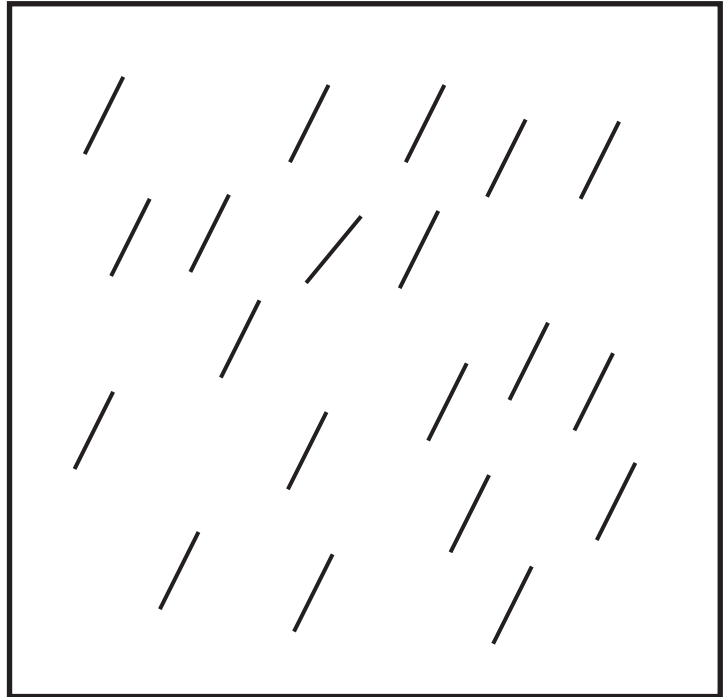


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Bulletin of the Applied Vision Association



Meeting Report: AVA Christmas meeting, Aston
GJ Burton Lecturers
Abstracts: AVA annual meeting,
Visual Search, London
References on Vision

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



Noticeboard



AVA on the Internet

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.

There is also an AVA anonymous ftp site at: <ftp://hc.les.dmu.ac.uk>

This site contains:

- a hyperspectral data set of natural scenes produced by Gavin Brelstaff (see <http://www.crs4.it/~gjb/ftpJOSA.html>).
- David Foster's bootstrap program for estimating the accuracy of a statistical estimate derived from a set of experimental data (see <http://www.vs.aston.ac.uk/Research/bootstrap.html>).

If there is anything else you think this archive should contain then let us know.

AVA and OPO Subscriptions

Membership for 1998/1999 will be as follows: ordinary members £18, student members £9. Those members who pay by standing order for the AVA and Ophthalmic and Physiological Optics please check that the correct amount is being paid to the AVA.

Editorial

This issue of the Bulletin contains the programme and abstracts of the forthcoming AVA Annual meeting which will be held at the College of Optometrists, London and have the theme of "Visual Search". There is also a list of all the people who have given the Geoffrey J. Burton lecture. This issue also includes a meeting report of the highly successful Christmas meeting at Aston University.

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

Deadline for copy for the next Bulletin - 16th April 1999

Geoffrey J. Burton Memorial Fund

The fund was established in 1986 with the aim of providing financial assistance to students (postgraduates studying for a higher degree or first-year postdoctoral junior scientists) 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 £400.

The AVA Committee has decided that from now on there will be a single award made once a year. The closing date for awards will be the last day in February each year and will be for conferences held from 1st March to the end of the following February (i.e. there will not be retrospective awards). Applicants do not have to be presenting at an AVA conference.

The next closing date for applications is:

29th February 2000

for conferences held between 1st March 2000 and 28th February 2001.

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

The AVA Secretariat,
College of Optometrists,
42 Craven Street,
London,
WC2N 5NG.

A PDF format version of the application form is available on the AVA web site at:
<http://www.dmu.ac.uk/ava/>

The award for 1999 will be announced at the AVA annual meeting on 17 March 1999 at the College of Optometrists, London.

AVA Christmas Meeting - Nonlinear Vision

Wednesday 16th December 1998

Aston University

Meeting Report

The third AVA Christmas Meeting, like the first and second, was held in the Department of Vision Sciences at Aston University, Birmingham. The meeting, held on the 16th December, attracted 58 attendees. To the relief of the organizers, this was a shade above last year's turnout of 54. I say relief because the large number of late and on-the-day registrations made this quite unexpected. Perhaps this relaxed approach is a sign of already how well established this event is as a regular fixture.

The theme of the meeting, nonlinear vision, was apparent in the invited talks. The first two of these, by Alan Johnston and Andrew Derrington, dealt with the subject of second-order (i.e. contrast, rather than luminance, defined) motion. From the lively debate that followed it was clear that this is a research area with a wide following. The doubts that some have raised in the past as to the reality of (pure) second-order motion were not voiced. The debate has now shifted onto whether special nonlinear mechanisms are used or whether the nonlinearities of "ordinary" luminance mechanisms suffice. In the third invited talk, Michael Morgan, argued that nonlinear mechanisms were necessary to account for certain illusions (such as the Poggendorff figure). Linear mechanisms were ruled out by showing that the illusion persisted without diminishment in a luminance balanced version.

After lunch came two sessions of refereed talks. The first of these continued themes raised in the morning, with talks on (inevitably nonlinear) grouping mechanisms. Where the grouping concept was applied variously to filter outputs, edge elements and features. The final session of the day was given over to talks on temporal vision and colour. I found the colour element of this particularly stimulating as all four talks were on non-overlapping aspects of colour science: constancy, similarity, scene statistics and stereopsis. The final talk on colour and stereopsis once more used the language of first-order/second-order mechanisms. I wonder whether, in ten years time, at the 13th AVA Christmas meeting (at Aston no doubt) the terms linear/nonlinear and first-order/second-order will still be common currency.

During the coffee and lunch breaks, nine posters were the focus of discussion. The subject matter of these posters reflected the talks: colour, feature detection and integration. Among them, was the day's only contribution that came close to the AVA's remit as the Applied Vision Association, that was a poster on "age-related changes in feature integration". No-one seemed uncomfortable or surprised with the wide latitude given to AVA relevance.

The day ended with a very pleasant session of wine drinking in amongst the posters. No snow this year but a very successful meeting nevertheless!

Lewis Griffin
Aston University

Editor's note

Many thanks to Tim Meese, Sarah Waugh and Ursula Stevens for organising this successful meeting.

