

Bulletin of the Applied Vision Association



Vision Scientists Memorial Fund
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AVA2002 report and abstracts
Defective Vision - call for papers
References on Vision

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APPLIED VISION ASSOCIATION

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://ftp.psy.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.op.umist.ac.uk/bootstrap.html>).

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

AVA and OPO Subscriptions

Membership for 2001/2002 will be as follows: ordinary members £20, student members £10. It is now possible to pay by direct debit or credit card.

Editorial

This bumper issue of the Bulletin contains a report of the AVA Christmas meeting at Aston plus report and abstracts of AVA2002 and the AGM. We include an announcement concerning the recent resolution put to AVA members and the future of awards from the AVA. We also include details of the forthcoming BCOVS/AVA meeting in Cambridge and of a meeting at UMIST which might be of interest to AVA members. 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 – 5th July 2002

Geoffrey J. Burton Travel Award

The Geoffrey J Burton 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. This fund has been renamed to the Vision Scientists Memorial Fund but the AVA will continue to award an annual Geoffrey J. Burton Travel Award from this fund with criteria similar to previous years. Donations to the fund can be directed to the AVA secretariat and cheques etc. should be made payable to "The Vision Scientists Memorial Fund".

The maximum award to any one individual is £400.

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:

28th February 2003

for conferences held between 1st March 2003 and 28th February 2004.

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/>

2002 Geoffrey J. Burton Travel Award

The 2002 Geoffrey J. Burton Travel Award has been given to Mariana da Silva from the Department of Psychology, University of Surrey.

Mariana will be presenting at VisionSciences in Sarasota in May 2002. Her abstract is as follows:

The role of action-relevance in the perception and representation of natural scenes

M.M. Silva, M.F. Bradshaw, J.A. Groeger Psychology, University of Surrey, Guildford, UK

Goodman (1980) showed that action schemas influence the retention of visual information within pictures. Here, we investigate whether such schemas affect perceptual processing of natural scenes using the standard 'change-blindness' flicker paradigm. Target objects were selected as either of high or low relevance to a salient action performed by an actor within the scene. Time to detect changes which involved surface properties of objects (e.g. colour or swapping with a similar object) was compared to time to detect those which involved object identity (e.g. deletion or swapping with a different object). Eye movements were recorded throughout using a head-mounted eye tracker, and related to the detection of change and relevance of the target object to the action. Observers viewed photographs of natural scenes which displayed one action performed by an actor within them. Four objects in each scene were pre-classified to be of high or low relevance to the action and to the scene. Subjects were required to inspect each scene in order to either (i) recall or (ii) recognise the objects at a later stage. Observers were also requested to react as soon as any change was detected. Time to change detection was found to be related to object relevance as well as to the scene. In general, changes to low relevant objects were detected faster, which suggests that expected items are less attended to. Fixation position was invariably found to be near the area where the change occurred when it was detected. The data suggests that prior knowledge or assumptions about the world, organised in the form of action schemas can affect the eye movement inspection patterns of natural scenes, and the allocation of visual attention within them. These results are consistent with those reported by Holfingworth and Henderson (2000).

Vision Scientists Memorial Fund

The AVA has been administering the Geoffrey J. Burton memorial fund for over 15 years. This fund was set up in memory of Geoffrey Burton who tragically died young. The purpose of the fund was to help young vision scientists with travelling expenses to conferences. In recent years the AVA has been conscious that it might be appropriate also to remember other vision scientists who have died young. One example is that of Richard Eagle. The AVA committee therefore considered what might be the best way forward. We do want to continue remembering Geoffrey Burton yet we are aware that it is difficult and inefficient to administer a number of restricted funds with relatively small sums in them. Therefore the AVA committee proposed that the Geoffrey J. Burton memorial fund be renamed the Vision Scientists Memorial Fund. This proposal was taken to members with voting in accordance with the AVA constitution. The proposal to rename the fund was narrowly passed. I think it appropriate that a number of things are made clear:

1. The Geoffrey J. Burton memorial lecture at the AVA AGM will continue.
2. The Geoffrey J. Burton travel award will continue with applications being made in the same way as in previous years.
3. The AVA committee would like to set up a Richard Eagle award. It is proposed that this award will be annual and awarded at the end of each summer (to distinguish it from the Geoffrey Burton travel award). The precise details of the award will be announced shortly.
4. The AVA would like to invite contributions to the Vision Scientists memorial fund. The fund would then be used to make the awards when necessary.

