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APPLIED VISION ASSOCIATION
10 KNARESBOROUGH PLACE
LONDON SW5 OTG
Tel: 0171-373-7765 Fax: 0171-373-1143

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email: I_MOORHEAD@dra.hmg.gb

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email: karen.carr@src.bae.co.uk

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email: J.P.Harris@reading.ac.uk

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Fax. 0116 257 7708
email: mscase@dmu.ac.uk

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Dr Barnaby Reeves, 72 Saint Mary's Road, Oxford,
OX4 1OB. Tel. 01865-250963
email: barney.reeves@bris.ac.uk

Dr Steve Taylor, 40 Pinewood Road, Ferndown,
Bournemouth, BH22 9RR. Tel. 01202 861480

AVA CORPORATE MEMBERS:

British Telecom Research Laboratories, Martlesham Heath, Ipswich,
Suffolk IP5 7RE. Contact: Dr D Travis.

Data Cell Ltd., Hattori House, Van Wall Business Park, Maidenhead,
Berks., SL6 4UB. Contact: Mr A Washbourn.

Institute for Human Factors TNO, P.O.Box 23, 3769 ZG Soesterberg, The
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House, 222 Balham High Road, London SW12 9BS.

Netherlands Ophthalmic Research Institute, Postbus 12141 1100 AC,
Amsterdam, The Netherlands. Contact: Dr T. J. T. van den Berg.

Pilkington Optronics, Glascoed Rd., St Asaph, Clwyd, LL17 0LL Contact:
Mr J. Foley.

Sowerby Research Centre, British Aerospace, P.O.Box 5, Filton, Bristol
BS12 7QW. Contact: Dr KT.Carr.

Deadline for copy for the next Bulletin - 21st February 1997

EDITORIAL

We now have a new title to this publication—The Bulletin of the Applied Vision Association. The reason for the change was because we are now publishing abstracts of all AVA meetings here and we wanted a title that would reflect this change. In this issue of the bulletin we have more details of AVA '97 and the abstracts of the highly successful meeting on Locus questions in Vision at Aston University. If you (or someone you know) would like to apply for some money from the Geoffrey Burton Memorial Fund then now is the time to act. Last of all, the AVA is selling books of some of its conferences at knock-down prices—see the piece later on. Remember that the latest information on the AVA is on our web site: <http://www.dmu.ac.uk/ava/>

If you have any comments on the Bulletin of the AVA then do contact me:
mscase@dmu.ac.uk

**AIM OF THE AVA: TO PROMOTE AND ADVANCE THE APPLICATION OF
RESEARCH WORK IN ALL AREAS RELATED TO VISION**



Noticeboard



AVA on the World Wide Web

The Applied Vision Association now has its own world wide web pages at:

<http://www.dmu.ac.uk/ava/>

The pages contain details of who is on the committee, contact emails, latest details on forthcoming AVA meetings and links to other vision related pages. There are also archives of abstracts from previous AVA meetings.

These pages (ie the Bulletin) are eventually published on the world wide web. However, we have deliberately avoided simultaneous publication in paper and electronically. The electronic version is available free to everyone. Therefore one might argue that it is not necessary to be an AVA member to benefit from information in the Bulletin. The AVA committee decided to put a delay in publishing the Bulletin electronically of at least 3 months. So if you want the latest information and the highly valuable reference list then you need to look at the paper version and subscribe to the AVA.

AVA and OPO Subscriptions

Membership for 1996/1997 is the same price as last year. However, the price for OPO subscriptions has increased slightly. Those members who pay by standing order please don't forget to amend your standing order accordingly.

Geoffrey J. Burton Memorial Fund

The fund was established in 1986 with the aim of providing financial assistance to students (in non-established or fixed term posts) based in the UK travelling to any conferences or meetings at which they will be presenting a paper or poster. Donations to the fund can be directed to the AVA secretariat and cheques etc. should be made payable to "The Geoffrey J. Burton Memorial Fund".

The maximum award to any one individual is £200.

Awards can be made for any conference in the calendar year in which the award falls (1997 in this case). You do not have to be presenting at an AVA conference. The awards will be made twice a year.

The closing dates for applications are:

28th February 1997

31st August 1997

To apply for an award you need to complete an application form which is available from:

The AVA Secretariat,
College of Optometrists,
10 Knaresborough Place,
London,
SW5 0TG.

Tel: 0171 373 7765

Fax: 0171 373 1143

AVA books for sale

The AVA has a number of new books for sale from conferences that it has organised over the years.

Payment can be by cheque or postal order in UK pounds (sorry, no credit cards) to "Applied Vision Association". Send your payment with the order to:

AVA Secretariat,
Applied Vision Association,
College of Optometrists,
10 Knaresborough Place,
London SW5 OTG.

