, New Haven, Conn. 06519 USA) Journ. of Neurophysiol. 41/3, 572-588, 1978.

The author used tungsten microelectrodes for recording from single cells in the monkeys visual cortex. Of the four classes of color-coded cells present in the primate striate cortex those having concentric receptive fields with one red-green opponent color system in the field center and the opposite organization in the surround were investigated. The dual-opponent neurons are most sensitive to simultaneous color-contrast conditions. The cumulative evidence from the numerous and very interesting experiments indicates that the concentric cells appear to receive direct geniculate inputs and, therefore, represent the first cortical stage in the integration of color and color-contrast information. - Ingeborg Schmidt.

Color vision mechanisms in monkey striate cortex : simple cells with dual opponent-color receptive fields, by Ch. R. MICHAEL (Department of Physiology, Yale University School of Medicine, New Haven, Conn. 06510, USA), J. Neurophysiol. 41/5 1233-1249, 1978.

In continuation to the experiments on the chromatic and the spatial properties of single cells in the rhesus monkey's striate cortex (see preceeding abstract), it was found that the single cells have receptive fields consisting of a central rectangular area containing one red-green opponent color system and two parallel antagonistic flanks with the reverse opponent-color organization. The green-sensitive and red-sensitive cone processes underlying the on-and the off- responses had peaks at 520-540 nm and 575-580 nm. The cells are probably involved in the perception of simultaneous color-contrast phenomena and may have some relationship to the McCullough effect. The orientation selectivity of a cell to colored bars was caused by the

antagonistic interaction between cones with the same spectral properties but with different spatial positions in the receptive field. The simple cells were always activated by the contralateral or the ipsilateral eye only. The distribution of the simple cells was limited almost exclusively to the three subdivisions of layer IV. The study indicates that the simple cells are the second stage in the cortical integration of color. - Ingeborg Schmidt.

Color-sensitive complex cells in monkey striate cortex, by Ch. R. MICHAEL (Department of Physiology, Yale University School of Medecine, New Haven, Conn. 06510, USA) J. Neurophysiol. 41/5, 1250-1266, 1978.

The cells in the rhesus monkey's visual cortex described in this paper were color-sensitive complex neurons, responding only to moving monochromatic bars or edges of light. Stimulus width was critical, not the length. The spectral sensitivity curves obtained with monochromatic background were similar to the absorption spectra of the monkey's green sensitive or red sensitive cones. Most complex cells were driven by both eyes. Nearly all of the complex units were found in layers II, III, V and VI. The multiple-unit recordings support the theory that the complex cells receive direct synaptic contacts from the dual opponent-color simple cells studied earlier and that the complex neurons are the third stage in the cortical integration of color information. - Ingeborg Schmidt.

Spatial processing of luminance and color information, by R.L. DeVALOIS (Department of Psychology, University of California, Berkeley, California, USA) Invest. Ophthalm. a. Visual Science, ARVO Symposium Abstract, 17/9, 834-835, 1978.

The general conclusions are that cortical cells can more accurately be described as two-dimensional spatial-frequency filters than as bar or edge detectors and that the spatial information coming from color and luminance variations is processed similarly, but over different spatial-frequency ranges. Color information is mainly present in the visual system at lower spatial frequencies and plays an important role in object perception. Luminance variations are analyzed mainly over the middle-to-high spatial frequency range and play a role in object perception and also in perception of fine details within objects. - Ingeborg Schmidt.

Visibility of chromatic flicker upon spectrally mixed adapting fields, by C.E. STERNHEIM, C.F. STOYMEYER and M.C.K. KHOO, Vision Res. 19, 175-183, 1979.

Flicker thresholds are reported for a number of temporal frequencies, up to 12 Hz in the presence of a chromatic adapting field, either red or green. Below 4 Hz for the case of a green light added to a flickering red field, the threshold was reduced, indicating a cancellation. For higher flicker rates the additional field elevated the threshold, showing additivity. Dichoptic presentation failed to produce the effect indicating a peri-

pheral mechanism at work. For the 12 Hz modulation spectral sensitivity curves were obtained for ₸ 4 and ₸ 5 using Stiles' classical isolation technique. These functions were used to estimate the flicker sensitivities of the red and green mechanisms for 12 Hz, which were found to be similar, agreeing with the majority of previous investigations of temporal M.T.F. The results indicate that more than one cone type must be controlling the state of adaptation in the visual system used for detection of low frequency flickering stimuli. A discussion on the role of colour-opponent channels in detection follows. - Janet Voke-Fletcher.

Metric of color borders, by R.W. RODIECK (Department of Physiology, University of Sydney, Sydney, New South Wales 2006, Australia) Science 197 No. 4309, 1195-1196, 1977.