I hope that this clarifies the current position and reassures members that the AVA will continue to honour the memory of Geoffrey Burton and the awards associated with his name will continue.

Mark Scase
AVA Chairman

AVA Christmas Meeting

VISIONS OF VISION

Aston University 17 December 2001
Meeting Report

It seems that no Christmas break can begin without the gathering that has become known to all as the Christmas AVA. Every year it has a snazzy, but suitably vague title that allows contributions from all, and this year was no different.

It all started with a bang – otherwise known as Tom Troscianko. He discussed the work of himself and his fellow authors on natural image statistics and presented a simple cortically based model of contrast discrimination with practical applications in computer graphics. They have also found that the colour statistics of a particular and very “natural” group of natural images – namely fruit on foliage – provide a good match of the spatial transfer characteristics of colour vision, that may also prove to have useful applied applications.

The next talk, by Lewis Griffin, examined the huge problem of how to identify the “real” image from the huge set of possible images that could have produced the same pattern of responses of visual neurones. Rather than the more traditional approach of features detection and combination followed by categorisation, he considers a strategy that identifies a simple iconic image associated with a particular subset of the possible images, before extraction of qualitative structure. The “unknown quantity” with this approach is the exact rules for selecting the appropriate subset, so Lewis discussed some possibilities along with their strengths and weaknesses.

We have all hankered after some of the latest VR equipment, but Ian Thornton and Chris Christou have been lucky enough to use it for real. They showed that boundary extension, where we remember a wider angle of view from a picture than was actually seen, can be produced within a virtual reality set-up. Work of this type shows that the use of VR can be a practical method for controlling and manipulating such experiments.

Previous models for stereo grouping have concentrated on the stereo correspondence problem but Zhaoping Li has developed a computational model, based on intercortical interactions in V2 which addresses both

stereo correspondence and pre-attentive stereo segmentation. The model also accounts for depth edge highlighting, disparity capture, popout and transparency.

Mark Georgeson followed with another computational model, this time for encoding the blur of edges. He has developed a template approach that identifies blur based on a similarity measure between a 2nd derivative “signature” of an edge with a series of 1st derivative Gaussian templates with different scales. This approach successfully predicts the perceived blur of non-Gaussian edges (better than alternative models), and also can account the perceived sharpening of a blurred edge as it is sharpened.

MacDonald, Kwak and Luo discussed a colour matching experiment they carried out under different lighting conditions. They found that colours appear lighter under high lighting levels rather than low lighting levels – a result that is not predicted by the CIECAM97 colour appearance model. Although the effect may be due solely to rod contributions they also considered the possibility that a simultaneous contrast effect may also be occurring.

The afternoon session began with a talk from Peter Thompson. It could have been titled “The contribution of British rail and the mobile phone to vision research”. Apparently he was actually discussing a series of experiments carried out by Andrew Dunn comparing an “action” version of the Judd illusion, where subjects pointed to the endpoints and midpoints of the Judd arrow, with the more usual visual task. Their aim was to probe the action pathway, which, it was predicted, should only be affected by such illusions when a delay is imposed between the stimulus presentation and response. Interestingly, they found that the mislocation of the end and midpoint also occurred in the “action” task, although in some conditions, such as the delayed response, the “visual” and “action” illusions do not appear to be the same.

Kevin Brooks has investigated the contribution of disparity change and monocular motion cues on stereo motion and speed discrimination. Speed discrimination thresholds were measured for various disparity pedestals in random dot stereograms (which contain both cues) and dynamic random stereograms (which only contain disparity cues) and concluded that both cues influence stereomotion speed discrimination.

Julie Harris (of page 3 THES fame on the previous day) considered whether

3D motion can be predicted by a combination of responses from 2 independent mechanisms; one sensitive to the motion parallel to the plane of the eyes (“lateral motion”) and the other perpendicular (“motion in depth”). Minimum displacement thresholds for a motion detection task were well predicted by probability summation of the two channels. The same model can only account for direction discrimination for multi-frame motion, while two-frame motion models only require the “lateral” mechanism.

Although it is thought that it would be useful for vision to decompose complex motion in optic flow fields into an orthogonal basis set, the exact basis set used by vision has not been determined. Tim Meese discussed two experiments that set out to further our understanding of this. The first experiment, using stimuli with orthogonal global motion components, suggested non-independent mechanisms when the components were locally non-orthogonal. A second experiment suggested that vision does not have 2D templates matched to the component known as deformation, though pairs of orthogonal 1D templates might be used. His overall conclusion is that vision does contain multiple mechanisms for complex motion, but not from an orthogonal basis set.

