DALTONIANA

NEWSLETTER

OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

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THE LAST PAGE OF THIS ISSUE IS THE CALL FOR PAPERS AND PRELIMINARY INSCRIPTION FORM FOR THE SIXTH INTERNATIONAL IRGCVD SYMPOSIUM IN WEST-BERLIN (17th-19th SEPTEMBER 1981)

6TH INT. IRGCVD SYMPOSIUM - BERLIN 1981

Robert M. BOYNTON (La Jolla, Cal., USA) accepted to give the invited lecture on the special theme "Spatial and temporal approaches for studying colour vision".

Egill HANSEN (Oslo, Norway) accepted to give the invited lecture on the special theme "Peripheral thresholds and chromatic discrimination in ophthalmological diagnosis".

André DUBOIS-POULSEN (Paris, France) accepted to give the invited lecture on the special theme "Pathology of the higher optic centers and colour vision".

Till now Peter GRÜTZNER (Darmstadt, BRD), William T. HAM jr (Richmond, Virginia, USA), J.D. MOLLON (Cambridge, UK), Alfred PINCKERS (Nijmegen, The Netherlands), Dirk VAN NORREN (Soesterberg, The Netherlands) and B.R. WOOTEN (Providence, Rhode Island, USA) accepted to participate to the panel discussion "Why is the blue mechanism more liable to acquired damage?", most of them asking to present a formal paper on this subject before the panel discussion.

It is stressed by the IRGCVD directorial committee :
(1) that no financial support from the IRGCVD is presented to the participants to the panel discussion;
(2) that all papers have to be announced to the general secretary before 1st february 1981;
(3) that the verbal presentation of the free papers will have to be as short as possible owing to the adjunction of the panel discussion and the need of more discussion time.

Guy VERRIEST.

LITERATURE SURVEY

Rod-cone interrelationships at light onset and offset, by Th.E. FRUMKES and G.R. HOLSTEIN (Department of Psychology, Queens College, The City University of New York, 11367, USA), J. opt. Soc. Amer. 69/12, 1727-1730, 1979.

All stimuli were presented to the right eye of the two observers by means of a four-channel Maxwellian view optical system (J. opt. Soc. Amer. 58, 1657, 1968). Once every four seconds a 512 nm test flash (15' diameter, 25 ms duration) was presented 7° in the temporal field along the horizontal meridian. The test flash (F_t) was superimposed on a concentric adapting flash (F_a) of 500 ms duration, and of 0.5 scotopic trolands (tds) illuminance, of either 512 nm or 655 nm wavelength and either 8° or 1° diameter. The photopic illuminances were 0.35 and 15 tds for the adapting flashes respectively. In a typical experimental session, lasting 1.5 to 2 hours, an adapting flash of one size and illuminance was employed. After 25 min dark adaptation, test and adapting flash were presented together at a given delay interval according to a randomized schedule. The observer then adjusted the test illuminance for threshold. Then another delay interval was set and the procedure repeated. F_t (on the ordinate) was determined as function of delay interval F_a-F_t (on the abscissa). Negative abscissa values indicate that the test flash preceded the adapting flash onset, positive values indicate that the adapting flash occurred first. With an 8° adapting field, with either wavelength, threshold begins to rise above control threshold at about -100 ms and reaches a maximum at about the +50 ms interval. About 100 ms before adapting flash offset (the +400 ms interval) test threshold begins to decline, approaching control levels at the +700 ms interval. With few exceptions both the 512 and 655 nm adapting flashes yield at 8° essentially the same data. To the extent that the 655 nm flash has an identical effect upon rods but much greater on cones than 512 nm flash these data strongly suggest rod-cone independence. At 1°, particularly at negative intervals, the 655 nm adapting flash has much greater influence upon rod threshold than the 512 nm flash. Near the offset of the flash this tendency is reversed. In summary the spatial constraints needed to obtain rod-cone interaction under steady adaptation levels apply to transient conditions of adaptation. The underlying mechanism for rod-cone interaction is qualitatively different for "on" and "off" channels. - Ingeborg Schmidt.

Extrafoveal spectral sensitivity during dark adaptation, by B. STABELL and U. STABELL (Institute of Psychology, University of Oslo, Oslo, Norway), J. opt. Soc. Amer. 70, 81-86, 1980.