Tansley and Boynton (Daltoniana no. 26, p. 1, 1976) had demonstrated that the distinction of the border between two colors as judged by normal subjects is about the same as that judged by tritanopes. Thus blue cones make little if any contribution to the distinctness of color borders compared with green and red cones. Available evidence suggests that a one-dimensional representation of the colors along a line is sufficient to adequately characterize the distinctness of color borders. In final remarks B.W. Tansley and R.M. Boynton agree with Rodieck's conclusion. They refer also to reports by Valberg and Tansley (not yet published). Assuming that the mechanisms responsible for the perception of chromatic borders in normal observers should be similar to the one that controls color vision more generally for the tritanope, a "tritanopic purity difference function" was calculated. The absolute value of the tritanopic purity difference (Δp_1) was calculated for each pair of spectral lights used to generate a chromatic border and compared with the visual distinctness ratings that 3 observers gave to the borders formed by the opposition of pairs of these spectral lights. - Ingeborg Schmidt.

Opponent hues in visual masking, by M. GAMBLE (Simon Fraser University, Burnaby, British Columbia, Canada), Percept. Motor Skills 46, 979-983, 1978.

The subjects were 5 males with normal visual acuity and normal color vision. The stimuli were presented on a three-channel tachistoscope and timer. The luminance of all stimulus fields was equated. After the subject was dark adapted for 20 min he was asked to identify the exposed letter A, T or U of the hues red, green, yellow and blue at the predetermined exposure duration with the added complexity of a red, green, yellow or blue masking stimulus of 200 msec duration. The interval between test and mask stimulus was 20 msec for both conditions : when the test stimulus was followed by the mask stimulus (backward sequence) and when it was preceded by the masking stimulus (forward sequence). Results indicate that in the backward sequence a greater masking effect occurred

when the stimuli were of non-opponent hue pairs (R-Y, R-B, G-Y, G-B) than when compared with opponent hue pairs (R-G, Y-B). For the forward sequence the masking effect was reduced in comparison to the backward sequence. The findings appear to reflect the presumed temporal and spatial antagonistic qualities of opponent hue processes as postulated in the Hering model of color vision. - Ingeborg Schmidt.

Heterochromatic additivity and the acuity response, by S. GUTH and B. GRAHAM (Indiana U.), Vision Res. 15 (2), 317-319, 1975.

Experimental results in normal and protanopic Ss show that the sums of the component luminances for red-plus-green as well as red-plus-red mixtures were very near unity, and statistical analyses failed to reveal any nonadditive effects. Results suggest that Abney's law is appropriate for predicting visual acuity judgments and that spatial resolution is mediated primarily by the non-opponent mechanisms. -Patrice M. Dunn.

Complementary afterimages and the unequal adapting effects of steady and flickering light, by I.M. LOOMIS (Department of Psychology, University of California, Santa Barbara, California 96106, USA) J. opt. Soc. Amer. 68/3, 411-416, 1978.

A monocularly observed match was established between a complementary afterimage, produced by a steady left adapting field and that produced by the right adapting field, flickering at 4 Hz. Only the afterimages persisting beyond the initial 15 s of the post-adapting interval were matched. The results indicate that in all cases a steady adapting exposure is more effective in producing an afterimage. If left and right adapting fields were equated in average retinal illuminance the left afterimage would always appear more saturated. A steady field having an average retinal illuminance of only 0.05 times that of the flickering field gave rise to an equally saturated afterimage. The results are taken as evidence that complementary afterimages produced by extended moderate intensity exposures are primarly a consequence of neural adaptation. - Ingeborg Schmidt.

A study of foveal tritanopia, by S.R. COBB and M.R. Mc CROSKAN, Perceptual and Motor Skills, 46/3 (Part 2), 1319-1327, 1978.

When luminosity functions for large (2° 12') and small (12.5') foveal test fields were compared, a sex related difference was noted. Decreasing field size enhanced long wavelength sensitivity for males, and depressed sensitivity to wavelengths between 550 and 600 nm for females. In addition, there was less inter-subject variability for females than for males. - Gary L. Trick.

Primate cone sensitivity to flicker during dark and light adaptation as indicated by the foveal local electroretinogram, by W.S. BARON, R.M. BOYNTON and D. VAN NORTEN, Vision Res. 19, 109-116, 1979.

In an attempt to investigate how the transient threshold elevation in the dark adaptation curve relates to the steady state threshold and correlate electrophysiological findings with sensory perception, the foveal local electroretinogram was measured in primates using sinusoidal temporally modulated stimuli between 5 and 50 Hz. It was considered that the late receptor potential of the long and middle wavelength sensitive cones were most likely to be determining the response sensitivity measured. Threshold versus intensity curves were obtained for the range of frequencies. The recovery function was an exponential at high frequencies, but between 5 and 20 Hz the curve obtained was not so described. The results are discussed in both psychophysical terms and the photopigment regeneration processes. - Janet Voke-Fletcher.