Alexa Ruppertsberg measured chromatic selectivity of the global motion mechanism in random dot kinematograms. Interestingly, the task was almost impossible to do for S-cone isolating colours but the chromatic sensitivity for other colours appeared to be determined by the stimulation of the red-green channel, irrespective of the distribution of colour within the red-green channel.

We were then introduced to an interesting version of the barber pole illusion used by Johannes Zanker. He used it to test whether the strength of the illusion depends on the ratio of aperture circumference to the overall aperture area. To do this, he fragmented the aperture into identically sized smaller apertures so that their cumulative area was always constant. He found that the perceived direction of the illusion increases with the number of fragments, confirming his hypothesis.

Robert Snowden, discussed the phenomena of crowding in the periphery, where the legibility of a letter declines when other letters surround it. As stimuli, letters are high bandwidth, so Bob measured crowding of small sinewave patches at different eccentricities. He found evidence for increasing effects of interaction among the responses to the stimulus

patches as eccentricity increased but could not determine whether this was due to an increase in the strength of the interactions, or the distance over which the interactions occurred.

Michael Wright has been investigating the location and discrimination of Gabor targets from an array of distracter Gabors (with a different spatial frequency). He has found that biasing the spatial frequency difference between the target and distracters effects both, although differently. Arriella Popple also worked with similar targets in distracter arrays, using orientation rather than spatial frequency, but considered the spatial distribution of localising errors. She found that location errors tended to be close to the target, but more errors were made when the target was towards the top or bottom of the display. Also localisation was more accurate in dense arrays, suggesting contextual influences in orientation pop out rather than signal detection among independent orientation samples.

Eugene McSorley presented results from experiments examining accurate programming of saccades to a target of a particular spatial frequency, with the presence of different frequency distracters. Subjects were unable to discount the presence of a single distracter when it appeared between the target and the fixation point, but could when there were more distracters arranged around the screen. Curiously, it seems it is easier to locate the target from a larger number of distracters, than just one.

Finally, Tom Freeman, entered the fray and prepared us for the evening ahead, by telling us about alternative way of measuring extra-retinal movement. The new technique degrades the influence of the familiar position cues and he found that different signal and noise mixtures at the null point all appear to move at the same speed. Overall Tom concluded that positional information appears to have little influence on the original Filehne illusion.

At this point we left to have a glass or two of wine followed by the now traditional trip to the Sacks of Potatoes. I'm not sure whether this transformed our host in the way that Tom Troscianko's earlier photographic evidence suggested it would, but if so, I suspect that he wasn't alone.

Long may the Christmas meeting continue.
Gill Barbieri-Hesse

AVA Annual Meeting and AGM College of Optometrists, London 27 March 2002

Meeting theme: Achromatic Vision

AVA2002 abstracts

Geoffrey J. Burton Memorial Lecture

Professor Mark Georgeson, Aston University

From filters to features: a multi-scale template model for human spatial vision

Papers

Second-stage Mechanisms: a Computational Model

T.J. Atherton¹, S.J. Hinds¹, and K. Langley², ¹Computer Science, University of Warwick, Coventry, CV4 7AL, and ²Psychology, UCL, Gower Street, London. Email: tja@dcs.warwick.ac.uk

We outline a model of second stage spatial processing in mammalian vision. The model is an extension of the familiar “filter-rectify-filter” scheme having the form of two functionally identical stages in series; Stage 1: “filter-rectify-pooling”, Stage 2: “filter-rectify-pooling”. We explicitly define the form of the “pooling” which is over orientation. The model has some interesting properties. The first stage produces multiple intermediate image maps that carry information about the presence of energy-orientation symmetries (zero-fold indicates energy within the filter’s pass-band, two-fold is edges or bars, etc). Also available as outputs of the first stage are phase-orientations that are derived by omitting the “rectify” from the processing flow. We do not consider phase-orientations in this paper, instead see Atherton (2002). We focus on the “demodulated” energy-orientations from the first-stage and how these might be further processed to provide insight into Contrast Modulated (CM) gratings and plaids, Orientation-defined texture edges Nothdurft, and the “Collator” units described by Moulden (1994). There are remarkable similarities between the first and second stages, but also differences. The first stage takes in a