Books available:

The cost for each book is £15 (including postage in the UK) for AVA members or £20 for non-AVA members. If you are outside the UK then add £5 per book to each of the prices above.

Gale, A.S., Astley, S.M., Dance, D.R. and Cairns, A.Y. (1994) **Digital Mammography**. Elsevier (424 pages).

Gale, A.S., Freeman, M.H., Haslegrave, C.M., Smith, P. and Taylor, S.P. (1988) **Vision in Vehicles II**. North Holland (420 pages).

Gale, A.S., Brown, I.D., Haslegrave, C.M., Kruyse, H.W. and Taylor, S.P. (1993) **Vision in Vehicles IV**. North Holland (355 pages).

Brogan, D., Gale, A. and Carr, K. (1993) **Visual Search 2**. Taylor and Francis (477 pages).

The cost of the Dalton conference book is £43 (including postage in the UK) for AVA members or £48 for non-AVA members. If you are outside the UK then add £5 per book.

Dickinson, C., Murray, I. and Carden, D. (1996) **John Dalton's Colour Vision Legacy**. Taylor and Francis (784 pages).

AVA '97

Image Quality

including the AVA Annual General Meeting

9th - 11th April 1997

University of Abertay, Dundee

Preliminary programme of speakers:

For more information contact Dr Malcolm Cook:
email m.cook@river.tay.ac.uk

Keynote Address

1) Image Quality
Andrew Watson (NASA Ames)

Industrial Papers

3) To be Announced
BASE, British Aerospace Systems and Equipment Ltd.

4) To be Announced
GEC Electroptics

5) To be Announced
Pilkington (Barr and Stroud)

Visually Based Performance

16) Tracking at Different Display Frequencies
M.J. Cook

17) Gaze Displacement with a Moving Visual Frame
M.T. Swanston, H. Pengelly and M.J. Cook

General

9) A Naive Approach to Visual Coding
R. Clement and I. Moorhead

9) To Be Announced
P. Thomson

10) Duration Neglect in Television Picture Quality Information
D. Hands, S. Avons, and J. Davidoff

12) Encoding Faces in Byte Sized Chunks
M.H. Maxfield

Spatial Vision

6) Evidence for the independence of first- and second-order vision
A.Schofield and M. Georgeson.

8) Spatial Interactions between motion and colour
M.O. Scase

Virtual Display Technologies

13) Image Quality Measurements for Evaluating Stereoscopic Display Performance
Arun Bhoopal

14) The Impact of Helmet-Mounted Displays on Visual Attention
A.M. Rohaly and R. Karsh, US ARL.

15) Methods of Assessing Presence, A Sense of Being There within a
displayed

J. Freeman, S.E. Avons and J. Davidoff

Clinical and Related Papers

20) Changes in Perceived Image Size after PRK Surgery

H.E. Ross, B.J. Craven and G. Whittaker

7) Defocus, Ocular Aberrations and Contrast Sensitivity Function

R.L. Woods, N.C. Strang and D.A. Atchison.

11) Dark-adaptation as a model of the Parkinsonian visual system

B. Wink

Posters

18) Second-order vision requires second-order calibration.

A.Schofield and M. Georgeson.

19) Designing Signing

S.E. King and M.J.Cook

Preliminary programme, registration and accommodation costs

For more information contact Dr Malcolm Cook:

email m.cook@river.tay.ac.uk

Wednesday 9th April

Costs

Registration Day 1 (Free for this day's presenters)

One Day Registration Fee:

AVA Member £25.00

Non-AVA Member £30.00

Accommodation Day 1

Session 1 : 9:00-10.30 Image Quality I

Morning Coffee

Session 2 : 11:00-12:30 Image Quality II

University Lunch £7.00 (SA)

Session 3 : 14:00-15:30 Image Quality III

Afternoon Tea

Session 4 : 16:00-17:00 Image Quality IV

Civic Reception 18:30 at University of Abertay Free

Buffet Dinner 19:00 at University of Abertay £15.00

Accommodation £33.00

Thursday 10th April

One Day Registration Fee

AVA Member £25.00

Non-AVA Member £30.00

Registration Day 2 (Free for this day's presenters)

Accommodation Day 2

Session 1 : 9:00-10.30 Industrial/Clinical Speakers

Morning Coffee

Session 2 : 11:00-12:30 Industrial/Clinical Speakers

University Lunch £7.00 (SA)

Session 3 : 14:00-15:00 Guest Speaker

Afternoon Tea and Exhibit Session

Session 4 : 16:00-17:00 Industrial/Clinical Speakers

Poster Session/Finger Buffet 17:00-18:00 Free

Conference Dinner

Evening Meal on HMS Unicorn 19:00 £25.00

Accommodation £33.00

Friday 11th April

Registration Day 3 (Free for this day's presenters)