The extrafoveal spectral sensitivity function was measured on the Wright Colorimeter at different intensity levels above the cone plateau of the long-term dark adaptation curve. A normal trichromat observed with the right eye through a 2 mm artificial pupil. A 7° circular adapting field was centered 7° temporally to the fovea. In flicker photometry tests the 1x1° colorimeter field was located 7° temporally. In heterochromatic brightness matching tests a bipartite field subtending 1x2° was observed 7° temporally to the fovea. In both tests wavelength, intensity and adaptation conditions were changed. - During most of the cone-plateau period of dark adaptation the spectral sensitivity function was found to be photopic in form at all intensity levels employed. In the dark-adapted state the two techniques appeared to measure different processes. The flicker technique yielded a spectral sensitivity function which was basically scotopic in form at all intensity levels employed while this function obtained with the brightness matching technique was basically photopic in form. It is suggested that the flicker technique appears to single out the rod activity while when the brightness matching technique is used, in a dark adapted state, both rods and cones contribute to the brightness response over the major portion of the spectrum for a long transitional intensity range. - Ingeborg Schmidt.

Stiles's π_5 color mechanism : tests of field displacement and field additivity properties, by C. SIGEL and E.N. PUGH Jr. (Department of Psychology, Northeastern University, Boston, Massachusetts 02115, USA), J. opt. Soc. Amer. 70, 71-81, 1980.

The π_5 color mechanism was isolated in two observers by measuring increment thresholds (in log quanta s^{-1} deg^{-2} of visual angle, incident on the cornea) with a 667 nm, 200 ms, 1.06° foveal test flash superimposed in the center of a 10.3° diameter monochromatic (410, 500 or 650 nm) or bichromatic (650 + 620 nm; 650 + 500 nm; 650 + 410 nm or 500 + 410 nm) adapting field. Each increment threshold curve was measured in the following way : 15 min dark adaptation, 5 min practice on the dark field, 2-2.5 min of threshold measurements on each of eight successively more intense fields. The data of both observers obey Stiles's field displacement law and exhibit no systematic deviations from field additivity. The "results cannot reject the hypothesis that the first log unit of adaptation observed under π_5-isolation conditions is determined exclusively by the quantum catch rate of the long-wavelength-sensitive cones." - Ingeborg Schmidt.

Blue-sensitive cones do not contribute to luminance, by A. EISNER and D.I.A. MacLEOD (Department of Psychology, C-009, University of California, San Diego, La Jolla, California 92093, USA), J. opt. Soc. Amer. 70, 121-123, 1980.

In order to distinguish changes in blue-cone contribution to luminance from changes in the red- and green-cone contribution a pair of tritanopic confusion wavelengths were employed as standard and test, 439 and 492 nm for a normal trichromat and 439 and 510 nm for a deuteranomalous, for measuring flicker photometry. The observer fixated centrally the 1.5° circular field in a circular violet background of 420 nm and of 7° diameter and about 0.1 td to 30 td luminance. He adjusted radiance of the test to eliminate or minimize flicker. Peak luminance of the 439 nm standard was 10 td, frequencies were 2 Hz, 10 Hz. If the blue cones were contributing in an additive fashion to luminance then the radiances of the midspectral test required to produce a null in flicker would decrease with increasing background luminance and with increasing frequency since the 439 nm standard would loose the extra effectiveness derived from its greater blue-cone contribution. The actual radiances required were independent of both background luminance and frequency, indicating a lack of any measurable blue cone contribution to luminance. The results show beyond reasonable doubt that the blue cones make no significant contribution to luminance as defined by flicker photometry. - Ingeborg Schmidt.

Spatial adaptation of short-wavelength pathways in humans, by C.F. STROMEYER III, R.E. KRONAUER and J.C. MADSEN (Division of Applied Sciences, Harvard University, Cambridge, Mass. 02138, USA), Science 207, No 4430, 555-557, 1980.