Geoffrey J. Burton Lecturers

Recent members of the AVA might be interested to see the list of vision scientists who have delivered the Geoffrey J. Burton Memorial Lecture in the past.

1987 Adrian Hill (Oxford Eye Hospital) The Meaning of Measurement

1988 Mike Brady (Oxford University) Computer Models of Vision

1989 Ray Guillery (Oxford University) Visual Pathway Abnormalities in Albinism and their Development

1990 Cal Nodine (University of Pennsylvania) Helping Clinicians Perceive the Invisible

1991 Don Pearson (University of Essex) The Search for Image Primitives

1992 Glyn Humphreys (University of Birmingham) Parallel Machinery and Serial Behaviour in Vision

1993 Stephen Ellis (NASA) Nature and Origins of Virtual Environments (There's Nothing New to Cyberspace!)

1994 Oliver Braddick (University College London) Space, Time and Age in Visual Motion Processing

1995 Jan Koenderink (Utrecht University) Shape constance in Pictorial Space

1996 Ken Nakayama (Harvard University) Visual Search

1997 Andrew Watson (NASA) Image Quality

1998 Nick Wade (University of Dundee) Scottish Visionaries

1999 John Findlay (University of Durham) Searching with the Eyes and the Brain

AVA 99 - Annual Meeting College of Optometrists, London

17 March 1999

including the

GEOFFREY J. BURTON MEMORIAL LECTURE

Prof. John Findlay
Department of Psychology, University of Durham
“Searching with the eyes and the brain”

The meeting will also include the Annual General Meeting of The Applied Vision Association.

Registration is £25 for non AVA members and £16 for members (£15 and £10 for students) which includes refreshments and lunch.

For further details please contact :-

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Glasgow G4 0BA	
SCOTLAND	

MEETING PROGRAMME

10.00 Registration and Coffee

10.30 Can V1 mechanisms give higher sensitivities to medial axes of figure shapes?
Z. Li.

10.50 The Effect of Subthreshold Sensory Stimulation on Learning in Visual Search. Lauren Stewart and Vincent Walsh.

11.10 Effects of Dot Density in the Artificial Scotoma Paradigm, Andrew Welchman and Julie Harris.

11.30 Attentional Asymmetries between Visual Fields in Visual Search Tasks. Amanda Ellison and Vincent Walsh.

11.50 Searching for change with and without awareness. Ian M. Thornton and Diego Fernandez-Duque.

12.10 Visual search for motion in depth: how do we find z-motion? Julie M. Harris and Jane H. Sumnall

12.30 Buffet lunch and posters

13.30 Annual General Meeting

14.00 Geoffrey Burton Memorial Lecture
Prof. John M. Findlay.

15.00 Search amongst new objects is more effective than search amongst old objects but the response is not necessarily faster. Angus Gellatly and Geoff Cole.

15.20 Multiple roles for memory in visual search. David Shore and Raymond M. Klein.

15.40 Visual Search and motion - is it all relative ? Simon K. Rushton and Mark F. Bradshaw.

16.00 Tea and Posters

16.30 Regularisation and adaptation in a neural model of motion perception. Keith Langley and Colin W.G. Clifford.

16.50 An examination of the spatiotemporal integration of spatial frequencies. Eugene McSorley and John M. Findlay.

17.10 Safety Analysis of a Scanning Laser Display R.J.M. Jones and E. Liggins.

17.30 Wine and Posters

Does attention have access to monocular input? J. Solomon.

Long term stability of instrument myopia and its relation to tonic accommodation. P.A. Ward and J.P. VIVEASH.

Pre-attentive visual search and visual display technology. P.A. Ward and C. Carr.

Selective attention and the ideal observer applied to binocular summation David Rose and S. Pardhan

Visual search in Alzheimer's disease. Andrea Tales, Tom Troscianko, Stuart Butler, Gordon Wilcock, Roy Jones and Jane Fossey.

CONFERENCE ABSTRACTS

Regularisation and adaptation in a neural model of motion perception

Langley, Keith and Clifford, Colin W.G.

Psychology Department, University College London, London

Neurons in sensory systems encode and transmit information about attributes of the environment. Much of the information transmitted by spiking neurons appears to be encoded in the rate at which they fire. This rate necessarily has a positive value. We propose that the use of positive-valued signals to transmit information is a fundamental constraint on neural computation. We examine the implications of this constraint for models of motion detection. The detection of image motion is represented mathematically as a linear programming problem in which variables are restricted to having non-negative values. We propose an adaptive model that can detect a coherent motion signal from the responses of velocity tuned linear filters. Additional constraints are introduced as regularisers to stabilise the model. The regularisers are based upon the idea that image motion orthogonal to a one dimensional signal is assumed to be zero. It is shown how inhibition, motion opponency and contrast normalisation consistent with the properties of V1 complex and MT motion cells are motivated by the method of solution. The model exploits both divisive and subtractive velocity gain control to explain several properties of motion perception, namely, perceived biases in speed and direction and a subset of dynamic and static motion aftereffects including direction repulsion.

Search amongst new objects is more effective than search amongst old objects but the response is not necessarily faster

Gellatly, Angus and Cole, Geoff

Department of Psychology, University of Keele

This paper describes a series of visual search experiments in which the search display was presented to the observers very briefly. In the first two experiments the target was an illusory square containing stationary horizontal lines on a background of downward moving lines; non-targets were illusory squares containing upward moving lines. The comparison of interest is between new and old objects. New objects are those which appeared immediately following an auditory signal to search for a target. Old objects had been present on the screen for (usually) 500 ms before an auditory signal to indicate that one of them may become a target. The search display was always terminated within 500 ms. In Experiment 1, old and new objects always occurred in separate trials. In Experiment 2, each trial contained a mixture of old and new objects. In both experiments, new object targets were detected more frequently than old object targets. Experiments 3 and 4 replicated and extended this finding for the case in which targets, non-targets and background were all different shades of grey, showing the effect is not confined to a particular class of stimulus. Experiment 5 reverted to the use of motion defined stimuli but used reaction time as the dependent measure, it included a set size manipulation and search displays which were terminated by the participant's response. Error data are consistent with the previous detection data but the RT data are not. The results will be discussed in terms of enhanced pre-attentive processing and of inhibitory response processes.

Can V1 mechanisms give higher sensitivities to medial axes of figure shapes?