signal proportional to luminance and produces complex “feature maps” that carry information about energy-orientation. At each position the result is (literally) a complex number of the form $a(x,y) + i.b(x,y)$ (or equivalently $r(x,y).[\cos(x,y) + i.\sin(x,y)]$), the map codes the presence of an oriented image feature as the magnitude of response, $r(x,y)$, and the orientation of the feature as the phase, (x,y) . The type of feature at each position is coded by which map the response occurs in. The second stage takes its input from the first-stage responses, and here is one difference, the input is a complex image. The second-stage filters are tuned to frequencies between two and four octaves below those of the first-stage filters. The processing at the second-stage takes the same form as at the first-stage. The complex input to the second-stage has the remarkable property that an orientation-defined edge is most easily detected by the second-stage when the energy-orientation from the first-stage output differs by 180 degrees across the edge. The talk will take a non-theoretical approach, outline the model, and be illustrated by examples of second-order stimuli processed by the model. Extensions of the model to include pooling over spatial frequency and its relationship to responses beyond the Classical Receptive Field will be discussed.

Subitization and attentional engagement by transient stimuli

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A series of experiments were carried on the selection of moving and static items during enumeration. Small numbers of targets can be enumerated with little increase in reaction time and error, a process referred to as subitization (Kaufman, Lord, Reese and Volkman, 1949). For moving targets among static distracters, there was efficient selection characteristic of subitization. This was not the case for static targets among moving or transient distracters, which showed much larger RTs and a steady increase in RT with target number.

Efficient selection of the static targets was possible, however, when static targets and moving distracters were presented more foveally. With small inter-item spacing, grouping by proximity among the static items may have facilitated segmentation. This was tested in Experiment 2 by increasing the size of the static items in the more dispersed displays to

increase grouping. Although reaction times were slightly improved, they still increased linearly with target number.

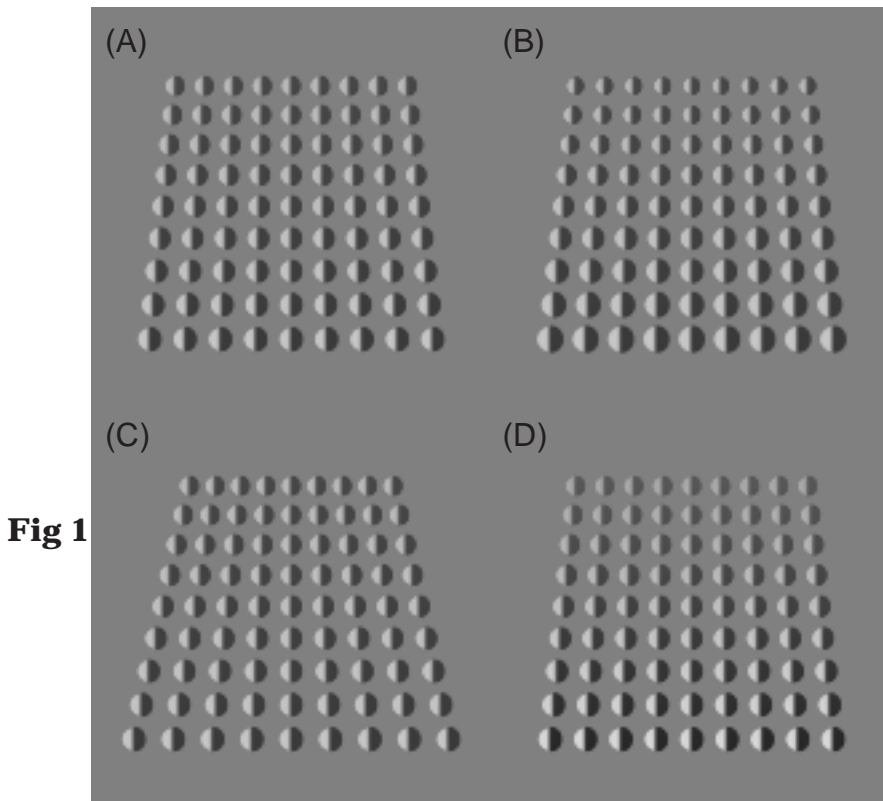
A second possibility is that when targets fall across relatively wide spatial areas, subitization will depend on cells with large receptive fields if those targets are to be detected in parallel. Such cells also tend to be activated strongly by motion (Baizer, Ungerleider, and Desimone, 1991). In particular, cells in Area MT respond selectively to movement and have been suggested as the cause of a similar asymmetry between moving and static targets in visual search (McLeod et al., 1991). In contrast, with foveal presentation the receptive fields would be much smaller leading to a different response to moving stimuli. In these displays, the moving items were perceived as having a higher velocity than when the display area was large and seemed to form a coherent moving background. This increased segmentation of moving and static items appeared to be supporting parallel selection of the static targets. In an experiment manipulating the speed and spacing of the items, it was shown that when distractors moved more slowly, subitization of static targets among moving distractors broke down and there was no evidence for rapid enumeration of up to 4 targets. Ivry and Cohen (1992) suggested that cells responding to static stimuli are also affected by moving stimuli, when the velocity is relatively slow and large receptive fields are activated - processing may be biased toward the magno / dorsal system. Hence parallel detection of static items amongst moving ones may be difficult.