Stiles's two-color methods to separately stimulate different spectral classes of cones was used. The observer fixated in Maxwellian view monocularly an intense uniform field, 4° in diameter, of 560 nm (band-width 13 nm), 200,000 trolands. Red (632,8 nm) or violet (441,6 nm) sinusoidal gratings were superimposed over the entire adapting field. The red and violet pattern selectively stimulated the long wavelength π_5 and short-wavelenght π_3 mechanisms. The grating were generated as interference patterns directly on the retina with laser beams in polarization interferometers. For further details see the original paper. The results show that an adaptive pattern that selectively stimulates the short wavelength (blue) cones strongly elevates the threshold only for a grating test pattern that also selectively stimulates the same cones. - The experiments demonstrate that spatial and color-selective channels can be revealed with the technique of spatial adaptation. - Ingeborg Schmidt.

Blue-sensitive cones of the cat produce a rodlike electroretinogram, by E. ZRENNER and P. GOURAS (Max Planck Inst. for Physio. and Clin. Res., Bad Nauheim, BRD, and Columbia Univ. Coll. Physicians and Surgeons, 636 W 168th St., New York, N.Y. 10032, USA), Invest. Ophthal. 18, 1076-1081, 1979.

The authors use selective chromatic adaptation to isolate the blue-sensitive cone ERG of the cat. It does not resemble the middle-wavelength sensitive cone ERG but rather that of the rod ERG, suggesting anatomical and physiological similarities between blue-sensitive cones and rods. This might account for the vulnerability of these two receptor types in diseases of the external retinal layers. - James E. Bailey.

Shift of the Stiles-Crawford function peak with wavelength, by C. BOURDY (Laboratoire de Physique Appliquée, Muséum National d'Histoire Naturelle, 43, rue Cuvier, F75005, Paris, France) J. of Optics (Paris) 9/4, 205-215, 1978.

The author studied the relation between the Stiles-Crawford-effect I and wavelength. He used Stiles' classical optical setting which allows to introduce two controlled maxwellian view light paths and to make their entrance point in the pupil vary. Thus variations of the differential luminance threshold between two fields could be measured. The pupil of the observer was dilated. The location of the maximum efficiency point, regarded as the effective center of the pupil, shows variation with wavelength, as tested on seven observers for three wavelengths (470 nm, 536 nm and 653 nm). With regard to the pupils geometric center (C) the peak shift varies among subjects. The blue peak is almost alwqys nasal and the red peak either nasal or temporal with respect to C. The optical and dynamic factors of this variation are analyzed and the variation is interpreted with regard to horopter and stereoscopy, The correlation between the location of the red and blue peaks and horopters seems to confirm the part played in the pupil by the Stiles-Crawford function peak as a center of perspective crossed by the main visual line of sight. - Ingeborg Schmidt.

Bezold-Brücke phenomenon of the extrafoveal retina, by U. STABELL and B. STABELL (Institute of Psychology, University of Oslo, Norway), J. opt. Soc. Amer. 69/12, 1648-1652, 1979.

Up to now the Bezold-Brücke phenomenon has not been measured on the extrafoveal retina. The authors measured the luminance-dependent hue shift on a normal trichromat during the cone-plateau period and after 30 min dark adaptation employing a number of retinal illuminations within the medium intensity range and at different excentricities of retinal locations. The Wright colorimeter was arranged with one reflecting prism illuminating the 1°x1° test field observed extrafoveally and another prism illuminating the 1°x1° comparison field observed foveally. Test and comparison field were presented in succession using 0.5 s flashes. An artificial pupil of 2 mm in diameter was fixed immediately in front of the eye. The results indicate that both the rod and the cone mechanisms contribute to the luminance-dependent hue shift of the extrafoveal retina. - Ingeborg Schmidt.

Visual contrast sensitivity functions obtained with colored and achromatic gratings, by M.A. NELSON and R.L. HALBERG (Systems Research Laboratories, Inc. 2800 Indian Ripple Road, Dayton, Ohio, 45440, USA), Human Factors 21/2, 225-228, 1979.

Two subjects measured threshold contrasts for red, green and achromatic sinusoidal gratings. Red and green gratings were obtained by inserting Wratten Kodak filters No. 24 and No. 61. The space-average illuminance for all stimuli was 1000 trolands. Nine spatial frequency ranges were used, from 0.25 to 15 cycles/deg. The horizontal and vertical angular subtense of the gratings was 10° on a dark surround. All stimuli were presented in Maxwellian view. Contrast thresholds were determined by the method of adjustement. Contrast was changed by the addition of light from another channel and simultaneous reduction of light in the grating channel. A 1000 troland white blank field was inserted immediately after each threshold setting. No significant differences in contrast thresholds were found among the three gratings types. It was concluded that under conditions of normal viewing no significant differences should be expected in the aquisition of spatial information from monochromatic or achromatic displays of equal resolution. - Ingeborg Schmidt.