One Day Registration Fee

AVA Member £25.00

Non-AVA Member £30.00

Accommodation Day 3

Session 1 : 9:00-10.30 Open Contributions

Morning Coffee

Session 2 : 11:00-12:30 Open Contributions

University Lunch £7.00 (SA)

Session 3 : 14:00-15:30 Applied Aspects of Image Quality

Afternoon Tea

Session 4 : 16:00-17:00 Applied Aspects of Image Quality

Accommodation £33.00

Registration Cost for 3 Days :

AVA Member £60.00

Non-Member £75.00

(eg an AVA member presenting and registering for 3 days would pay 60-25=£35.00)

Evening Meal at Mains Castle for participants taking sleeper and staying over.

Individuals pay for the cost of their own meal.

The AVA committee intends to offer one or more prizes of 50 pounds (depending on the number and quality of submissions) for the best post-graduate/post-doctoral posters or demonstrations.

Please send abstracts (200-300 words, deadline 1 January 1997 but late submissions might be considered) and expressions of interest to:
N.B. Send your own full postal address, telephone, fax and e-mail.

Dr M.J. Cook,
Division of Psychology,
School of Social Science,
University of Abertay Dundee,
Bell Street,
Dundee,
DD1 1HG

Tel: 01382 308749

Fax: 01382 308877

e-mail: m.cook@river.tay.ac.uk

Meeting Abstracts

Locus Questions in Vision

18th December, 1996, Aston University

A full report will appear in the next edition of the Bulletin. Here are the abstracts of papers and posters presented at the meeting. The abstracts will also be published in the journal *Perception*.

Locus hocus-pocus: towards a functional architecture for early spatial vision

Mark Georgeson (School of Psychology, University of Birmingham, Birmingham B15 2TT, U.K.; E-mail: m.a.georgeson@bham.ac.uk).

Questions about the site (locus) of visual processes might appear necessarily to be seeking answers in terms of brain neuro-anatomy and associated physiological processes. However, the known and ever-growing complexity of multiple visual areas, their functions and interconnections rather suggest that the goal of a complete neural circuit-diagram, even if it were realizable, would be uninterpretable. I argue that an important aim is to build simpler functional models of visual processing that are broadly consistent with anatomy, physiology and psychophysical evidence, but which may sacrifice some fine detail in favour of conceptual simplicity. No single discipline is pre-eminent, and converging evidence from several disciplines is particularly valuable. To illustrate this view, I offer the outlines of a model for edge-finding in the context of binocular vision. The model involves several stages: oriented spatial filtering, summation of filter outputs, binocular summation and edge-coding. The output representation is a feature-map in which edges, their attributes and spatial locations are made explicit. The proposed architecture appears capable of accounting for (among other things) the appearance of monocular and dichoptic plaids, the existence of both eye-specificity and inter-ocular transfer of aftereffects, and the absence of stereoscopic tilt when monocular tilt aftereffects are combined.

Visual Memory for Orthogonal Spatial Frequencies

M. Lages & M. Treisman (Department of Experimental Psychology, South Parks Road, Oxford OX1 3UD, UK.; E-mail: martin@selina.psych.ox.ac.uk).

It has been suggested that spatial frequency discrimination at suprathreshold contrast is unaffected by comparing gratings of orthogonal orientation. Regan (1985, *JOSA A* **2**, 619-621) concluded that short-term visual memory holds spatial frequency information independently of its orientation. This finding needs explanation because well-established results from masking and postadaptation at near-threshold contrast suggest that encoding by low level analysers is orientation selective.

In this experiment spatial frequency discrimination was tested for orthogonal gratings with different spatial frequency ranges. A vertical and a horizontal sinusoidal grating both with a spatial frequency of 2.5 c/deg in one condition and 5.0 c/deg in another, served as reference stimuli. They were presented for 10 secs on a calibrated CRT display linearized in luminance. After a retention interval of 30 secs, stimuli from a vertical and a horizontal set of 11 spatial frequencies were presented in randomly intermixed order for 0.2 secs each. On each trial Ss judged whether the vertical or horizontal test grating was higher or lower in spatial frequency than the references. For both orientations two sets of test gratings were generated each ranging from -0.5 to +0.25 octaves around the midpoint. The midpoints of the ranges were 2.25 and 2.75 c/deg in one condition and 4.5 and 5.5 c/deg in the other. Ss received all combinations of sets in four sessions on consecutive days.

Results suggest that storage and retrieval of spatial frequency information is not necessarily independent of orientation. The presence of sequential dependencies between trials supports criterion setting theory (Treisman & Williams, 1984, *Psych Rev* **91**, 68-111) in which the information provided by previous trials determines the location of the midpoint.