Effect of chromatic uncertainty on detectability of a visual stimulus, by D.S. GREENHOUSE and Th. E. COHN (School of Optometry, University of California, Berkeley, California 94720, USA), J. opt. Soc. Amer. 68/2, 266-267, 1978.

The observer fixated the superposition of green and red light emitting diodes, which appeared yellow and was seen at the center of a rectangular, photopically illuminated background. The luminances of the diodes were matched photometrically. The two possible stimuli were a red-shift and a green-shift stimulus nearly equally detectable and subjectively equally visible. There were three separate detection experiments : 1) with a red-shift stimulus 2) with a green-shift stimulus and 3) either stimulus could occur as determined at random by computer. In the forced-choice experiments the observer decided in which of two temporal intervals a color shift had occured. For all three subjects detectabilities were approximately equal in the two certainty conditions. Under condition of uncertainty (third experiment) for all subjects detectability was less than under certain conditions. Refering also to previous results the authors conclude that human vision is affected by stimulus parameter uncertainty, whether spatial, temporal or chromatic, consistent with the prediction of the theory of signal detectability. - Ingeborg Schmidt.

Accommodation and color, by W.N. CHARMAN and J. TUCKER (Department of Ophthalmic Optics, University of Manchester, Institute of Science and Technology, Manchester M60 IQD, England), J. opt. Soc. Amer. 68/4, 459-471, 1978.

Previous studies of the effects of color on the accommodative response are reviewed, including experiments on color deficients : E.F. Fincham (J. Physiol. 121, 570, 1953) found that the accommodative mechanism for normal trichromats could respond to smaller targets if these were illuminated by a

mixture of red and green lights rather than by a monochromatic yellow whereas such an improvement was lacking in deuteranopes and protanopes. G.G. Heath (Amer. J. Optom. 33, 457-465, 1956) found absence of accommodative response in rod monochromats. In the present study the subjects (probably all normal trichromats) observed black Snellen letters at the center of a clear uniformly illuminated 18° circular background. The letters were viewed through a refractor head, the combination of target distance and refractor head lens power giving the required target vergence. The color of the target was varied by using combinations of color and neutral density filters. In all cases the effective luminance of the clear field was 10 $cd.m^{-2}$. A laser optometer system was used to determine the average level of accommodation under various conditions. The monocular steady-state response to targets was recorded. Trained observers change their level of accommodation when viewing a target at a constant distance, to compensate for the varying ocular longitudinal chromatic aberration as the color of the target is changed. Untrained subjects may show inconsistent responses. Differences in training and instructions given to the subjects may explain some discrepancies with the data of previous authors. Results in white and green are closely comparable. The ocular longitudinal chromatic aberration increases slightly with accommodation. The results are related to current ideas on the accommodative system. - Ingeborg Schmidt.

Accommodation and chromatic aberration in young children, by J.G. SIVAK and C.W. BOBIER (School of Optometry, University of Waterloo, Waterloo, Ontario, N2l 3G1, Canada), Invest. Ophthalm. 7/7, 705-709, 1978.

Static and dynamic retinoscopy was performed without filters and through Kodak Wratten filters No. 25 and 55 (dominant wavelengths of 615 nm and 530 nm, respectively) on 26 children between the ages of 2 and 6 years. The results indicate that the children may be divided into three groups : Type A children, 48 to 80 month, focus the red end of the chromatic interval when fixating at far and the green end when fixating at near with sparing of accommodation. Type B children, 40 to 61 month, show selective focusing of the red end of the chromatic interval at both far and near, that is they did not use the interval to spare accommodation. In type C, the youngest group (31 to 45 month), there is haphazard focusing within the chromatic aberration interval at far and near. The results suggest that the eyes use of the chromatic aberration interval to spare accommodation is learned by about the fourth year of life. - Ingeborg Schmidt.

Some remarks on refraction scotomata, in relation to eye chromatic aberration, by L. BARCA and R. PAOLETTI (Iª Cattedra di Clinica Oculistica dell'Università di Firenze, Carreggi, 50100, Florence, Italy), Atti Fond. G. Ronchi. 33, 750-758, 1978.