Color vision testing, by Th. GROSVENOR (Illinois College of Optometry, 3241 S. Michigan Ave., Chicago Ill. 60616, USA), The Journal of Optometry (New Zealand), June 1978, pp. 4-8.

The paper represents a review on inherited color vision anomalies, color vision tests, color vision counseling and acquired color vision anomalies. - Ingeborg Schmidt.

Vector model for normal and dichromatic color vision, by S.L. GUTH, R.M. MASSOF and T. BENZSCHAWEL (Department of Psychology, Indiana University, Bloomington, Indiana 47406, USA), J. opt. Soc. Amer. 70, 197-212, 1980.

The vector model described earlier (S.L. Guth and H.R. Lodge, J. opt. Soc. Amer. 63, 450-462, 1973) represented a linear transformation of the color mixture primaries but did not specify the receptor inputs to subsequent systems. A slightly revised version of the model which does have three cone receptors for its initial stage allows accounts of phenomena that involve receptor effects as well as dichromatic color vision. The model enables prediction of a wide range of data for both normal and all forms of dichromatic vision. Predictions for dichromatic vision include achromatic points and confusion loci, spectral sensitivity, heterochromatic additivity and wavelength discrimination. The problem of the color violet, which is missing in the model, remains a puzzle. - Ingeborg Schmidt.

Variation of deuteranopic blind fundamentals and the visual cone pigment erythrolabe, by A. KRÖGER-PAULUS and H. SCHEIBNER. (Physiologisches Institut II, Universität Düsseldorf, Düsseldorf, BRD), Ophthalmic Res. 12, 177-183, 1980.

The blind fundamentals and alychnes of nine deuteranopic observers have been determined. With their help, the spectral tristimulus function $\bar{b}(\lambda)$, $\bar{g}(\lambda)$, $\bar{r}(\lambda)$, based on the CIE 1931 Standard Colorimetric Observer were reduced to the spectral distimulus functions $\bar{k}(\lambda)$, $\bar{w}(\lambda)$ and the spectral luminosity function $\bar{l}(\lambda)$. The interpersonal scatter of the deuteranopic fundamentals was tested by means of the Kruskal and Wallis H test; the result was in accordance with Alpern's cluster hypothesis for visual cone pigments, in particular erythrolabe. - The Authors.

Uses of modified X-Chrom for relief of light dazzlement and color blindness of a rod monochromat, by H.I. ZELTZER (57 Grant Str., Waltham, MA 02154, USA), J. amer. opt. Assoc. 50/7, 813-816, 1979.

After listing the signs and symptoms of rod monochromasy and briefly mentioning contributions to the study of this abnormality the author describes a 16 year old female with obviously inherited rod monochromasy. Electroretinography manifested normal rod response to blue and red light stimulation with respect to amplitude and implicit time. No cone response was detectable in red light stimulation, also not to white light at 30 cycles p.sec. Dark adaptation testing demonstrated a normal final rod threshold. Color vision was tested with the Panel D-15, TMC and Ishihara test. In order to eliminate dazzlement, which was the chief complaint, the patient was fitted binocularly with red contact lenses, modified X-chrom lenses, to be worn outdoors. Indoors the contact lens was removed on the nondominant right eye to improve color discrimination. This caused red objects to appear darker than blue for the right eye and brighter than blue for the left eye. The patient benefits from alternate occlusion of one eye and also from retinal rivalry with both eyes open. - Ingeborg Schmidt.

A possible explanation as to why the newly sighted (person whose vision was restored after many years of blindness) commonly perform well on pseudo-isochromatic colour vision tests, by I.E. GORDON and D. FIELD (I. E. G. presently Dept. of Psychology, Univ. of Exeter, Devon, UK), Perception 7/1, 119-122, 1978. fig., 7 refs. - From "Sensory World".

Colour vision testing in specific industries and professions, by Janel VOKE. Published by Keeler Instruments Ltd. (Academic House, 24/28 Oval Road, London NW1 9ND), 1980, 45p. (big format), 17 tables, 22 fig.