Evidence for perceptual grouping indicates a late rather than early site supporting transparent motion

Peter W. McOwan^{1,2} & Alan Johnston¹ (1. Department of Psychology, University College London, Gower Street, London, WC1E 6BT, U.K. 2. Present Address: Department of Cybernetics, The University of Reading, Whightknights, Reading, RG6 2AY, U.K; E-Mail: pmco@psychol.ucl.ac.uk).

Motion transparency is often thought to depend upon a low-level segregation of the moving image by early filters in the visual system, so

allowing the representation of transparency by a function with multiple values at any spatial position. An alternative to this low-level structural explanation is that the attribution of multiple surfaces reported in motion transparency results from high level grouping of local velocity measures. To examine the validity of the grouping hypothesis we require a method which keeps local motions essentially the same, but switches the global percept from transparent to non-transparent. We use arrays of micro motion patterns comprising four small squares which move around the perimeter of a larger square. The motion of these elements consisted of two cycles, first in a clockwise sense, then anticlockwise. By removing the horizontal pairs of dots on one cycle and the vertical pairs on the subsequent cycle subjects report the perception of two surfaces sliding transparently across each other. When all dots are present, in effect adding together two independent transparent motions, subjects report local rotations. A structural framework might predict a four way transparency. This pattern of results holds when the displays contained pattern elements which can be grouped on the basis of identity and also when the displays were rendered as random dot kinematograms. This evidence points to a late rather than early site for the mechanisms serving motion transparency in the human visual system, possibly in the human analogue of monkey MSTd. In primates, neurons in MSTd have been shown to have large receptive fields which signal local rotations, spiral motion and translations. It is at this level of processing that neural systems could distinguish effectively between the local rotations and transparent translations reported here.

This work is supported by grants from the Wellcome Trust

Low-contrast stimuli activating parvo- and magno- streams

J. J. Kulikowski and A. G. Robson. (Visual Sciences Lab. (Mill/G.126), UMIST, POBox 88, Manchester M60 1QD; E-mail: ymum21@umist.ac.uk).

Parvo- and Magno- neurones in the macaque geniculo-striate pathway differ in sensitivity, but show considerable functional overlap. Several anatomical studies have shown that many V1 neurons receive both P- and M- inputs. The best separation of the P- and M- responses can be achieved by using low-contrast grating stimuli, chromatic for P- and achromatic for the M-stream, provided that spatial and temporal parameters of stimuli are optimised. Specific recommendations are based on: (1) observations of single cell responses in the macaque striate cortex, V1, and recordings of Visual Evoked Potentials, both in macaque and man, whose results were reported previously (Kulikowski, 1991, "From Pigment to Perception" p. 197, Plenum; Kulikowski at al., 1996, *Vision*

Res. **36**, 3397-3401) and (2) revised optimisation procedures. (1) Low contrast (about 0.1), low spatial frequency gratings (<10% of the achromatic spatial resolution limit for a given retinal eccentricity) can be used to dichotomise responses in V1 of the anaesthetized macaque: (A) Achromatic coarse gratings activate only V1 neurones with purely transient responses, solely dependent on a change in contrast. Such responses peak around 5 Hz. (B) Chromatic gratings stimulate chromatic-opponent units which have sustained response components (i.e. dependent on standing contrast) and their temporal frequency tuning is broad (maximal around 1 Hz); these neurones are not sensitive to achromatic stimuli. Stimuli of medium contrasts activate cells with largely overlapping temporal properties; both chromatic and achromatic stimuli may activate neurones whose optimal responses are between 0.7-10 Hz. (C) Scalp VEPs (recorded in unanesthetized macaques and humans) to coarse achromatic gratings of low contrast are purely transient: similar to onset, offset and pattern reversal. Chromatic gratings elicit VEPs which are larger to onset than pattern reversal, consistent with the sustained properties of the underlying neuronal mechanisms (see below). (2) In humans, isoluminant chromatic gratings (not checks) elicit onset-VEPs with distinct negative waveforms localised around the occipital site (at or below Oz), whereas achromatic-reversal VEPs are positive. One dimensional Laplacean VEPs between the inion and parietal sites show that the achromatic-reversal waves have a broader and slightly more parietal distribution (than the chromatic-onset waves). Chromatic grating stimuli can further be optimised to elicit VEPs typical of red/green and blue-cone-pathway responses, both sustained and with low-pass temporal frequency characteristics. Any presence of band-pass temporal tuning in the chromatic-reversal VEP may mean achromatic and/or magno-intrusions. Crucially, isolation of the blue-cone pathway requires "tritanopic" stimuli, restricted in size (in order to minimise the effects of aberration and macular pigment), whereas magno-responses to isoluminant red/green borders must be minimised by using low contrasts. Finally, relative shortening of the onset period increases chromatic responses. However, such asymmetrical timing disguises transient components (typical of achromatic intrusions) which are most effectively shown by comparing VEPs to equal-period onset, offset and reversal. We conclude that optimised achromatic and chromatic gratings can activate three non-overlapping systems, specific to luminance-contrast (magno-transient), red/green and blue/yellow (both parvo-sustained) mechanisms.