Z. Li

Gatsby Computational Neuroscience Unit, University College London, 17 Queen Square, London WC1N 3AR, UK

Human observers are more sensitive to targets (e.g. bars) when they are placed in the centre of figure shapes such as circles or squares. Evidence of higher neural responses to figure centres has been observed in the primary visual cortex (V1). However, it is not clear whether the effects arise from V1 mechanisms or from higher centre feedbacks. We use a model of the primary visual cortex to show that some of these effects can arise from the contextual influences induced by the intracortical interactions within V1. The neural elements in the model consist of the pyramidal cells and

inhibitory interneurons from layer 2-3 of the cortex, the local reciprocal connections between the two cell types, and the longer range horizontal connections from the pyramidal cells to other pyramidal cells and interneurons. The visual inputs are filtered by the classical receptive fields before being received by the pyramidal cells. The intracortical interactions make the pyramidal responses dependent on the stimulus outside their receptive fields, thus changing their sensitivities according to the contextual surround. We examine in particular how sensitivity enhancements to targets at the centre of figures depend on the shape, size, and other attributes (e.g. the texture features) of the figures, and whether the enhancement is also present at other locations inside the figures or even outside the figures. Our results are consistent with previous simulations from this model and suggest that V1 mechanisms contribute significantly to some aspects of pre-attentive segmentation.

The Effect of Subthreshold Sensory Stimulation on Learning in Visual Search

Stewart L. and Walsh V.

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Performance on visual search tasks improves with learning. In previous experiments we have argued that improvements occur as a function of low level sensory changes rather than higher level cognitive ones. We tested this hypothesis by attempting to disrupt or improve the learning of visual search using transcranial magnetic stimulation (TMS). We established the threshold at which stimulation over area V5 could elicit moving phosphenes so that stimulation intensity could be set at a given percentage of this (80%). Subjects then trained on a form/motion conjunction search task for 1300 trials and received either no TMS, TMS at 3Hz TMS, or TMS at 10Hz or sham TMS on every trial. Stimulation did not disrupt visual search accuracy or reaction times. Only 3Hz stimulation had an effect on learning, consistent with other studies which have shown an effect of TMS on visually related learning. We suggest that this provides additional evidence that learning in visual search is due to sensory changes rather than cognitive strategies.

Multiple roles for memory in visual search

Shore, D and Klein, R.M.

Department of Psychology, Dalhousie University, Halifax, Nova Scotia, B3H4J1, Canada

It is a near universal assumption that memory, in several forms, contributes to visual search performance. This traditional view has been denied in a recent paper (Horowitz & Wolfe, 1998, *Nat.*, 394, 575-577). After outlining fundamental problems with the interpretation of the data from this paper, we focus on recent findings which support the traditional view. Klein & MacInnes (in press, *Psyc. Sci.*) demonstrated a strong tendency against the refixation of items in a dense array and further showed that saccadic latencies are slower when a target is presented at a previously fixated location. This converges with the observation that simple detection is slowed following target presentation at a location occupied by a distractor in a serial search display (Takeda & Yagi, 1998, *Proc. Int. Workshop on Adv. in Res. on Vis. Cog.: Select. and Integr.*, 211-216), as if previously attended items are inhibited from re-inspection (cf Klein, 1988, *Nat.*, 334, 430-431). In a possibly related phenomenon, Watson & Humphreys (1997, *Psych. Rev.*, 104, 90-122) demonstrated that previewing a subset of the distractors allows them to be visually marked, and thus discounted. These effects refer to the ongoing processing of a visual search display and thus implicate either perceptual or working memory systems. With respect to long-term memory, items which serve as distractors in one phase of an experiment are harder to find in a subsequent phase when they serve as targets (Lubow & Kaplan, 1997, *J. Expt. Psych.: Hum. Perc. Perform.*, 23, 14-24). These three observations clearly show that information about distractor items influences performance on both the current and subsequent search trials.

An examination of the spatiotemporal integration of spatial frequencies

McSorley, E. and Findlay John M.

Centre for Vision and Visual Cognition, Department of Psychology, University of Durham, South Road, Durham, DH1 3LE

The experiments to be presented were designed to examine the importance of spatial frequency processing delays in the visual system on the efficacy of their subsequent integration. In the first experiment subjects were asked to detect a full bandwidth square-wave stimulus in various sequential displays, in some of which the first three harmonics were presented separately and sequentially. The effect of the presentation

order of the harmonics, presented at short durations of 42 msec each running from either low to high or high to low in spatial frequency content, on square-wave detection was assessed. It was found that subjects incorrectly reported the presence of a square-wave significantly more often when the harmonics were presented in a low to high order. In experiment 2 subjects were asked to judge square-wave similarity with the same stimulus displays. Contrary to expectations, it was found that the high to low harmonic triplet was chosen significantly more often than the low to high stimulus to resemble a square-wave. The results suggest that the effective integration of spatial frequencies does not depend upon the low to high temporal structure imposed by initial spatial frequency processing delays. It is proposed that the integration of spatial frequencies is flexible and dependent upon task demands.

Attentional Asymmetries between Visual Fields in Visual Search Tasks.

Ellison, Amanda and Walsh, Vincent.

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It has been suggested that attentional resolution is greater in the lower than in the upper visual field. As there is no corresponding asymmetry between the areas in the primary visual cortex where the input from upper and lower visual fields is processed, an “attentional filter” has been proposed to act in one or more higher visual cortical areas in order to constrict the availability of visual information to the level of awareness. To investigate this, a visual search array was presented to the entire visual field and reaction times from upper and lower visual fields compared. In a second experiment, subjects trained in one visual field before being transferred to the other. There was no significant difference between reaction times for targets presented in either upper or lower visual fields when the array was presented to the entire visual field. However, when the array was restricted to either the upper or lower visual fields, reaction times were significantly slower for detection in the upper visual field. This agrees with the proposal of a greater attention resolution in the lower visual field. The occurrence of significant transfer of suggests that the substrates for this attentional resolution must be at a higher level than low level visual processing areas, where receptive fields are small with a more orderly retinotopic map prevents transfer of information between fields.

Visual search for motion in depth: how do we find z-motion?