This monograph is the result of the three year study on the industrial consequences of defective colour vision made by the author at the City University and supported by the Medical Research Council.

It is a work of paramount interest as it is largely based on colorimetric and performance field studies and it covers not only the (british) official colour vision requirements and (excepted traffic) the jobs for which colour vision defectiveness is already a well-known handicap, but also all professions in which colour plays a more or less important role, as ceramics industry, metallurgy/mining/heavy metal industries, jeweller/gemologist/diamond grader, medical/chemical laboratory analysis, medical/nursing and allied professions, paper making and printing industry, paint and printing ink manufacture, dyeing and textile manufacture and sales, engineering, cosmetics/beautician/manicurist/hairdresser/cosmetics director for stage, film, TV/cosmetics saleswoman, agriculture and horticulture, fine arts, food and drink industry, timber/furniture/tanning and allied trades, building materials industry. It is really the first time that we get exact (and actual) data for many of these professions. Among the many other sections of this monograph, this on "colour coding and the colour defective" is particularly interesting. If any, the only drawbacks are that the recommended colour vision requirements are set up only in terms of the results at the City University Test, and that the non english literature is merely ignored. In every way, this booklet is a "must" in the library of every colour vision specialist. - Guy Verriest.

Information transfer characteristics of moving light signals, by J. BERKHOUT (Department of Psychology, University of South Dakota, Vermillion, South Dakota 57069, USA), Human Factors 21/4, 445-455, 1979.

Eight different configurations and color combinations of rotating beam emergency vehicle lights were evaluated in terms of information converged about rate and direction of travel when viewed at night. The lights were viewed moving toward or away from the stationary observer at rates of zero, five and ten m/s at overall ranges of 300 to 450 m.

A total of 78 male subjects, ages 19 to 26 participated in these studies, all with substantial night driving experience. There was a tendency for the lights which gave the best results in judging direction of travel to give the poorest results in judging speed. All-red lights conveyed more information than combinations of red and blue lenses in the same light. Twin lights were superior to single beacons. When actually at rest, blue lights were seen as moving towqrds the observer more often than reds while the reds were more often seen as receding. This was most severe for a side-to-side alternate red flash pattern. The cues relevant to conspicuity appeared to be provided by changes in light intensity with distance rather than changes in angular displacement. - Ingeborg Schmidt.

Some effects of chromostereopsis on stereoscopic performance; implications for microscopes, by R.B. MATTAS, J.C. TOWNSEND and H.W. LEIBOWITZ (2021 Mock Orange Court, Reston, Virginia, 22091, USA), Human Factors 20/4, 401-408, 1978.

The subjects were 16 male students with at least 20/20 visual acuity and no colour deficiency as determined by the Dvorine pseudo-isochromatic plates. They were also tested for achromatic and chromatic stereoscopic acquity by the critical limen stereo test (Kraft et al. 1972). Chromostereopsis was measured as a function of interpupillary distance by adjusting two vertical chromatic stimuli in a modified Howard-Dolman apparatus. The stimuli were two vertical slits, one red (produced by a Wratten filter No. 47), of 1.88 x 30.1 min of arc viewed from 2.9 m distance. The photopic luminances were equated at 236.5 cd.m^{-2}. The subjects were instructed to change the position of the slits until they appared equidistant, by observing through a 2 mm artificial pupil. Further, the chromatic stereoperception was tested : 1) utilizing the standard interpupillary distance, 2) at the interpupillary distance at which red and blue appeared equidistant. Stereoscopic performance was found to be superior for achromatic as compared to chromatic stimulus materials when observing through small pupillary apertures. When interpupillary settings were predetermined to eliminate chromostereopsis, chromatic stereoperformance improved. A theoretical analysis of the results based on the discrepancy between optical and visual axis and centration of the pupil is presented. Suggestions are made for improved performance in microscope viewing of chromatic materials. - Ingeborg Schmidt.

Selective functions : Color Vision. (A bibliography with 181 abstracts) editor E.A. Harrison, February 1979, National Technical Information Service, Springfield, Virginia, 22161, USA.

The bibliography covers the period from 1964 to Jan. 1979 and supersedes previous editions (s. Daltoniana No. 30 p. 12). - Ingeborg Schmidt.