Frames of reference in vision

Nicholas J. Wade (Department of Psychology, University of Dundee, Dundee DD1 4HN, Scotland.; E-mail: n.j.wade@dundee.ac.uk)

If vision guides action then both need to share the same frame of reference. Actions can only take place in three-dimensional space, and therefore vision requires an internal representation in the same terms. Natural vision can be thought of as consisting of a sequence of computations that redefine the frames of reference relative to which signals are assigned (Wade and Swanston, 1996 *Perception* **25** 187-194). The initial mapping of external space is in terms of retinocentric signals, the two sets of which are combined with a signal for binocular eye movements to determine an egocentric frame of reference. This defines the directions in which objects are located, but not their distances. Information for body movement and apparent distance modify egocentric into geocentric signals. This final frame of reference reflects an internal representation in dimensional terms that can guide behaviour. A fourth frame of reference, referred to as patterncentric, can be defined by relative displacements of objects. Normally it operates in tandem with the other systems, but it can be dissociated from them. Many modern surgical procedures involve such dissociations, and minimal access surgery will be used as an example of applying the model.

On the status of a “proximal” stage in vision

Nicola Bruno¹, Marco Bertamini² (1. Dipartimento di Psicologia, Università of Trieste, via Università 7, 341243 Trieste, Italy; E-mail: nicola.bruno@univ.trieste.it; 2. School of Social Sciences, Staffordshire University, Stoke-on-Trent, ST4 2DE, U.K.; E-mail: M.Bertamini@staffs.ac.uk).

Most models of human vision assume that the first representational stage of visual processing is a proximal description (e.g., Palmer and Rock, 1994, *Psychonomic Bulletin & Review*, **1**, 29 -55). The assumption can be found in a wide variety of theoretical constructs including, among others, the notion of a preliminary ‘unasserted colour’ stage in the computation of surface colours; the proposal of an initial ‘region map’ or ‘mosaic’ of juxtaposed retinotopic regions in perceptual organisation, completion, and shape constancy; and the notion of a ‘pictorial’ register as an initial memory buffer for holding a representation of the light pattern at the retina. Experimental evidence cited in conjunction with an initial proximal stage has included psychophysical data, demonstrating sensitivity to proximal

quantities such as luminance and visual angle; information processing data, demonstrating mosaic-type responses or priming effects from mosaic-type representations at short exposures; and abundant physiological data demonstrating retinotopic maps in the primary visual cortex. On the basis of a reanalysis of this literature and of recent data, we contend that the assumption is unwarranted. Demonstrations of sensitivity to proximal quantities do not necessarily imply that proximal representations are achieved “first” in processing. Some information processing data are problematic and others may be accounted by alternative explanations, such as information conflict in pictorial displays. Finally, retinotopic maps need not be interpreted as proximal representations, because some level of spatial isomorphism is compatible with a variety of representations. An alternative view, (Bruno, Bertamini and Domini, *JEP:HPP*, in press) based on the hypothesis of parallel edge classification mechanisms, may account for the available evidence and for the phenomenology of proximal viewing.

Conscious & unconscious processing of visual signals: Psychophysical & fMRI studies

A. Sahraie^{1,2}, L. Weiskrantz², A. Simmons³, S. C. R. Williams³, J. L. Barbur¹ (1. Applied Vision Research Centre, City University, Northampton Square, London, EC1V OHB, U.K.; 2. Department of Experimental Psychology, University of Oxford, South Parks Road, Oxford, OX1 3UD, U.K.; 3. Neuroimaging Research Group, Institute of Psychiatry, De Crespigny Park, London, SE5 8AF, U.K.).

Lesions of the primary visual cortex result in scotomas in the corresponding visual field. Blindsight subjects maintain an ability to discriminate some stimulus attributes when the stimuli are restricted to the perimetrically blind areas and for which they report no awareness. But for stimuli under certain conditions they may also report that, although they did not ‘see’ the stimulus, they nevertheless were aware of the occurrence of a visual event. We have varied systematically a number of stimulus parameters in a series of psychophysical experiments and demonstrated above chance discrimination of moving stimuli both ‘with’ and ‘without’ conscious awareness of the visual stimulus (Weiskrantz et al., 1995, *PNAS (USA)* **92** 6122-6126). The results show that both the subject’s awareness of moving stimuli and the ability to discriminate correctly the direction of movement vary systematically with stimulus speed, excursion length and background and stimulus luminance. Based on these studies we were then able to choose stimulus parameters that

yield good discrimination performance both 'with' and 'without' conscious awareness of movement. Functional magnetic resonance imaging (fMRI) of the brain was then employed to determine which areas of the brain are activated by each of the two conditions. The results show that both 'modes' of discrimination cause increased activity that is measurable using fMRI in different areas of the frontal cortex. Discrimination without awareness also generates a significant increase in neuronal activity in several midbrain nuclei.