Both contrast threshold and absolute threshold were recorded using stimuli of different sizes at different eccentricities along the horizontal meridian of the nasal retina, varying the degree of out-of-focus blur while accommodation remained unaltered. Some findings, commonly found in the literature on refraction scotomata, are once more checked, such as the dependence of depth-of-field on both target size and retinal eccentricity, as well as the change in optimum dioptric correction as eccentricity increases. In the case of monochromatic targets, the expected "blue myopia" when the eye fixates at a red point was tested. In addition, the sensitivity of out-of-focus blur was found to be greater for red than for blue stimuli. The conclusion is drawn that in a perimetric test using colored targets it seems recommendable to give the patient a red fixation. Of course, this concerns the case where targets smaller than Ricco's area are used. For larger ones, sensitivity is known to be more-or-less independent of blur (within limits, of course!). Lucia Rositani-Ronchi.

On the colors seen in achromatic patterns, by N.J. WADE and R.H. DAY (University of Dundee, Dundee DD14HN, Scotland and Monash University, Clayton, Victoria 3168, Australia) Perception and Psychophysics 22/3, 261-264, 1978.

Temporally modulated achromatic patterns evoke subjective color sensations. It has also been reported that stationary achromatic patterns evoke a different color sensation in which shades of color are associated with specific contour orientations. This paper reports the results of experiments which examined the effect of the chromatic aberration, resulting from the regular astigmatism of the eye, on the color sensations evoked by the stationary achromatic patterns. The subjective colors reported were most frequently associated with the orientations which were out of focus (either due to normal astigmatism or the introduction of a cylindrical lens), and no relationship between particular colors reported and the orientation of the lines in the pattern was evident. These results support the hypothesis that the subjective color sensations evoked by stationary achromatic patterns are due to chromatic aberration.- Gary L. Trick.

Observed and calculated wavelength dependence of visual depth of field. A discrepancy, by A. SERRA (Cattedra di Ottica Fisiolopatologica dell'Università di Cagliari, Cagliari, 09100, Italy), Atti Fond. G. Ronchi 33, 806-809, 1978.

The distinction is stressed between dioptric depth of field and visual depth of field. The former increases with increasing wavelength, the latter shows an U-shaped trend. This effect is suggested to counteract the myopia induced by chromatic aberration of the eye at shorter wavelengths. - Lucia Rositani-Ronchi.

Rod and cone contribution to the EOG ratio, by A.J. AFANADOR and C.E. ANDREWS (School of Optometry, Indiana University, Bloomington, Indiana 47401, USA), Amer. J. Optom. a. Physiol. Optics 55/2, 101-107, 1978.

Using scotopically matched red and blue lights produced by red and blue Grass plastic filters of known transmittance, the authors found a 24% larger response to red light than to blue light for normal subjects. Thus they established that a cone contribution exists in the EOG ratio of normal subjects contrary to the previous belief that only rods are responsible for the EOG ratio. - Ingeborg Schmidt.

Anarchic versus random 100- ue responses, by L. BARCA and G. VACCARI (I. Cattedra di Clinica Oculistica dell'Università di Firenze, Careggi, 50100 Firenze, Italy), Atti Fond. G. Ronchi 33, 759-763, 1978.

The present report deals with 100-hue responses of some patients with acquired color vision deficiencies showing not well defined axis. We wonder whether such responses are the outcome of the overlap of Y-R and R-G defects or this of arranging the caps in a random fashion. For this, we applied the non-parametric runs test. For some subjects, the randomness hypothesis can be accepted for cap distributions across each box as well as for the response as a whole. For other subjects, on the other hand, the hypothesis of randomness is accepted for single boxes, or for the majority of them, but not for the response as a whole. However, to partition the caps into four boxes does not seem to represent a source of artifact : in fact, if the 85 caps are presented simultaneously, the subject being instructed to arrange them along a circle, the overall response results statistically distributed as in the case where the test is done in the conventional manner. - Lucia Rositani-Ronchi.

Influence of the colour temperature of the illuminant on the results of the clinical assessment of colour vision by means of pigment tests, Psycho-physiological concepts of colour vision (Influence de la température de couleur de la source d'éclairage sur les résultats de l'exploration clinique du sens chromatique à l'aide des tests à couleurs pigmentaires, Notions psycho-physiologiques de la vision des couleurs), par D. DUPUIS-LANGLE, Stencyled M.D. Thesis, Univ. of Marseille (France), 1978. 137 + VIII pages.

The author compared in normal subjects, and also in some subjects suffering from congenital and acquired colour vision defects, the results of Lanthony's desaturated panel, of the FM 100 hue test and of the Ishihara and AO HRR tests obtained on the one hand under 75 W Sylvania Brown Reflector E 27 spot lamps with a colour temperature of 2820 K, and on the other hand under 20 W Mazdafluor luxe daylight TFR 3E fluorescent lamps with a colour temperature of 6300 K, both installations providing on the desk the same illuminance of 2.00 lx. The

fluorescent illuminant was preferred because the normal results ranges were more restricted and because the pathological results were more clearcut.