Color vision, An historical introduction, by G.S. WASSERMAN, John Wiley and Sons, New York, USA, 1978.

The study of colour vision is an interdisciplinary one and many famous scientists and philosophers have contributed to it. It is therefore disappointing that Professor Wasserman should have chosen for this review only those writings which support an idiosyncratic approach to the subject. As an historical introduction the text is disappointingly meagre. The book also fails as an intended introduction to the subject for non-specialists because it denies several basic principles, including trichromacy. The chapter on colorimetry is full of misconceptions, incorrect definitions and misuse of terminology. Although brightness enhancement and early microspectrophotometric research are given detailed treatment important recent work and the contributions made by densitometry and selective bleaching are ignored. The characteristics of defective colour vision are incorrectly stated and the sex linked inheritance of protan and deutan defects is denied. Great length is devoted to opponent and zone theories of colour vision but how these are linked to produce a composite framework for understanding colour vision processes is not clearly described. - Jennifer Birch.

James Clerk-Maxwell - 100 years later, by C. DOMB, Nature 282, 235-239 (Nov. 15, 1979).

Writing on his major contributions to science, respecting color vision :

To understand the theory of colour vision it is important to differentiate between the optical (or true) spectrum of a beam of light and the chromatic spectrum as seen by the eye. Beams of light with different optical spectra can have the same chromatic spectrum. Isaac Newton had shown that the optical spectrum of white light is very complex, but Thomas Young at the beginning of the nineteenth century proposed that any chromatic spectrum can always be analysed into three components coresponding to three receptors in the eye.

Maxwell's work on colour vision started when he was an undergraduate at Edinburgh and continued for many years afterwards. He chose red, green and blue as primary colours, and devised a colour top by means of which tinted papers of different colours could be mixed in varying intensities and the results determined. In this way he initiated "quantitative colorimetry", analysing every hue into its appropriate components. Maxwell made the important observation that Young's hypothesis works only if negative as well as positive contributions are allowed. He also suggested that colour blindness corresponds to the absence of a red-sensitive receptor, and devised a pair of spectacles to enable a colour blind person to differentiate between red and green.

He invented a colour box in which beams of light of different colours could be mixed in variable proportions to match any given hue. With this apparatus he was able to achieve great accuracy in his experiments to chart the colour response of different individuals, and to demonstrate that the colour discrimination of normal people is very good. - From "Sensory World".

Judd's contributions to color metrics and evaluation of color differences, by D.L. MacADAM (The Institute of Optics, University of Rochester, Rochester, New York 14627, USA), Color Research and Application 4/4, 177-193, 1979.

The contributions of D.B. Judd to colorimetry extended over five decades. He participated in efforts to improve the Munsell System. Judd and his coworkers established the ISCC/NBS color names system and compiled a dictionary of color names. Judd had stimulated and promoted the CIE system in particular. He directed his attention to color-mixture data and functions and their connection with the luminosity function. Some of his papers concern evaluation of color differences and uniform chromaticity scale diagrams. In collaboration with Yonemura (J. Res. nat. Bur. Stand. Sec. A, 74, 23-39, 1970 and Farbe 20, 142-150, 1971) he suggested a formula for chromaticity differences that enabled to predict the wavelength discrimination curves for normal observers, protanopes and tritanopes. - Ingeborg Schmidt.

Neo-impressionism : the most scientific of all schools of color in art, by F. BIRREN (184 Bedford Str., Stamford, Connecticut 06901), Color Research and Application 4/4, 200-207, 1979.

Only at the end of the 19th century artists began willingly to let the scientists in the field of physiological optics guide their thoughts, aims and efforts. The scientific revelations of such men as Maxwell and Helmholtz were introduced in France by O.N. Rood, chairman of physics at Columbia College, New York. They played an important role in color expression of the French neo-impressionists (pointillists). That in viewing small dots from a distance vision was limited chiefly to red and green with other colors appearing gray. B. explains as being due to tritanopia of the fovea. This was not know to the artists, although some art critics had noted the graying result from a distance. - Ingeborg Schmidt.