Which part of the field matters in colour matches?

(Jack Moreland & Catherine Alexander; Dept Communication & Neuroscience, Keele University, Staffs. ST5 5BG. U.K.; E-mail: J.D.Moreland@keele.ac.uk).

When large fields are used in colour matching, macular pigment often manifests entoptically as a dark area (Maxwell's spot) around the point of fixation. The measurements used to establish the CIE 10 deg Standard Colorimetric Observer were made by ignoring or excluding Maxwell's spot (Wyszecki and Stiles, 1982 *Color Science* [New York, Wiley] p 133). Macular pigment concentration is greatest close to the fovea and declines approximately exponentially with eccentricity (Moreland and Bhatt, 1984 *Documenta Ophthalmologica Proceedings Series* **39** 127-132). Where, on that declining slope, is the colour match determined?

This question has been brought to the fore recently by the work of CIE Technical Committee TC 1-36 which has been charged with the task of defining a continuous Standard Colorimetric Observer for field sizes in the range 1 to 10 deg.

Population data have been published for the local variation of macular pigment with eccentricity (Moreland and Bhatt, 1984). Calculation by integration to give a global (whole field) absorbance leads inevitably to an overestimate since the region of highest macular pigment concentration, Maxwell's spot, is ignored in colour matching.

Following Moreland and Bhatt's procedure, two subjects made colour matches using the stimulus pairs 460nm (B) + 570nm (Y) and 490 nm (C) + 610 nm (O) mixed in two half-fields. The fields were either annular (centred on a small dim red fixation light) or circular with radii in the range 1 to 5 deg. Annular fields were viewed eccentrically and circular fields were fixated centrally, ignoring Maxwell's spot.

Changes in macular pigment absorbance were reflected by changes in $\log(B/Y)$ and in $\log(C/O)$. Those for annular fields yielded the local retinal profile while those for the circular fields gave the effective "average" absorbance. Comparison of the two sets of colour matches indicated that

those for circular fields are determined by the local macular pigment absorbance at an eccentricity which is about 70% of the field radius.

Using the Pulfrich effect to compare luminance-dependent processing delays in colour vision

Sarah Mackie & Mark R. Baker (University Laboratory of Physiology, University of Oxford, Oxford, OX1 3PT, UK. Correspondence to Mark R Baker; E-mail: mark.baker@green.oxford.ac.uk).

When a moving stimulus is viewed binocularly with a light-attenuating filter before one eye, there is an illusory depth effect known as the Pulfrich effect. It is thought that the filter, by reducing the luminance of the stimulus, causes an increase in the normal delay in retinal processing of the visual image creating a disparity in the perceived position of the stimuli in the two eyes. Here we use this effect to investigate the luminance-dependent delays in the chromatic and luminance pathways, the existence of which is suggested by previous studies. A separate moving vertical sinusoidal grating was presented to each eye using a Wheatstone stereoscope with a CRT in the image plane. Fusion was ensured by placing identical stationary random-dot reference stimuli above and below the gratings. The filter-induced disparity was assessed by changing the phase of the grating presented to the right eye until the depth effect was cancelled. A blocked staircase method was used to adjust the phase. Three types of grating were used: (1) varying in luminance but constant in chromaticity (2) varying in the ratio of l- to m-cone excitation but constant in luminance and s-cone excitation (equiluminant) (3) varying in s-cone excitation but constant in luminance and the ratio of l-to m-cone excitation (equiluminant); each isolating a single set of visual processing pathways in turn.

The filter-induced interocular delay was found to be identical (6.25 ± 0.02 ms) for all three classes of stimuli. The presence of stereopsis in all three grating classes suggests that the dorsal (occipitoparietal) pathway postulated for stereopsis can access information from both sets of colour opponent systems as well as from luminance, implying that colour is not restricted to the ventral (occipitotemporal) pathway. The differences in luminance dependent delays in the chromatic channels reported elsewhere were not manifested here. That the filter-induced interocular delay was identical for all three classes of stimuli suggests that this is a different effect acting on mechanisms common to all the colour processing pathways—the delay is of retinal rather than cortical origin in the Pulfrich effect.

Pattern glare, reading and chromaticity

Arnold Wilkins (Medical Research Council Applied Psychology Unit, 15 Chaucer Road, Cambridge CB2 2EF, U.K.; E-mail: arnold.wilkins@MRC-APU.CAM.AC.UK).