The first 75 pages are devoted to the principles of colorimetry and colour vision. The author did no attempt in order to explain the differences of the test results under the two illuminants in terms of changes of the chromaticities of the used surface colours. - Guy Verriest.

The Besançon direct observation anomalometer (Anomalomètre à observation directe de Besançon), by C. REPIQUET, Stencyled M.D. Thesis, Univ. of Franche-Comté in Besançon (France), 1978. 54 + V pages.

The first part is an excellent review of the principles of the anomaloscopes of Maxwell, Rayleigh, Donders, Asher, Nagel, Jaeger & Schlaffer, Weale, Pickford-Nicolson, Goldmann, AN59, Moreland & Young, Moreland & Kerr and Richter. The second part is the full description and calibration of the fiber optics Besançon direct observation anomaloscope, that was already presented by Roth at the IRGCVD symposia and that allows, in its final version, reliable assessments of the Rayleigh and Trendelenburgh matches, and also of the spectral hue and saturation discrimination curves. The third part describes the practical aspects and the matches obtained in 10 normal, 2 deuteranomalous and 1 deuteranopic subjects, and also in single cases of iatrogenic poisoning, of diabetic retinitis and of retrobulbar neuritis. - Guy Verriest.

Experience with the Lovibond colour vision analyzer, by J.S. ENSELL (Research Division, Kodak Ltd, Headstone Drive, Harrow, Middlesex RA1 4TY, England), Color, Research and Application 3/1, 11-15, 1978.

When testing color vision with the Lovibond Colour Vision Analyzer (LCVA), to the subject is presented a circular array of colors surrounding a central neutral. He selects any colors which appear to match the central neutral and then the saturation of the chosen colors is increased until the subject can see a difference. The colors chosen and the saturation level at which the difference is perceived give a qualitative and quantitative diagnosis of the subject's color vision. A person has normal color vision if he selects only the neutral filter as a match. The test permits the diagnosis of protan, deutan or tritan deficiency and of its degree. It is simple to administer. The average duration is 3 min for normals and 7-12 min for subjects with defective color vision. 127 persons, 20 of those with color vision defects, were tested on the LCVA and the Ishihara plates. Agreement was good except that a tritan diagnosed by the LCVA could not be detected with the Ishihara plates and that the Ishihara test gives little information as to the extent of the defect. Such a comparison had been carried out before by S. Dain (A new colour Vision Test. Ph. D Thesis, The City University, London 1971). -Ingeborg Schmidt.

Blue cone function in a family with an inherited tritan defect, tested with electroretinography and psychophysics, by P. PADMOS, D. van NORREN and J.W. JASPERS FAIJER (Institute for Perception, Kampweg 5, Soesterberg, The Netherlands) Invest. Ophthalm. a. Visual Science 17/5, 436-441, 1978.

The subjects were 5 tritan-defectives, 1 male and 4 females, of a pedigree described by Went et al. (Mod. Probl. Ophthalm. 13, 272, 1974) with their defects ranging from mild to strong, but none of them a proven complete dichromat, and 10 subjects with normal response to the tritan color vision tests used, 9 men and one woman. The sensitivity of the blue cone system to low frequency flicker was tested with a psychophysical method alternated with ERG recordings in the same session, the subject constantly wearing the contact lens. With the psychophysical method the tritans showed no sign of the presence of the blue cone system. With the ERG the sensitivity was also significantly lower than in normal subjects thus indicating a retinal origin of the tritan defect. - Ingeborg Schmidt.

New linkage data for the X-linked types of muscular dystrophy and G6PD variants, colour blindness, and Xg blood groups, by M. ZATZ, S.B. ITSKAN, R. SANGER, O. FROTA-PESSOA and P.H. SALDANHA (Laboratorio de Genetica Humana, Instituto de Biociências, Universidade de Sao Paulo, Sao Paulo, Brazil) J. Med. Genetics 11, 321-327, 1974.

The sum of the lod-scores of nine families, in which Duchenne muscular dystrophy (D.M.D.) and G6PD or deutan colour blindness are segregating, indicates that the D.M.S. locus is far from the G6PD : deutan cluster. The lod scores of three families with Becker muscular dystrophy (B.M.D.) informative for the G6PD locus give a recombination fraction of 0.27; the 90% confidence limits are 0.17 and 0.40. This difference in linkage estimates for D.M.B. and B.M.D. with the colour vision locus suggests that the genes are located at two different loci on the X-chromosome. -E.A. Klasen/ L.N. Went.