ABSTRACTS FROM THE EUROPEAN CONFERENCE ON VISUAL PERCEPTION

(October 15-16, 1979, Noordwijkerhout, The Netherlands)

(There will not be proceedings of this conference)

<u>Chromatic brightness for lights of constant luminance</u>, by S.A. BURNS, V.C. SMITH, J. POKORNY & A.E. ELSNER, (The University of Chicago, Chicago, Ill. 60637, USA).

We determined brightness for constant luminance chromatic stimuli varying in colorimetric purity in a 2° bipartite field. Observers adjusted the radiance of a white hemifield. For dominant wavelengths 680, 610, 590, 560, 530, 500, 470, 440, 410 nm, colorimetric purities were set at 0.0, 0.05, 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 0.9, 1.0 with illuminance (HFP) constant at 20 td. During each session stimuli were presented in two 45 trial blocks of fixed dominant wavelength : the first block contained low-purity (0.0-0.4), the second high purity (0.4-1.0) stimuli; within each block stimulus order was random. Between matches the testfield was extenguished and observers viewed an 8° white field of equivalent retinal illuminance for 12 sec. Pilot data indicated that blocked trials and white adaptation minimized significant long-lasting chromatic adaptation effects. Brightness increased as colorimetric purity increased but differed for different wavelengths. Brightness additivity failures of both the enhancement and cancellation types were evident. The variations may be represented as a surface of constant luminance, but varying chromatic brightness.

<u>Chromatic response : an optimal stimulus size and contrast</u>, by T.S. TROSCIANKO, (Dept. of Anatomy, University of Bristol, England).

The chromatic response is assumed to be an indicator of the relative degree of stimulation of the chromatic "channel" over the achromatic "channel". As such, it is the correlate of perceptual terms such as saturation. Psychophysical techniques were used to give chromatic response as a function of (a) the relative luminance of the centrally-fixated stimulus to an achromatic surround/adaptation field, and (b) the stimulus subtense, in the range 10'-10°. In (a), it was found that chromatic response is maximised at or near a brightness match with the surround. In (b), the findings were more unexpected : in surrounds of higher luminance, 1° fields evoke maximum chromatic response, higher than 2° fields. The implication is that achromatic response may be higher for 2° than for 1° stimuli, as well as dominating for small stimuli. This may be a clue to understanding the discrepancy between physiological and psychophysical findings on the receptive field sizes of chromatic and achromatic units.

Gain mechanisms in chromatic adaptation; the link with heterochromatic increment thresholds, by J. WALRAVEN, (Institute for Perception TNO Soesterberg, The Netherlands).

The selective gain changes that underly the effect of chromatic adaptation were studied by the method of maintaining a constant (yellow) hue of a test stimulus presented superimposed on red or green backgrounds of varying intensity. It can be shown that the compensatory hue shift (required for maintaining yellow) reflects the combined action of receptor-specific gain factors (von Kries coefficients) that increase with intensity according to the wellknown t.v.i. function, that is, the function $\xi(x)$ as tabulated by Wyszecki and Stiles (1967).

The results can be accurately described by assuming (1) cone spectral sensitivities as derived by Vos and Walraven (1971), (2) gain spectral sensitivities conform Stiles' π mechanisms (Stiles, 1953). This analysis was possible only by making allowance for the "discounting of the background" principle.

Contributions of chromatic channels to brightness, by H.-D. BAUER & C.R. CAVONIUS (Institut f. Arbeitsphysiologie, Dortmund, FRG).

1. Substantial evidence exists suggesting that signals that originate in chromatic channels of the human visual system can contribute to perceived brightness.

2. The difference between spectral sensitivity measured by means of flicker photometry and that measured by direct brightness matching was taken as a measure of the chromatic brightness.

3. Measurements of chromatic brightness as a function of purity show different degrees of essential non-linearity, depending on the dominant wavelength.

4. Our data for chromatic brightness are very similar to those obtained by Evans using a "zero gray" criterion. Both methods yield functions in color space, that may be interpreted as the matches made by different setsof neurones, which are specifically sensitive to zero-gray, equal luminance, and equal brightness.

Null coordinates for the opponent color channels, by S.A. BURNS, A.E. ELSNER, J. POKORNY & V.C. SMITH, (The University of Chicago, Chicago, Ill. 60637, USA).