At a conservative estimate, about 10% of children aged 7-11 benefit from the use of a coloured overlay when reading, provided the colour is chosen to suit the individual child. With their chosen overlay the children read more quickly and more accurately, and they persist in using the overlay without prompting for many months (Jeanes et al, *British Journal of Psychology*, in press). The improvement in reading speed cannot be attributed entirely to placebo effects. We have developed a simple test of texture segmentation, which measures the ability to perceive a configuration of seven targets each defined by the same particular texture. The configuration is immersed in visual noise. The configuration appears in 12 test items with progressively increasing levels of camouflage. Performance on the test is poor in some children who use coloured overlays for reading, and improves when the overlay is used. The improvement in test performance with the overlay correlates with the improvement in reading speed. The benefits of overlays, though uncertain, have been attributed to a reduction in visual stress (Wilkins, 1995, *Visual Stress*, O.U.P.: Oxford), but they may also reflect an effect of colour on the transient signal evoked by eye movements across a high contrast pattern of visual noise.

The effect of line segment length on oriented-line-target detection in early vision

L. M. Doherty & D. H. Foster (Department of Vision Sciences, Aston University, Birmingham B4 7ET, U K. Fax: +44 121 333 4220; E-mail: dohertlm@aston.ac.uk).

Observers can detect a uniquely oriented line segment ('target' among uniformly oriented line segments ('nontargets')) even when viewing duration is very brief. There is evidence that performance in this task (measured in terms of orientation increment thresholds) is largely unaffected by the number of line segments present (Doherty and Foster, 1995 *Perception Supplement* **24** 132). This evidence indicates that the task involves low-level mechanisms which operate in parallel across the visual field. Yet a study involving the same task but a smaller stimulus field, shorter line segments, and in which the observers' prior knowledge of the stimuli was greater (Verghese & Nakayama, 1994 *Vision Research*

34 2453-2467), did not indicate parallel processing. The purpose of the present study was to determine why these findings differed. The experiment of Doherty and Foster was repeated using shorter line segments. Lines of length 0.25 deg visual angle were presented in a circular field of diameter 20 deg visual angle. There were 2, 3, 5, 10, or 20 line segments. Stimulus displays lasted 40 ms, and were masked after a 60-ms blank interval. Orientation increment thresholds increased as the number of elements was increased from 2 to 10. Thresholds changed very little as element number was increased from 10 to 20. The variation of thresholds with element number implied that line segment length, rather than the use of a 'top-down' strategy based on prior knowledge, was the main cause of the difference between previous findings. The results suggest that for displays containing few elements, fine detail can be processed in early vision by some mechanism with limited capacity, but when many elements are present, performance depends on coarser, parallel processes.

Learning to search for 2D and 3D targets defined by edges and by shading

J.P. Harris¹, C.I. Attwood² & G.D. Sullivan² (Departments of Psychology¹ and Computer Science², University of Reading, Whiteknights, Reading RG6 6AL, UK; E-mail: J.P.Harris@reading.ac.uk).

The theory of visual Recognition By Components (Biederman, 1987, *Psychological Review* **94** 115-147) suggests that a line drawing-like representation of natural images is produced at an early stage of human visual processing. To test this idea, we compared visual search for targets defined by edges or by shading. In Experiment 1, the target was a cube in one orientation, and the distractors were cubes in another orientation, and the stimuli were defined by shading alone, by lines alone, or by lines plus shading. Over six experimental sessions, an initial effect of number of distractors on search time disappeared for the shaded but not for the line-drawn stimuli. In Experiment 2, shaded cubes which satisfied the single light source constraint were compared with two types of shaded stimuli with the same silhouette and area, but containing internal Y and T junctions varied to give inconsistent or no orientation information. For practised subjects, the slopes of the plots of search times against number of distractors were steeper for the latter 2D stimuli than for the other stimulus types, suggesting a more serial-like processing. When naive subjects were tested on the same stimuli in Experiment 3, evidence for initial serial processing was found, though effects of distractor number disappeared for all stimuli after practice. We conclude that shaded 3D stimuli are processed pre-attentively, whereas equivalent line drawings

are processed more serially, even after practice. The data therefore suggest that line drawings and natural images are not equivalent in early human vision.

A study of visual search using Transcranial Magnetic Stimulation of the parietal cortex

E. Ashbridge, V. Walsh, & A. Cowey (Department of Experimental Psychology, University of Oxford, Oxford, OX1 3UD, UK; E-mail: lisi.ashbridge@psy.ox.ac.uk).