A replacement model of X-linked recessive colour vision defects, by T.P. PIANTANIDA (The Inst. of Molecular Biophysics, Florida State University, Tallahassee, Florida), Ann. hum. Genet. 37, 393-404, 1974.

A model is presented which proposes as the underlying causes of the X-linked recessive red-green colour vision defects the production of cone photopigments with absorption spectra which are displaced in the visible spectrum relative to those of the normal cone photopigments. Displacement of the absorption spectra is under the control of the allelic series at the protan locus and at the deutan locus and determines both the spectral sensitivity and the colour confusions associated with each type of colour vision. The dominance order at both colour vision loci is explained in terms of the absorption spectra of the normal and anomalous cone photopigments of allelic heterozygotes. - The Author.

Congenital color defectives across young sardinian population, by A. SERRA, C. MASCIA, C. DESSY and R. CASTI (Cattedra di Ottica Fisio-patologica dell'Universita de Cagliari, Cagliari 09100, Italy) Atti Fond. G. Ronchi 33, 700-705, 1978.

A sample of 238 males and 226 females, ranging in age from 9 to 16 years, was tested by means of the Ishihara test and Farnsworth's Tritan Plate. The percentages of congenital defectives now found at Cagliari is much lower than that previously encountered at Sassari. The discrepancy is ascribed in part to age differences, in part to geographical factors within the island Sardinia itself. - Lucia Rositani-Ronchi.

Incidence of colour blindness in Mysore City (India), by D.B. SASTRY (South India Station, V.V. Mohalla, Mysore), Human Heredity 24, 194-197, 1974.

A total of 4987 children were tested with the Ishihara plates and the incidence of colour blindness in different endogamous population groups is given. The frequency of colour blindness among the males falls in the range of 1.77 - 8.00%. The proportion of protan to deutan is 1 : 2.67. Some not proven conclusions are drawn about the possible significance of the observed differences. - E.A. Klasen/L.N. Kent.

Report on the common concept and the method of color vision test by ophthalmologists referring to the color deficient at employment and school entrance, by Y. OHTA and S. KOGURE (Department of Ophthalmology, Tokyo Medical College, Tokyo, Japan), Folia ophthal. jap. 28/6, 879-881, 1977.

To the exclusion of those working for university or public hospitals, we have held inquiry by means of questionnaire in order to find out the test methods and the concepts ophthalmologists have in common referring to the color deficient at employment and school entrance.

One hundred and twenty ophthalmologists in Tokyo were subjected to our survey, with 97(80.08%) returns. (1) Of the color vision test referred to in the school hygienic requirement, 53.6% of the answers favored the revision. This percentage is higher than the last by approximately 2.6 times. (2) Of the color vision test, 81.9% favored such a way that the test should be carried out at the 1st year-grade and the 4th year-grade of the elementary school. While 80.0% favored such a way that the test should be carried out at the 1st year-grade of the elementary school, at the 1st year-grade of the junior high-school, and at the 1st year-grade of the senior high school. (3) Of school entrance, 62.8% returned a negative for science and medical courses, while 17.5% answered not being affected at all. Of employment, 61.4% answered in such a way that the color deficient should be screened out accordingly for proper job-assignment as a matter of course, while 4.1% not being affected at all. (4) Of therapy, 67.7% answered not making any sense at all, while 3.1% answered in such a way that because of no other way, therapy should be suggested. (5) Of color vision test chart, 100% of the

anwsers were found applying Ishihara charts, 55.6% Okuma charts and 51.5% TMC charts. (6) Of the use of an anomaloscope, 73.1% answered no, while 26% experienced. (7) There were found 17 ophthalmologists applying other methods than color vision test charts. They were found out applying mainly D-15, 40-hue and 100-hue. (8) Of the result from color vision test, 15.7% answered in such a way that qualitative judgement could be obtained, 11.5% that qualitative judgement could hardly be obtained, and 72.6% answered "so, so". Of quantitative judgement, 9.3% answered possible, 15,6% impossible and 75% so,so. (9) Of the total judgement of color vision test, 62.1% answered that they would follow the results from the test charts, while 37.8% answered that they would take degree for the final judgement. Those answered accounting for 80.4% stated that they would send the subjects for scrutiny check if it was hard to judge properly. (10) We can summarize the opinions and others in such a way as follows : "We want a standardized classification and degrees for judgement", "Standard of judgement is not accepted as a common concept", "Lack of practicability", "Rough judgement doesn't present any inconvenience, but good judgement is required at school entrance examination and employment." "We would send any patients to a university hospital if scrutiny check is required." - Yasuo Ohta.

Defectiveness of colour vision and school health, by M. MARUYAMA (Jin'ai Women's Junior College), Folia ophthal. jap. 28/6, 881-886, 1977.