Julie M. Harris and Jane H. Sumnall

Neural Systems Group, Department of Psychology, University of Newcastle, Newcastle-upon-Tyne, NE1 7RU

We have measured how well observers can detect binocular 3-D motion when presented amidst stationary distractor dots, positioned randomly in depth. The target can be made to move laterally (x-motion), towards or away from the observer (z-motion) or along an intermediate trajectory that is a combination of the two. Z-motion, amidst 3-D distractors, is much harder to detect than x-motion. We suggested that this may be because motion mechanisms average signals from the left and right eye (Harris et al, 1998, *Nature Neuroscience*, 1, 165-168). This predicts that when presented with a combination of x- and z-motion, the visual system will respond as if only the x-motion is present. However, this prediction is not always true. As the amount of z-motion is increased, eventually its presence can improve performance over x-motion alone (Sumnall & Harris, 1998, *Perception*, 27, 51). Why is this? Observers often report seeing slight x-motion for a purely z-motion stimulus. It is possible that the ability to detect z-motion is based on imperfect averaging of left and right eye motion, resulting in a *leak-through*, of the x-motion signal. If so, then adding a small amount of x-motion jitter to a z-motion stimulus should result in reduced performance. Performance fell for z-motion as jitter was added, for 2 observers, but it did not fall to chance. For a third observer, performance fell much less quickly. There appears to be some effect of *leak-through*, of x-motion, but this cannot completely explain the ability to detect z-motion.

Effects of Dot Density in the Artificial Scotoma Paradigm

Welchman, A.E.

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Ramachandran & Gregory (1991, *Nature*) report that a peripherally presented grey square (target patch) embedded in a surround of white noise will perceptually fade following 7-10 seconds of steady fixation. The area occupied by the patch is then perceived as filled with the “twinkling” noise texture of the surround. Here we investigate two types of target patch. In one case, we employ the original mean luminance patch of Ramachandran & Gregory; in the other we define the patch by a difference from the surround in motion coherence. We investigate the effects of dot density on exposure time required for perceptual fading.

Subjects viewed a central fixation cross and reported when the target patch, located 10 deg from fixation, had faded. The time taken for perceptual fading was measured as a function of dots in the stimulus. For the grey patch: Stimulus exposure time needed for perceptual fading increases as the density of dots surrounding it decreases. For the patch containing moving dots: Time to fade decreases as dot density decreases. These data point to the importance of the interaction between the properties of the target patch and the surrounding texture in determining the time course of perceptual fading in the artificial scotoma paradigm. Divergent effects are observed for patches defined by texture difference or motion coherence difference. This suggests that different mechanisms may be involved in the perceptual filling-in of each case.

Visual Search and motion - is it all relative?

Rushton, S.K. and Bradshaw, M.F.

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It has previously been reported that searching for oriented targets embedded within both moving and stationary oriented distractors is faster when the target is moving than when it is stationary (Driver and MacLeod, 1992; MacLeod, Driver and Crisp, 1988). The characteristics of cells in cortical area MT/V5 — namely its blindness to static elements (and poor resolution for orientation) has been used to account for this motion-advantage (and in some cases motion-disadvantage). Here we investigate whether this effect holds for both absolute and relative motion. Absolute motion is defined by the change in position of an element on the retina and must be recovered by taking eye position into account whereas relative motion is defined by the relative change of position of different elements in a scene and can be recovered without recourse to information about eye position. The sensitivity of the visual system is usually found to be much greater for relative than for absolute motion tasks (e.g. Snowden, 1992) but any relative influence on tasks, such as visual search, is unknown. In the present experiments we dissociate absolute and relative motion of the stimulus elements by manipulating the presence and motion of a reference border in an otherwise featureless display. The results clearly show that both absolute and relative motion affect visual search tasks. The implications for the underlying physiology will be discussed.

Searching for change with and without awareness.

Ian M. Thornton(1) & Diego Fernandez-Duque(2)

Cambridge Basic Research, Cambridge, MA(1) Psychology, University of Oregon, Eugene(2)

Rensink (Visual Cognition, in press) has recently described a useful new method for exploring attentional processing, a method that marries standard visual search arrays with the change blindness flicker paradigm (Rensink et al., 1997, Psych. Sci; see Simons & Levin, 1997, TICS, for a review). In the current work, we use a variant of this methodology to examine the representation of change in the absence of awareness. We presented observers with a search array consisting of a ring of 8 or 12 rectangles (half horizontal, half vertical). The array was shown for 250 ms and then during an intervening blank period (250 ms) the orientation of one rectangle was switched and the whole array redisplayed for a further 250 ms. In one series of experiments, the redisplayed array was followed by a 2AFC task in which observers had to select the rectangle that changed. In a second series of experiments, the redisplayed array was followed by a color singleton, either at the location of change, or at a diametrically opposite location, and observers made a speeded red/green discrimination. In all experiments, observers also indicated whether they had been aware of any change in the initial displays. Our results show that a) observers can identify the changing object at above-chance levels even when they report having no conscious awareness of change and b) this ability does not rely on the redeployment of attention.

Safety Analysis of a Scanning Laser Display

Jones, R.J.M. and Liggins, E.

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Scanning laser retinal displays (SLRDs) are a novel form of display which scan a modulated laser beam across the retina of the eye so as to form an image. Although safety assessments of such a system have been made, none have used the British and European laser safety standard, BS EN 60825:1 (1994). This paper describes such an assessment. The maximum safe exposures are given as corneal irradiances, and for both normal and scan failure situations. For scan failure the maximum permissible exposure is 2.55 mWcm^{-2} for an exposure of 0.25 seconds, which is the maximum time until the blink reflex terminates the exposure. For normal use the maximum permissible exposure is dependent on the exposure

duration, screen size and the wavelength of the light, but for a virtual 15" monitor at 0.5m and an 8 hour exposure the limit is approximately 2mWcm^{-2} below 550nm, rising for longer wavelengths, to 35mWcm^{-2} at 630nm and 100mWcm^{-2} at 670nm. The paper also gives these limits in equivalent monitor luminosities. Finally, the laser safety standard is applied to conventional displays, and the limits compared with those found for SLRDs.

Selective attention and the ideal observer applied to binocular summation

Rose, D. and Pardhan, S.

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Binocular contrast summation to threshold is a consequence of both higher sampling efficiency and lower equivalent internal noise for binocular targets (Pardhan and Rose, *Perception* 26, 1334, 1997; *IOVS* 39, S617, 1998). The contributions of each mechanism were estimated by adding varying amounts of external noise and extrapolating to zero, and differed depending whether the masking noise was correlated or uncorrelated between the eyes. A two-stage model is presented. First is a matrix of neurophysiological channels that are selective for all possible pairings of ocular dominance and stereoscopic disparity. At the second stage, attention is 'ideally' directed to (i.e. information is read out or used from) only the channels that respond to the signal. In our experiments, all targets were presented on the horopter but binocular, left eye and right eye targets were randomly intermixed. Binocularly correlated external noise impaired detection by injecting noise into the ideally attended channels (zero disparity and all ocular dominances) whereas uncorrelated external noise broadened attention: because the noise energy covered many disparities, its onset automatically drew attention away from the horopter.