Summing Pictorial Depth Cues to Increment Threshold: A Similar Result to Binocular Disparity and Motion

Tim S. Meese & David J. Holmes. Neurosciences Research Institute, Aston University, Birmingham, B4 7ET, UK. Email: t.s.meese@aston.ac.uk

As any undergraduate student of visual perception knows, there are many routes by which the missing dimension of depth can be recovered from our two retinal images. Over recent years investigators have begun to ask how information from these different routes are combined to deliver coherent unified perceptions. While some experiments have inquired about combination across very different depth cues, including static pictorial cues and binocular disparity (e.g. Johnston et al, 1993, *Vision Research*, **33**, 813-826), these investigations have effectively adopted matching or nulling techniques. Consequently, it is unclear whether these experiments

reveal properties of sensory mechanisms or cognitive strategies. In a more incisive approach, Bradshaw and Rogers (1996, *Vision Research*, **36**, 3457-3468) have gathered performance data using psychophysical probes of adaptation and summation-to-threshold and concluded that vision contains neural mechanisms for summing depth cues, at least from sources of motion parallax and binocular disparity. Here, we extend the use of the summation technique to investigate the combination of three static achromatic depth cues using stimulus elements arranged in nine rows and nine columns (see Fig 1).



Stimuli were viewed monocularly through a black viewing tunnel to enhance perception of depth. Stimulus duration was 100 ms and the width of the middle row of elements was 10.2 deg. The null stimulus, which carried each of three independent depth cues plus a gentle compression of the distance between the rows, is shown in Fig 1A. Test stimuli were similar, except that they contained increments (or decrements) in one or two of three cues (gradients in: element size, row width and element

contrast are shown in Fig1 B, C and D respectively). In each session, practised observers had to discriminate a test stimulus from the null stimulus in a two interval forced-choice design. Cue-increment thresholds were measured for (i) each of two different cues and then (ii) a compound stimulus containing normalised levels of the two cues. This whole procedure was repeated at least five times for each pair of cues. To remove static positional cues of individual elements, the stimulus was jittered by up to ± 0.5 of the width and height of the central element on each presentation. For both observers, substantial summation was found between size and contrast cues (B & D), but only when both cues were increments; when one of the cues was a decrement, summation was abolished. One of the observers also showed substantial summation for the other two pairings: (1) width and contrast and (2) width and size. In a control condition, neither observer showed summation for any of the three depth cues with an orientation-gradient that was included in both the null and test intervals (not shown).

We conclude that human vision contains summing mechanisms with inputs from at least some of the static pictorial depth cues. Whether this is the same or a different mechanism from that reported by Bradshaw and Rogers (1996) remains to be investigated.

This work was supported by a pilot-study grant awarded by the Leverhulme Trust

A Fourier model for predicting letter acuity in peripheral vision.

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A major goal of vision research is to develop computational models that predict visual performance on various tasks. One such task is letter acuity, for which a variety of models have been developed for foveal vision (e.g. Parish D.H. and Sperling G., Vision Research, 1991; Alexander K.R. et al, JOSA A, 1994; Solomon J.A. and Pelli D.G., Nature 1994). However, models of letter acuity for peripheral vision are underdeveloped by comparison. Two possible reasons for this state of affairs are that (1) peripheral vision has not been studied as extensively as foveal vision, and (2) the different factors which limit peripheral resolution (neural

undersampling and aliasing) preclude a simple importation of foveal models into peripheral vision.