Considering the social adaptability of the defectiveness of colour, it is most necessary to rectify our common ideas, and school health plays a great part in it. Then there are mainly two aspects of health service and health education, but the main points of it are an adequate physical checkup and the guidance connected with their lives. The test of the defectiveness of colour vision, which we call a screening test, ought to be adopted at the age of the fourth grade in the elementary school. If the defectiveness is detected, the guidance and the three grading minute examination are necessary. The following problems may be the urgent necessities : (1) Amendment of physical checkup provision. (2) Making preparation to receive minute examination, and (3) Making-up of a guide for colour vision-defectiveness.-Yasuo Ohta.

Color information in iconic memory, by W.P. BANKS and G. BARBER (Department of Psychology, Pomona College, California 91711, USA), Psychol. Rev. 84/6, 536-546, 1977.

Report on a series of experiments that give evidence of retention of information about color in very short-term visual memory commonly termed "iconic memory". The experiments show that the cones at photopic levels of illumination participate as fully in the post stimulus, iconic representation of a visual array as do the rods. - Ingeborg Schmidt.

Enhancement of chroma by the design of illuminants, by H. HEMMENDINGER (Hemmendinger Color Laboratory, Belvidere, New Jersey 07823, USA) Color, Research and Application 3/2, 89-92, 1978.

Computations reveal that the metric chroma (with other words "the colorfullness") of objects may be enhanced by appropriate design of the spectral distribution of the illuminating source. An illuminant of this type is the Thornton "prime-color lamp" (See also Daltoniana Nr. 5, p. 1, 1972). - Ingeborg Schmidt.

The preliminary examination-Part II : Color vision testing, by Th. GROSVENOR (Illinois College of Optometry, 3241 S. Michigan Ave., Chicago, Ill. 60616), Optometric Monthly 69/5, 149-156, 1978.

A short orientation about the color vision defects, faced by the optometrist in a workaday situation, their range, diagnosis and possibly counseling. - Ingeborg Schmidt.

ANNOUNCEMENTS

UNIVERSITY OF BRADFORD

Research Fellow in Visual Science

Applications are invited for a 2 year Post-Doctoral Fellowship for research on The Characteristics of Normal and Defective Colour Vision. The successful candidate will be attached to the new Chair in Visual Science and will work under the direction of Professor J.D. Moreland. It is hoped to make the appointment as soon as possible.

Salary within range £ 3883 - £ 6555 p.a. (under review). Superannuable.

Further particulars and application forms from the Registrar, University of Bradford, BD7 1DP, West Yorkshire, UK.

I should like to add that the appointment may be extended to three years. The Research Fellow would be expected to collaborate in some of my current activities which include : the completion of a large-field colorimeter designed particularly, but not exclusively, for work in the peripheral retina; the investigation of acquired colour vision defects; the use of optokinetic nystagmus as an objective means of investigating normal and defective colour vision.

A separate laboratory will be provided for the pursuit of independent research. The Research Fellow will also share in some undergraduate and postgraduate lectures.

J.D. Moreland.

ADVANCES IN COLOUR REPRODUCTION

Cambridge, 29-30.9.1980

This symposium is being organised by the Colour Group (Great Britain). It will be held at Churchill College, Cambridge University, England.

The programme will consist of one introductory invited paper and three specialist invited papers on photography, television and printing. These specialist papers will be followed by contributed papers. Dr. R.W.G. Hunt (Kodak Limited, Harrow, England) has agreed to present the introductory paper.

Offers of papers, which may deal with any aspect of the science and technology of colour reproduction by photography, television or printing, must be submitted to the Organising Committee, with two copies of an abstract of approximately 300 words, by 30 November 1979. The abstracts, which will be published as preprints, should not include any figures. They will be considered by the Organising Committee, who will be responsible for their acceptance and their grouping together. It is anticipated that 25 minutes will be allowed for presentation.

Abstracts of papers should be sent to : Dr. M.R. Pointer (Colour Group Symposium), Kodak Limited, Research Division, Wealdstone, HARROW Middx. HA1 4TY, UK.

ACTA CHROMATICA

Acta Chromatica is the official publication in English of the Color Science Association of Japan devoted to original papers on all aspects of the science of color and related subjects.

This publication is a very convenient way for you to keep up with the progress of color science in Japan. About five original papers in English by Japanese scientists and often an invited paper contributed by an eminent foreign color scientist appear in every issue (about 40 pages). Although manuscripts written in any major European language will be accepted, all of the back numbers happen to be in English.

The first issue was published in 1962. At present Acta Chromatica is scheduled to be published annually, and a total of 12 have been issued; Vol. 1, No. 1-5, Vol. 2, No. 1-5 and Vol. 3, No 1-2. Back numbers are available except Vol. 1, No 1 (sold out). We have presented reference copies to the Secretariat of your association.