Pre-attentive visual search and visual display technology.

Ward, P.A. and Carr, C.

Protection and Performance Department, Centre for Human Sciences, DERA, Farnborough, UK.

The traditional approach to assessing the impact of display technology on visual performance involves using either a rating/ranking or a reaction time paradigm. Both

these approaches have fundamental drawbacks: inherent variability in the data, large numbers of subjects and long experimental sessions. This study adopted a radically different approach by using a pre-attentive visual task and signal detection analysis. Most display technologies vary most in physical and temporal characteristics at the individual pixel level. Cathode ray tube (CRT) and a liquid crystal displays (LCD) are good examples of displays with very different pixel characteristics, notably the diffuse shape of the CRT pixel and the highly defined shape of the LCD pixel. The stimulus luminance and contrast were matched for both displays, and temporal characteristics were matched to within 20ms. Each LCD pixel subtended 1.2 min of arc. Because the simplest stimulus which will demonstrate pixel effects is a line which is not aligned with the display pixel structure the task chosen was detection of a sloping line within a field of similar vertical distractors (Ward and Foster 1988). Target detection was assessed as a function of eccentricity. Six subjects were used and data were converted to the bias free estimate of performance d' . The results indicated no significant difference in pre-attentive visual search as function of display technology, indicating that the pixel shape did not significantly affect performance.

Ward P.A. and Foster D.H. (1988) Anisotropic thresholds for orientation discrimination in brief multi-element displays. *Perception* 17, 392

Long term stability of instrument myopia and its relation to tonic accommodation.

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Tonic accommodation (TA) measurements were made before, and for 24 minutes after, 90 minutes use of a monocular optical device. Measurements of accommodation were made at 15 minute intervals during the 90 minute period. There was a significant change in TA from the pre-task to the post-task level. The shift in TA recovered over the post-viewing period. All the subjects demonstrated an inappropriate accommodation response when using the optical device which made them effectively myopic (instrument myopia (IM)). In all but one of the subjects the pre-task TA was significantly different from the first IM level. The level of IM varied greatly from subject to subject over a range from approximately 0.5 to 2.3D. In order to examine the long term stability of IM the subject data were pooled after first being normalised to remove the effects of inter-subject variability. This analysis indicated that the mean IM only varied within approximately 0.3D from its initial level. The analysis further indicated that the shift in TA is towards the mean IM level. Thus IM appears

to be unlike other anomalous myopias, such as night myopia, in that it is not a simple return of the accommodation system to its resting state. Also IM itself influences TA, by effectively pulling the TA towards the IM level. The change in TA is similar to Ebonholtz (1983) hysteresis effects and requires approximately 30 minutes dark adaptation to recover.

Ebonholtz S.M. (1983) Accommodative hysteresis: a precursor for induced myopia? *Invest. Ophthalmol. & Vis. Sci.* 24,513-515.

Does attention have access to monocular input?

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We used two types of paired display to determine whether or not visual search mechanisms have access to monocular input. In Type A both halves of each pair contained a Gabor target amongst perpendicular distractors. One target was horizontal; the other was vertical. Two spatial frequencies were used, one for one half, the other for the other half. The distribution of target and distractors within each half was identical so that when combined, the two targets formed a plaid. All of the distractors also formed plaids. When combined halves were viewed monocularly, the time required to locate the target did not vary with the number of distractors. We surmise that our target plaids are located by a pre-attentive mechanism. When the two halves were presented dichoptically, target location was even faster. This indicates that pre-attentive search mechanisms (possibly better described as texture-segregation mechanisms) have access to monocular input. Pairs of Type B differed from pairs of Type A in two ways: only one half of each pair contained a target and no Gabors formed plaids when the two halves were combined. With pairs of Type B, location time was proportional to the number of distractors. Thus, location of Type-B targets appears to require attention. For three of four observers, dichoptic and monocular displays produced similar location times. This indicates that attentive (“serial”) search mechanisms do not have access to monocular input.

Visual search in Alzheimer's disease

Andrea Tales, Tom Troscianko, Stuart Butler, Gordon Wilcock, Roy Jones and Jane Fossey.

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We asked whether the presence of Alzheimer's disease compared to normal ageing affected the performance of different kinds of visual search task. Of particular interest was whether Alzheimer's disease resulted in a particular impairment in a Conjunction search task in which the difference between target and distractor elements was defined by a conjunction of two features (orientation and lightness). Two control conditions were employed: a purely preattentive task and a single-dimension partly attentive task in which the target element was slightly larger than the distractors- a size task. The results suggested that individuals with Alzheimer's disease have a particular impairment in the conjunction and not in the size task. This implies that Alzheimer's disease particularly affects those mechanisms which compare across more than one feature type and spares the preattentive system. This study provides a double dissociation with previous work on Parkinson's disease which points to an impairment at the preattentive and not the attentive levels in Parkinson's disease. The two diseases therefore seem to affect different parts of the visual pathway.

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

Gale, A.S., Brown, I.D., Haslegrave, C.M., Krussey, 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).



Selected References



- Akutsu, H and Levi, DM (1998) Selective attention to specific location cues: the peak and center of a patch are equally accessible as location cues. *Perception*, 27, 1015-1023.
- Averbuchheller, L, Lewis, RF and Zee, DS (1999) Disconjugate adaptation of saccades: contribution of binocular and monocular mechanisms. *Vision Research*, 39, 341-352.
- Barbur, JL, Wolf, J and Lennie, P (1998) Visual processing levels revealed by response latencies to changes in different visual attributes. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 265, 2321-2325.
- Bartels, A and Zeki, S (1998) The theory of multistage integration in the visual brain. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 265, 2327-2332.
- Benson, PJ, Guo, K and Blakemore, C (1998) Direction discrimination of moving gratings and plaids and coherence in dot displays without primary visual cortex (V1). *European Journal of Neuroscience*, 10, 3767-3772.
- Bilodeau, L and Faubert, J (1999) Global motion cues and the chromatic system. *Journal of the Optical Society of America A-Optics Image Science and Vision*, 16, 1-5.
- Bilodeau, L and Faubert, J (1999) The oblique effect with colour defined motion throughout the visual field. *Vision Research*, 39, 757-763.
- Birch, J and Dain, SJ (1999) Performance of red-green color deficient subjects on the Farnsworth lantern (falant). *Aviation Space and Environmental Medicine*, 70, 62-67.
- Bogdanov, S and Maddox, WT (1998) Perceptual representation of visual stimuli. *Journal of Mathematical Psychology*, 42, 479-480.
- Boynton, GM, Demb, JB, Glover, GH and Heeger, DJ (1999) Neuronal basis of contrast discrimination. *Vision Research*, 39, 257-269.