To develop a model of peripheral letter discrimination, we measured threshold size for discriminating 33 pairs of Snellen letters at 30 degrees eccentricity in the nasal retina for two subjects, after correction of optical defocus. These pairs were chosen so that they differed in power by less than 10%. As a measure of psychophysical dissimilarity (D) for each pair we subtracted their images in the spatial domain, performed a Fast Fourier Transform on this difference image, and divided the RMS power in the resultant 'difference spectrum' by the sum of the RMS powers of the individual letter spectra. A plot of D vs. psychophysical threshold letter size gave a correlation of $R=0.8$. Threshold letter size varied by a factor of 4 depending on which letter pair was being discriminated. When D was calculated for letters that were low-pass filtered at different cutoff frequencies ranging from 2.5 down to 0.625 cycles/letter (c/let), the correlation with psychophysical performance was greatest when cutoff was 1.9 c/let ($R=0.85$) and only declined significantly when cutoff fell below 1.25 c/let. Conversely, when the difference spectrum was high-pass filtered at different cutoff frequencies, the correlation decreased continuously as the cutoff increased. These results imply that the band of frequencies between zero and 1.9 cycles/letter gives the best prediction of psychophysical discriminability of Snellen letters in peripheral vision, and is in close agreement with previous studies of foveal letter acuity indicating that spatial frequencies below 2 c/let are most useful for letter discrimination.

Looking at op art from a computational viewpoint.

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Arts history tells an exciting story about repeated attempts to represent features, which are crucial for understanding of and acting in our environment, and which at the same time go beyond the inherently two-dimensional nature of a flat painting surface: depth and motion. In the twentieth century, marked by the invention and development of kinematic media (cinema, television, internet), some artists such as Bridget Riley began to experiment with simple black and white patterns that can create vivid dynamic illusions in static pictures. The cause of motion illusions in

Op Art paintings is yet a matter of debate, but there are good indications that eye movements may play an important role in this phenomenon. In order to gain some insight on the possible consequences of retinal image shifts, synthetic wave gratings, dubbed as ‘riloids’, were used as basis for a geometric analysis and as inputs for a computational model of early motion processing. This two-dimensional array of motion detectors (2DMD model) provides response maps that represent the spatial distribution of motion signals generated by a stimulus, such as a two-frame sequence reflecting a saccadic displacement. The (moiré) interference pattern of the difference between the pattern at two stimulus locations can be interpreted luminance change necessary to detect local motion. Based on this geometry one would expect regions of motion in different directions, which is confirmed by first simulations providing motion signal maps in which local directions form extended patches of similarity. The direction usually does not correspond to the direction of pattern displacement, which can be expected as an instance of the so-called ‘aperture problem’ from the geometry of the curved gratings, giving rise to a variety of phase shifts and orthogonal motion components in the different regions of the pattern. The patchy structure of the simulated motion detector response to the displacement of riloids resembles the motion illusion, which is not perceived as coherent shift of the whole pattern, but as a wobbling and jazing of ill-defined regions. Although other explanations are not excluded, this might suggest that the puzzle of Op Art motion illusions could potentially have an almost trivial solution in terms of small involuntary eye movement leading to image shifts that are picked up by well-known motion detectors in the early visual system.

Direction repulsion: Evidence for speed tuned velocity adaptation and a principal axis bias.

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Background: The perceived direction of a moving test sinusoidal grating may be altered by adaptation to another moving grating whose direction of motion is different. It is suggested that the adaptive changes in perceived direction, which are generally repulsive, are controlled by two main factors: (i) speed tuned velocity adaptation; and (ii) a principal axis bias. **Methods:** The test and adapting stimuli were sinusoidal gratings of

3.5 cpd periodicity and 8.0 Hz drift rate. To measure the direction of motion of the test patterns, subjects were required to determine whether the spatial orientation of a line marker appeared more clockwise than the direction of motion of the test patterns. Both the absolute and relative direction of the adapting and test gratings, and their contrast, were varied to determine the effects of motion adaptation on perceived direction. Results: When varying the absolute orientation of the test and adapting grating, but fixing the direction difference between them at 45° , direction repulsion was maximum when the adapting grating direction lay along the principal axes. Direction repulsion was minimum when the adapting grating moved along an oblique direction. When varying the relative direction between the test and adapting grating for two different adapting grating directions, the maximum shift in the direction repulsion in both cases occurred when the test grating moved in the direction of a principal axis. When varying the relative contrast but fixing the direction of the adapting and test gratings, the direction repulsion was independent on the contrast of the test signal for a high contrast adaptor. Conclusions: The results suggest that the perceived shifts in direction repulsion are a consequence of a speed tuned adaptive mechanism. The results are consistent with the predictions made by a quadratic programming model of motion perception in which both speed and direction are coded by opponent mechanisms that lie along the principal axes.