Current opponent process theories postulate that color information is represented in two opponent channels (red-green and yellow-blue). Unique hues occur when one or the other channel is nulled so that its output does not modify color percepts. Neutral white occurs when both channels are nulled. For two observers we used the method of adjustment to determine null coordinates in color space for each of the opponent channels. 26 td circular fields of either 40' or 2° were presented within a dark surround. The null coordinates or unique hue loci are expressed as chromaticities in

Judd's revised chromaticity diagram. The null coordinates for the red-green channel were determinded using a variable short-wavelength light with one of several fixed desaturants (white, 571 nm spectral light, or the observer's spectral unique yellow). The null coordinates for the yellow-blue channel were established by varying chromaticity along lines connecting short-wavelength (450 nm or 470 nm) and long-wavelength stimuli (650, 590, 580, 570, 550 and 530 nm). Neither set of data is well fit by a single straight line on the Judd diagram.

Local excitation as a basic Principle of color coding, by J. PAULUS (Physiologisches Institut II der Universität Düsseldorf, Germany).

Color opponent curves can be calculated from trichromatic photoreceptor sensitivities by subtracting a local excitation E(C) from individual cone signals C :

$$H = k\,C - E(C),$$

where k is an arbitrary factor, chosen to force the zero crossing of the opponent curve H to occur at the proper wavelength.

A correlation with anatomical structures of the retina, in particular in the outer plexiform layer is possible : E(C) may well correlate with the so-called S-potentials. The concept of local excitation can explain the hue violet and certain physiological variabilities observed in single-unit experiments.

Furthermore, it is possible to demonstrate trichromatic and dichromatic color vision by varying only the retinal mosaic according to the missing cones in dichromatic vision.

Fundus reflectometry and visual pigment kinetics, by P. BAUCS (Institute for Perception TNO, Soesterberg, The Netherlands).

In the method of fundus reflectometry the reflected light from the ocular fundus provides a measure of the optical density of visual pigments. A complication herewith is that part of the reflected light has not been in contact with the pigment. This straylight causes an alinear relation between the so-called "double density" of the photometric wedge and the fraction of bleached pigment. In the literature about visual pigment kinetics this is often not recognized. Our experiments indicate that cone pigment density is between 0.4 and 1.1, and that the processes of pigment bleaching and regeneration deviate significantly from Rushton's "kinetic equation".

Task-s ecific increase of reaction time and partial neglect of bilateral hemifield stimuli in brain-damaged patients, by F. REISCHIES and C. HEESCHEN (Department of Physiology, Freie Universität, 1000 Berlin 33, Germany).

In patients with unilateral lesions in one cerebral hemisphere, reaction time experiments (Donders-C type) were performed. The visual stimuli were projected tachistoscopically and simultaneously to an area 2.6 degrees left and right of the fovea centralis. Four possible stimuli were a plied : a red or a green (blue) circle, a red or a green (blue) rectangle of 9.3 degrees^2 area. The left or the right or both stimuli were positive at random. The subjects had to respond with the hand ipsilateral to the side of the lesion. We carried out three experiments : (1) The positive stimulus was the colour (red) regardless of shape and regardless of whether the red stimulus was projected into the right or left hemifield. (2) The positive stimulus was the shape (circle) regardless of the colour and regardless of the side of the projection. (3) The positive stimulus was a green (blue) rectangle regardless of the side (i.e. colour and form entered the definition of the positive stimulus). Broca patients (left hemispheric anterior lesions) responded significantly slower to stimuli in the right visual hemifield when colour and shape had to be discriminated simultaneously (green rectangle) as compared to their response. to colour and shape alone as well as compared with the other groups (Wernicke aphasics, non-aphasics with right hemisphere lesions, normals). In all brain-damaged patients the probability of no-responses increased when colour and shape had to be recognized and the target was projected to the visual hemifield contralateral to the cortical lesion.

Improvement of visual functions by reduction of the adaptation level - paradoxical behavior of some patients with fundus dystrophies, by W. JAEGER & H. KRASTEL (University Eye Clinic, Heidelberg, West-Germany).

In some patients with presumed dystrophies of the photoreceptors, we found a saturation of visual mechanisms at considerably low adaptation levels. This resulted in a very distinct improvement of visual acuity by means of the use of tinted glasses. The underlying defect is discussed and analyzed employing psychophysical and electrophysiological techniques.

(collected by Guy Verriest).