Bradley, DV, Fernandes, A, Lynn, M, Tigges, M and Boothe, RG (1999) Emmetropization in the Rhesus monkey (*Macaca Mulatta*): birth to young adulthood. *Investigative Ophthalmology & Visual Science*, 40, 214-229.

Brazis, PW, Graffradford, NR, Newman, NJ and Lee, AG (1998) Ishihara color plates as a test for simultanagnosia. *American Journal of Ophthalmology*, 126, 850-851.

Busey, TA (1999) Localization and identification tasks rely on different temporal frequencies. *Vision Research*, 39, 513-532.

Carney, T and Klein, SA (1999) Optimal spatial localization is limited by contrast sensitivity. *Vision Research*, 39, 503-511.

Cauquil, AS, Bessou, M and Bessou, P (1998) Anteroposterior dynamic balance reactions to circular movement of the visual field without ocular pursuit. *Experimental Brain Research*, 123, 382-386.

Chapman, PR and Underwood, G (1998) Visual search of driving situations: danger and experience. *Perception*, 27, 951-964.

Clark, JJ (1999) Spatial attention and latencies of saccadic eye movements. *Vision Research*, 39, 585-602.

Collin, CA and Chaudhuri, A (1998) A maximum motion technique for assessment of color vision defects. *Perception & Psychophysics*, 60, 1337-1343.

Crognale, MA, Teller, DY, Yamaguchi, T, Motulsky, AG and Deeb, SS (1999) Analysis of red/green color discrimination in subjects with a single X-linked photopigment gene. *Vision Research*, 39, 707-719.

Dakin, SC and Herbert, AM (1998) The spatial region of integration for visual symmetry detection (vol 265, pg 659, 1998). *Proceedings of the Royal Society of London Series B-Biological Sciences*, 265, 2455.

Dev, A and Vandebomgaard, R (1998) Is our color vision blurred? *Journal of Mathematical Psychology*, 42, 501.

Diaz, JA, Chiron, A and Vienot, F (1998) Tracing a metameric match to individual variations of color vision. *Color Research and Application*, 23, 379-389.

Doherty, LM and Foster, DH (1998) Visual target detection: dependence of parallel processing on observer's performance level. *Journal of Mathematical Psychology*, 42, 511.

Dracopoulos, DC and Rosin, PL (1998) Special issue on machine vision using neural networks. *Neural Computing & Applications*, 7, 194.

Duret, F, Issenhuth, M and Safran, AB (1999) Combined use of several preferred retinal loci in patients with macular disorders when reading single words. *Vision Research*, 39, 873-879.

Eagle, RA, Hogervorst, MA and Blake, A (1999) Does the visual system exploit projective geometry to help solve the motion correspondence problem? *Vision Research*, 39, 373-385.

Erwin, E and Miller, KD (1998) Correlation-based development of ocularly matched orientation and ocular dominance maps: determination of required input activities. *Journal of Neuroscience*, 18, 9870-9895.

Faubert, J, Diaconu, V, Ptito, M and Ptito, A (1999) Residual vision in the blind field of hemidecorticated humans predicted by a diffusion scatter model and selective spectral absorption of the human eye. *Vision Research*, 39, 149-157.

Fdezvidal, XR, Garcia, JA and Fdezvaldivia, J (1998) A perceptual measure to predict the visual distinction between two color images. *Pattern Recognition Letters*, 19, 1137-1152.

Fine, EM and Rubin, GS (1999) Reading with central field loss: number of letters masked is more important than the size of the mask in degrees. *Vision Research*, 39, 747-756.

Gavrila, DM (1999) The visual analysis of human movement: a survey. *Computer Vision and Image Understanding*, 73, 82-98.

Gellrich, MM, Neumaier, S, Auwhadrach, C, Gellrich, NC and Hansen, LL (1998) Retinal ganglion cell layer and visual function in a patient with optic disc drusen. *Graefes Archive for Clinical and Experimental Ophthalmology*, 236, 904-915.

Gillam, B, Blackburn, S and Nakayama, K (1999) Stereopsis based on monocular gaps: metrical encoding of depth and slant without matching contours. *Vision Research*, 39, 493-502.

Graham, B and Judge, SJ (1999) Normal development of refractive state and ocular component dimensions in the marmoset (*Callithrix Jacchus*). *Vision Research*, 39, 177-187.

Grignolo, FM, Dibari, A, Bellan, B, Camerino, L and Maina, G (1998) Long-term refractive and phoric changes in visual display unit (VDU) operators. *European Journal of Ophthalmology*, 8, 76-80.

Guirao, A and Artal, P (1999) Off-axis monochromatic aberrations estimated from double pass measurements in the human eye. *Vision Research*, 39, 207-217.

Harper, R, Doorduyn, K, Reeves, B and Slater, L (1999) Evaluating the outcomes of low vision rehabilitation. *Ophthalmic and Physiological Optics*, 19, 3-11.

Hemmendinger, H (1999) The role of opponency in twentieth century colorimetry. *Color Research and Application*, 24, 6-9.

Hoffmann, M, Dorn, TJ and Bach, M (1999) Time course of motion adaptation: motion-onset visual evoked potentials and subjective estimates. *Vision Research*, 39, 437-444.

Hogema, JH (1997) Compensation for delay in the visual display of a driving simulator. *Simulation*, 69, 27-34.

Huber, DE (1998) Entrainment as a model for visual adaptation and persistence. *Journal of Mathematical Psychology*, 42, 482.

Ivers, RQ, Mitchell, P and Cumming, RG (1999) Sensory impairment and driving: the blue mountains eye study. *American Journal of Public Health*, 89, 85-87.

Jaschinski, W, Brode, P and Griefahn, B (1999) Fixation disparity and nonius bias. *Vision Research*, 39, 669-677.