Posters

Interaction between luminance gratings and disparity gratings

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Lowered stereoscopic thresholds were found in some random dot disparity gratings of spatial frequency f , when luminance gratings of spatial frequency f or $2f$ were added in the same orientation. The facilitation depended on relative spatial phase. However, when the phase relationship between the luminance and disparity gratings was manipulated such that relative phase was unpredictable, the threshold facilitation was eliminated. Thus, the lowering of threshold can be attributed to the spatial

cueing effects of the luminance grating and the removal of spatial uncertainty. This was confirmed by showing that the presence of an explicit spatial cue, in the form of extended horizontal lines that differed from the remainder of the display only in terms of the granularity of the random noise texture, produced maximum facilitation. In a further experiment it was shown that a luminance grating of frequency f added to a suprathreshold disparity grating of frequency f or $2f$ was seen by the majority of observers as a shading pattern on a 3D corrugated surface. Depending on spatial phase, the luminance grating can modify the perceived shape of the stereoscopic corrugated surface. The possibility of suprathreshold interactions is suggested by biases in judgements of apparent depth.

Observers exploit binocular disparity information in motor tasks within dynamic telepresence environments.

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Binocular disparity has, become increasingly commonplace in telepresence systems despite the additional cost of its provision. Experiments which show that perceptual and visuo-motor performance is worse under monocular than binocular viewing are often cited as justification for its use. Here we question whether this experimental comparison and provide an important set of data which compares performance on a motor task under binocular, monocular and bi-ocular (where both eyes receive the same view) conditions. Binocular cues were found to be particularly important in the control of the transport component. In the binocular conditions peak velocity scaling with object distance was greater than in the other conditions, and in the bi-ocular condition, where the binocular distance cues conflicted with pictorial information, no scaling was evident. For the grasp component, even in the presence of conflicting size and depth information, grip scaling remained equivalent in all conditions. For the transport component at least, binocular cues appear important and the decrease in performance observed in behavioural studies under monocular conditions is not attributable to lack of information in one eye but rather to the lack of binocular depth cues. Therefore in the design of telepresence systems to be used in telemanipulation tasks, the use of stereoscopic display technology seems justified.

Effects of Visibility and Separation upon Vernier Acuity for Narrowband and Broadband Stimuli.

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Purpose: This study investigates the influence of visibility on vernier acuity thresholds for abutting and separated narrowband stimuli (Experiment 1), and asks whether these data can account for broadband vernier performance (Experiment 2).

Methods: Experiment 1: Vernier thresholds were determined for sinusoidal grating stimuli at two spatial frequencies (1 & 8 c/deg.) across a range of contrasts (0.05-0.8) and exposure durations (35-2100msecs). Performance was assessed for the abutting configuration, and when a gap equivalent to 0.5 to 2.5 times the spatial period of the grating was introduced between the upper and lower halves of the grating. Experiment 2: Vernier thresholds were determined for a square-wave stimulus as a function of contrast (0.06 to 0.78). Exposure duration was fixed at 2100msecs. Thresholds were determined at the appropriate contrast levels for the fundamental frequency (1.8c/deg.) of the square-wave, and for a number of the harmonics (3F, 5F, 7F, 9F).

Results: Experiment 1: Abutting condition: As expected, vernier performance was found to improve as a function of contrast at all exposure durations for the lower spatial frequency (1c/deg). This was also true for the higher frequency (8c/deg) at short exposure durations. However, performance exhibited considerable contrast independence when longer durations were employed. Separated conditions: As the separation between the target elements was increased, vernier performance became increasingly independent of contrast. This trend was more evident at the lower frequency. Experiment 2: Abutting condition: At high contrasts of the square-wave, vernier sensitivity is roughly equal for the F, 3F, 5F & 7F components. However, square-wave vernier performance is consistently better than the best performance for the component frequencies. Separated condition: When a gap equivalent to 0.5 times the spatial period of the fundamental frequency is introduced between the stimulus elements, it appears that only the fundamental and third-harmonic contribute to square-wave vernier performance.

Conclusion: Vernier performance for abutting stimuli can be invariant across much of the contrast range, provided high frequency stimuli and long exposure durations are employed. Despite this, contrast independence is not exhibited for abutting broadband stimuli because, within the broadband stimulus, the contrast of the higher harmonic components never reaches a level which is high enough to reveal this plateau. As with detection of broadband stimuli, we suggest that vernier performance for abutting and closely separated broadband stimuli represents the envelope of vernier sensitivity of those spatial frequency mechanisms activated by the broadband stimulus.

Do depth aftereffects arise pre-attentively?

David Rose¹, Mark F Bradshaw¹, Paul B Hibbard². ¹Department of Psychology, University of Surrey, Guildford, Surrey GU2 7XH and ²Department of Psychology, University of St Andrews, St Andrews, Fife KY16 9AJ.