If you would like to subscribe for the Acta Chromatica write to : Japan Publications Trading Co., Ltd.
P.O. Box 5030 Tokyo International, TOKYO, Japan.

The subscription rate is $ 7.00 a copy, but the cost of back numbers is $ 8.00 a copy. These rates include postage.

For more information, please contact Mr. A. Kodam, Secretary of CSAJ, c/o Japan Color Research Institute, 1-19, Nishiazabu 3 chome, Minato-ku, TOKYO 106, Japan.

ASSOCIATION INTERNATIONALE DE LA COULEUR (AIC)

The conference on "Colour Measurement and its Application", which was sponsored by the AIC as an interim meeting, took place in London on 3-4 October 1978 and were very well attended. The Executive Committee (EC) of the AIC had a business meeting on 2 October 1978, from which the following results have to be reported :

1. Study Group on Colour Education

The EC approved the terms of reference for a new study group on colour education and appointed Dr. Schanda as chairman. Terms of Reference : a. To collect information on the ways in which colour is taught in different countries to children, to students and to adults, including content, methodologies and demonstrations. b. To present the information collected in ways that would be helpful to teachers of colour.

2. Judd-AIC-Award 1981

The EC voted for Prof. Dr.-Ing. M. Richter to be the recipient of the Judd-AIC-Award 1981, which will be presented during Color 81 Berlin.

The Award for 1979 will be presented to Dr. G. Wyszecki during the AIC Midterm Tokyo Symposium 1979 in Tokyo on 16.-17. August.

3. Proposed Change of Statutes

The EC will present two proposals for change of article 7 of the statutes to the next delegates meeting at Berlin 1981.

A. Brockes, Secretary-Treasurer.

FIFTH INTERNATIONAL IRGCVD SYMPOSIUM

Strawberry Hill, June 26-28, 1979

FIRST AUTHORS OF THE PAPERS (please check)

Neuro-anatomy of colour vision processes : Stell (inv.), Marc (inv.), Sperling (inv.), Zeki (inv.), Djamgoz, King-Smith, Plouvier, Arecchi, Valeton, Mac Leod.

Colour vision at high luminances : Ruddock (inv.), Palmer, Pereira, A. Wright, Zwick (2 papers), Hansen, de Matiello, Leprince, Dain, Tánczos.

Colour vision in relation to other visual functions in clinical ophthalmology : Smith (inv.), Ruddock, Birch, Bowman, Lakowski, Robbins.

Methods of examination : Hill, Roth (2 papers), Dain (3 papers), Chta, Moreland, Fletcher (2 papers), Parra, Hukami, Velhagen, Tánczos, Arizaga, Obstfeld, Friedmann.

Congenital defects : Kröger (2 papers), Klingaman, Voke, Cobb, Pickford, Van Heel, Hill, Van den Merendonck, Yasuma.

Acquired defects : Carta, Vola, Lanthony, Scheibner, Robertson, Begg, Moreland, Serra, Lagerlöf, Cobb.

Practical aspects : Verriest (3 papers), Barca, Hill.

Various subjects : Werner, Drum, Waterfield, Schmidt, Hill, Weale.

(Papers collected by Ruddock, Moorfields papers and cancelled papers not mentioned).

Due to the number of papers offered it is not, regretfully, possible for papers to be presented "in absentia" : this was agreed at the IRGCVD general meeting in Parma.

The authors are requested to present explantory word slides with their talk to assist members whose first language is not English.

The preferred terms were previously published in Daltoniana.

Jennifer Birch - Guy Verriest.

The Fifth Symposium of the International Research Group on Colour Vision Deficiencies. June 26-28th 1979

St. Mary's College,
Waldegrave Road,
Strawberry Hill,
Richmond-upon-Thames.

HOW TO GET THERE

The nearest Southern Region Station (British Rail) is Strawberry Hill. The only bus which passes the College is number 270.

From Heathrow travel by one of the following routes :

1. Via the Underground network to Richmond and then either by bus 270 from the station forecourt or transfer to Southern Region train (same station-different platform) to Strawberry Hill.
2. Via service bus number 285 (from bus station outside Terminal 2) to Teddington and then by bus 270.
3. Via Greenline Express bus number 727 (from same bus station) to Teddington and then by bus 270.

From Central London travel by one of the following routes :

1. Via the Underground to Richmond and then either by bus or train as above.
2. Via Southern Region train from Waterloo via Clapham Junction to Strawberry Hill. (For departures from Victoria change at Clapham Junction).

From Gatwick Airport board the Southern Region train to London-Victoria but change at Clapham Junction for Strawberry Hill train.