Johnston, RL, Seller, MJ, Behnam, JT, Burdon, MA and Spalton, DJ (1999) Dominant optic atrophy - refining the clinical diagnostic criteria in light of genetic linkage studies. *Ophthalmology*, 106, 123-128.

Kerkhoff, G (1998) Rehabilitation of visuospatial cognition and visual exploration in neglect: a cross-over study. *Restorative Neurology and Neuroscience*, 12, 27-40.

- Khurana, B (1998) Visual structure and the integration of form and color information. *Journal of Experimental Psychology-Human Perception and Performance*, 24, 1766-1785.
- Kraft, JM and Brainard, DH (1999) Mechanisms of color constancy under nearly natural viewing. *Proceedings of the National Academy of Sciences of the United States of America*, 96, 307-312.
- Kurtenbach, A, Schiefer, U, Neu, A and Zrenner, E (1999) Preretinopic changes in the colour vision of juvenile diabetics. *British Journal of Ophthalmology*, 83, 43-46.
- Ladavas, E, Zeloni, G and Farne, A (1998) Visual peripersonal space centred on the face in humans. *Brain*, 121, 2317-2326.
- Lappin, JS and Craft, WD (1998) Fechner's insight and the retinal beginnings of spatial vision. *Journal of Mathematical Psychology*, 42, 479.
- Laughlin, SB (1999) Visual motion: dendritic integration makes sense of the world. *Current Biology*, 9, R15 (4 pages).
- Lawrence, DJ, Brogan, C, Benjamin, L, Pickard, D and Stewartbrown, S (1999) Measuring the effectiveness of cataract surgery: the reliability and validity of a visual function outcomes instrument. *British Journal of Ophthalmology*, 83, 66-70.
- Leigh, RJ (1998) Oscillopsia: impaired vision during motion in the absence of the vestibulo-ocular reflex. *Journal of Neurology Neurosurgery and Psychiatry*, 65, 808.
- Lennie, P (1998) Single units and visual cortical organization. *Perception*, 27, 889-935.
- Leopold, DA and Logothetis, NK (1998) Microsaccades differentially modulate neural activity in the striate and extrastriate visual cortex. *Experimental Brain Research*, 123, 341-345.
- Levi, DM, Klein, SA and Sharma, V (1999) Position jitter and undersampling in pattern perception. *Vision Research*, 39, 445-465.
- Li, YSW, Yuen, CWM, Yeung, KW and Sin, KM (1999) Prediction of the best-fit regression model to correlate instrumental colour measurement and visual assessment. *Journal of the Society of Dyers and Colourists*, 115, 22-31.

- Macintyre, J (1998) Special issue on machine vision using neural networks. *Neural Computing & Applications*, 7, 193.
- Macri, A, Rolando, M, Corallo, G, Iester, M, Verrastro, G and Calabria, G (1998) A comparative study of computerised visual field testing and optic disc morphometric parameters in the follow-up of primary open angle glaucoma. *Eye*, 12, 916-920.
- Maloney, L and Landy, M (1998) A statistical framework for combination of consonant visual cues. *Journal of Mathematical Psychology*, 42, 499.
- Mangiameli, LJ and Peters, L (1999) A non-visual battery for assessment of spatial abilities. *Archives of Clinical Neuropsychology*, 14, 86.
- Martin, PR (1998) Colour processing in the primate retina: recent progress. *Journal of Physiology-London*, 513, 631-638.
- Metha, AB and Mullen, KT (1998) Failure of direction discrimination at detection threshold for both fast and slow chromatic motion. *Journal of the Optical Society of America A-Optics Image Science and Vision*, 15, 2945-2950.
- Mihaylova, M, Stomonyakov, V and Vassilev, A (1999) Peripheral and central delay in processing high spatial frequencies: reaction time and VEP latency studies. *Vision Research*, 39, 699-705.
- Momose, K, Kiyosawa, M, Nemoto, N, Kimura, Y, Okuyama, F and Senda, M (1999) Visual temporal frequency characteristics determined by pseudorandom stimuli. *Investigative Ophthalmology & Visual Science*, 40, 50-54.
- Morland, AB, Bronstein, AM, Ruddock, KH and Wooding, DS (1998) Oscillopsia: visual function during motion in the absence of vestibulo-ocular reflex. *Journal of Neurology Neurosurgery and Psychiatry*, 65, 828-835.
- Mullen, KT and Losada, MA (1999) The spatial tuning of color and luminance peripheral vision measured with notch filtered noise masking. *Vision Research*, 39, 721-731.
- Mullen, KT and Sankeralli, MJ (1999) Evidence for the stochastic independence of the blue-yellow, red-green and luminance detection mechanisms revealed by subthreshold summation. *Vision Research*, 39, 733-745.

- Murphy, KJ, Carey, DP and Goodale, MA (1998) The perception of spatial relations in a patient with visual form agnosia. *Cognitive Neuropsychology*, 15, 705-722.
- Mussap, AJ and Levi, DM (1999) Orientation-based texture segmentation in strabismic amblyopia. *Vision Research*, 39, 411-418.
- Nakahara, K, Ohbayashi, M, Tomita, H and Miyashita, Y (1998) The neuronal basis of visual memory and imagery in the primate: a neurophysiological approach. *Advances in Biophysics*, 35, 103-119.
- Nakamura, Y and Ohtsuka, K (1999) Topographical analysis of motion-triggered visual-evoked potentials in man. *Japanese Journal of Ophthalmology*, 43, 36-43.
- Nicholls, MER and Wood, AG (1998) The contribution of attention to the right visual field advantage for word recognition. *Brain and Cognition*, 38, 339-357.
- Nilsson, UL, Frennesson, C and Nilsson, EG (1998) Location and stability of a newly established eccentric retinal locus suitable for reading, achieved through training of patients with a dense central scotoma. *Optometry and Vision Science*, 75, 873-878.
- Olivier, I, Weeks, DJ, Lyons, J, Ricker, KL and Elliott, D (1998) Monocular and binocular vision in one-hand ball catching: interocular integration. *Journal of Motor Behavior*, 30, 343-351.
- Olzak, LA and Thomas, JP (1999) Neural recoding in human pattern vision: model and mechanisms. *Vision Research*, 39, 231-256.
- Pollen, DA (1999) Feature article on the neural correlates of visual perception. *Cerebral Cortex*, 9, 4-19.
- Pope, DR, Edwards, M and Schor, CM (1999) Orientation and luminance polarity tuning of the transient-vergence system. *Vision Research*, 39, 575-584.
- Porrill, J, Frisby, JP, Adams, WJ and Buckley, D (1999) Robust and optimal use of information in stereo vision. *Nature*, 397, 63-66.
- Reinvang, I, Magnussen, S and Greenlee, M (1998) Visual ERPs to high and low spatial frequency stimuli. *Journal of Psychophysiology*, 12, 314.