Several studies suggest that the posterior parietal cortex (PPC) is involved in serial conjunction search. However, almost nothing is known about the time course of the involvement of these visual areas in visual search tasks. We examined the role of the PPC in visual search, using disruptive single-pulse Transcranial Magnetic Stimulation (TMS). TMS was applied over cortical areas of 5 subjects while performing an orientation “pop-out” or a colour x orientation conjunction visual search task. Stimulation onset asynchronies (SOA) were between 0-200 msec after stimulus presentation, interspersed with no stimulation condition. TMS over the right PPC had no detrimental effect on the performance of pop-out search. However, TMS did significantly lengthen reaction times on conjunction search trials where the target was present, when stimulation was applied over the right PPC with an SOA of 100 ms. During trials where the target was absent, TMS affected conjunction search when applied with an SOA of 160 ms. No significant effect was observed during stimulation over the left PPC or other cortical areas. Therefore, right PPC is involved in serial conjunction searches, but not in parallel pop-out searches.

Locus of learning in visual search

Vincent Walsh¹ & Amanda Ellison² (1. Dept of Experimental Psychology, University of Oxford, South Parks Rd, Oxford, OX1 3UD, U.K.; E-mail: Vincent.Walsh@psy.ox.ac.uk , 2. Dept of Psychology, Trinity College, Dublin, Ireland).

Visual search tasks can be modified in complexity and attentional requirements and different elements of task demands and stimulus characteristics may be transferred from learning on one kind of task to another. We have investigated transfer of perceptual learning on a range of visual tasks in order to identify which components of search are common

or specific to different kinds of tasks. Subjects were trained on parallel, pop-out tasks or conjunction, serial tasks and transferred to the other task after several thousand training trials. We observed several levels of specificity in learning: specificity for stimulus parameters, task demands and response requirements. On the basis of neuropsychological studies and recent learning experiments with transcranial magnetic stimulation it is argued that the different levels of specificity are indicative of different roles for temporal, parietal and frontal cortical regions in learning of visual search.

Magnetoencephalographic (MEG) evidence for non-geniculostriate visual input to human cortical area V5

Ian E. Holliday^{1,2}, Stephen J. Anderson¹ & Graham F.A. Harding² (1. Dept. of Psychology, Royal Holloway College, University of London, Egham, Surrey, TW20 0EX, U.K. 2. Clinical Neurophysiological Unit, Aston University, Birmingham, B4 7ET, U.K.; E-mail: i.holliday@aston.ac.uk).

Evoked magnetic responses were measured with a SQUID neuro-magnetometer to colour and motion stimuli presented within either the blind or sighted visual hemifields of hemianopic observer GY. The colour stimulus was a 1.0 c/deg, stationary, photometrically isoluminant red/green sinusoidal grating. The motion stimulus was a 0.5 c/deg, rapidly drifting (16 Hz) achromatic sinusoidal grating. Both stimuli subtended 4 deg vertically by 6 deg horizontally, positioned such that the stimulus extended beyond the area of macular sparing into the lower field quadrant of the blind or sighted hemifield. Chromatic stimuli evoked responses in GY only from his sighted (ipsi-lateral) hemifield, and originated from a location consistent with a V1 source. Motion stimuli evoked responses from GY's blind (contra-lateral) and sighted (ipsi-lateral) hemifields, originating from a location consistent with extrastriate activity, possibly human V5. We conclude that there is non-geniculostriate input to extrastriate motion sensitive areas from both ipsi- and contra-lateral visual fields in the human visual system, and that this pathway subserves the residual visual sensitivity to motion in the blind hemifield that has been demonstrated psychophysically in observer GY (Barbur et al, 1980 *Brain* **103** 905-928).

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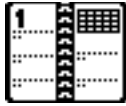
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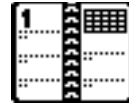
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References supplied (as usual!) by:

Chris Dickinson



Meetings Calendar



1997

- February 12-13 *Knowledge-based vision in man and machine.*
The Royal Society, London.
Contact: 0171 839 5561
<http://www.royalsoc.ac.uk/rs/>
- March 24-26 *Visual Scales: Photometric and Colorimetric Aspects.* NPL, Teddington, Middlesex.
Contact: Dr Julie Taylor, 0181 943 6539
Abstract deadline: 31 December 1996
- April 9-11 *AVA'97 Image Quality.* University of Abertay, Dundee, UK. Contact: Dr Malcolm Cook, University of Abertay, Bell Street, Dundee, DD1 1HG, email: m.cook@river.tay.ac.uk
Abstract deadline: 1 January 1997
- May 11-16 *ARVO Fort Lauderdale, USA*
<http://www.arvo.org/arvo/>
Abstract deadline: 6 December 1996
- September 14-17 *Vision in Vehicles 7, Marseilles, France.*
Contact: 01332-622287,
email: avru@derby.ac.uk
Abstract deadline: 14 February 1996