Ridder, WH, McCulloch, D and Herbert, AM (1998) Stimulus duration, neural adaptation, and sweep visual evoked potential acuity estimates. *Investigative Ophthalmology & Visual Science*, 39, 2759-2768.

Rushton, SK, Harris, JM, Lloyd, MR and Wann, JP (1998) Guidance of locomotion on foot uses perceived target location rather than optic flow. *Current Biology*, 8, 1191-1194.

Scheuerer, W, Buttner, U and Straube, A (1998) Prediction and a stationary, structured visual background influence the dynamics of the smooth-pursuit offset in humans. *Experimental Brain Research*, 123, 361-367.

Sharpe, LT, Stockman, A, Jagle, H, Knau, H, Klausen, G and Reitner, A (1998) Red, green, and red-green hybrid pigments in the human retina: correlations between deduced protein sequences and psychophysically measured spectral sensitivities. *Journal of Neuroscience*, 18, 10053-10069.

Skrandies, W, Anagnostou, E and Kleiser, R (1998) Visual evoked brain activity and discrimination performance during saccadic eye movements. *Journal of Psychophysiology*, 12, 325-326.

Slaghuis, WL and Ryan, JF (1999) Spatio-temporal contrast sensitivity, coherent motion, and visible persistence in developmental dyslexia. *Vision Research*, 39, 651-668.

Snowden, RJ (1998) Shifts in perceived position following adaptation to visual motion. *Current Biology*, 8, 1343-1345.

Talcott, JB, Hansen, PC, Willisowen, C, Mckinnell, IW and Richardson, AJ (1998) Visual magnocellular impairment in adult developmental dyslexics. *Neuro-ophthalmology*, 20, 187-201.

Tan, JCH, Spalton, DJ and Arden, GB (1998) Comparison of methods to assess visual impairment from glare and light scattering with posterior capsule opacification. *Journal of Cataract and Refractive Surgery*, 24, 1626-1631.

Thornton, IM, Pinto, J and Shiffrar, M (1998) The visual perception of human locomotion. *Cognitive Neuropsychology*, 15, 535-552.

Tootell, RBH, Hadjikhani, N, Hall, EK, Marrett, S, Vanduffel, W, Vaughan, JT and Dale, AM (1998) The retinotopy of visual spatial attention. *Neuron*, 21, 1409-1422.

VanHateren, JH and Ruderman, DL (1998) Independent component analysis of natural image sequences yields spatio-temporal filters similar to simple cells in primary visual cortex. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 265, 2315-2320.

Wagner, M and Hochstein, S (1998) Visual search with depth defined by linear perspective. *Neuroscience Letters*, S43.

Watamaniuk, SNJ and Heinen, SJ (1999) Human smooth pursuit direction discrimination. *Vision Research*, 39, 59-70.

Watanabe, A, Pokorny, J and Smith, VC (1999) Measuring short-wavelength-sensitive cone discrimination thresholds using pseudoisochromatic figures displayed on a color monitor. *Japanese Journal of Ophthalmology*, 43, 5-8.

Watanabe, K and Shimojo, S (1998) Attentional modulation in perception of visual motion events. *Perception*, 27, 1041-1054.

Wiener, MC and Richmond, BJ (1998) Using response models to study coding strategies in monkey visual cortex. *Biosystems*, 48, 279-286.

Willis, A and Anderson, SJ (1998) Separate colour-opponent mechanisms underlie the detection and discrimination of moving chromatic targets. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 265, 2435-2441.

Wist, ER, Ehrenstein, WH and Schraus, M (1998) A computer-assisted test for the electrophysiological and psychophysical measurement of dynamic visual function based on motion contrast (vol 80, pg 41, 1997). *Journal of Neuroscience Methods*, 86, 103.

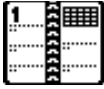
Wood, JM (1999) How do visual status and age impact on driving performance as measured on a closed circuit driving track? *Ophthalmic and Physiological Optics*, 19, 34-40.

Woods, RL, Tregear, SL and Mitchell, RA (1998) Screening for ophthalmic disease in older subjects using visual acuity and contrast sensitivity. *Ophthalmology*, 105, 2318-2326.

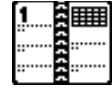
Yeshurun, Y and Carrasco, M (1999) Spatial attention improves performance in spatial resolution tasks. *Vision Research*, 39, 293-306.

References supplied (as usual!) by:

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Meetings Calendar



1999

- March 17 AVA99 annual meeting, College of Optometrists
David Simmons d.r.simmons@gcal.ac.uk
- May 7-8 Pre-Attentive and Attentive Mechanisms in Vision
Ft Lauderdale, USA
<http://www.elsevier.nl/locate/vision99>
- May 9-14 ARVO, Ft Lauderdale, USA
<http://www.faseb.org/arvo/>
- July 23-27 International Colour Vision Society 15th Meeting
Götting, Germany
<http://www.mpibpc.gwdg.de/abteilungen/141/ICVS99/>
Email: blee@gwdg.de
- August 10-14 23rd Pupil Colloquium, Nottingham
<http://www.mailbase.ac.uk/lists/pupil/files/>
- August 22-26 ECVP99, Trieste, Italy
Email: ecvp99@psicoserver.univ.trieste.it
<http://psicoserver.univ.trieste.it/ecvp99.html>
Abstract deadline 15th March 1999
- August 22-25 Vision in Vehicles 8, Boston, MA, USA
Email: S.Rivington@derby.ac.uk
<http://ibs.derby.ac.uk/viv8>
- September 6-8 British Congress on Optometry and Vision Science
Glasgow (BCOVS)
Email: P.C.Knox@gcal.ac.uk
<http://fhis.gcal.ac.uk/VS/BCOVS/home.htm>
Abstract deadline 1st July 1999
- September 13-16 British Machine Vision Conference, Nottingham
Email: Tony.Pridmore@nottingham.ac.uk
<http://www.nott.ac.uk/meom/bmvc99.html>
Abstract deadline 23rd April 1999