The computation of depth from binocular disparity is normally considered to occur in early areas of visual cortex. In contrast, the computation of motion may take place in early or in higher areas (V5/MT). Following the work of Chaudhuri (Nature, 344, 60-62, 1990) the mechanisms of motion perception have been established by several workers as vulnerable to the effects of attention, in that the motion after-effect is reduced if attention is focussed on a character-processing task during the adaptation phase. Here, we extend this method to the depth after-effect, using random-dot stereograms comparable in layout to the stimuli used for assessing motion after-effects.

Thus for the depth after-effect, subjects adapted to stationary random-dot patterns which formed two rectangular patches standing out by unequal amounts in front of a stationary background plane, one rectangle above and one below fixation. Aftereffect duration was tested on stationary test patterns containing two rectangles equally prominent in depth. Similarly, for motion after-effects, we adapted with two rectangles of random dots drifting in opposite directions (left and right) above and below fixation against a stationary background. Testing was then performed with the same stationary test stimulus as for the depth after-effect. In some conditions subjects detected, during adaptation, target letters in a stream of characters, which were presented at one of two rates.

We found that the durations of both after-effects were reduced in the conditions in which the character stream was processed during the adaptation phase. Moreover, the amount of the reduction increased in both tasks as the character stream became more rapid. The results are discussed in the light of recent theories that attention can modulate the earliest stages of visual processing, and it is suggested this must apply to depth as well as motion perception.

Meeting Report

This year's meeting suffered from a slight reduction in the number of oral presentations compared with recent years, but that said I think that the quality of the presentations more than made up for the quantity. Just to spoil the traditional chronological review, I shall start in the middle of the day, with the Geoffrey J Burton Memorial Lecture, this year given by Professor Mark Georgeson, of Aston University. For anyone who joined the AVA in the last 10 years, including myself, Geoffrey Burton is a bit of mystery - he had a high prominence, and in memoriam has had a fairly generous travel fund named after him, but little concrete information is available about the man himself. I was very pleased, then, when Mark started with an very warm reflection of the life and work of Geoffrey Burton, starting with the late 70s when he was part of the applied optics group of Imperial College. This eulogy not only started off his talk nicely, but was also relevant given other events during the day. The bulk of the talk was entitled 'from filters to features: a multi-scale template model for human spatial vision'.

The day started with a talk by Tim Atherton (with co-authors Hinds and Langley) on 'Second stage Mechanisms, a computational model'. Tim grappled with the problem of how human vision processing might work, proposing a two stage model. The model was illustrated by presenting the output of the model with various stimuli, including gratings and plaids, and Nothdurft's Square, which is a square defined only by a 90 degree rotation in a field of line sub-elements. (Come to think of it, that sounds like a square - I guess you just have to see it).

Tim Meese presented next, with a summary of his work on summation of pictorial depth cues (co-author D J Holmes). He started with a fantastically contentious proposal, that the term 'stereoscopic' be extended to include monocular depth cues. While I agree with the etymology, I was relieved when he moved on to the body of the presentation, a report of a relatively uncontentious experimental study. His stimulus consisted of a field of elements arranged in a trapezoidal matrix, the elements varying in size and contrast and the array varying in perspective, to provide the depth cues. The experiment presented the stimulus monocularly, and measured how threshold depth perception changed when multiple depth cues were presented. Interestingly, he found that summation occurred with the size and contrast cues, but only with addition, and not with subtraction. Tim went on to suggest three possible mechanisms for the summation (no summation, linear summation without noise, and linear summation with noise), and suggested which of the mechanisms best matched the data. One of the interesting aspects of the stimulus was that the orientation of each element did not vary with perspective - as if there was an array of vertical elements on a plane, rather than a set of flat elements on a plane, and it was suggested during the questions after the presentation that this might be the reason for not finding summation with the perspective cue in one of the observers.

Johannes Zanker, of Royal Holloway, rounded off the morning with a very interesting talk about motion illusions in op-art. He started with a brief but fascinating history of op art, finishing with the motion illusions, particularly those of Hajime Ouchi (the Ouchi illusion) and Bridget Riley (Fall) and even included Australian aboriginal art (the Wititj illusion). Johannes suggested that while the full cause of the motion illusions in op-art are still a matter of debate, eye movements play an important part. To investigate this, he described a set of modelling experiments with 'Riloids', which are synthetic op art patterns that follow the sinusoidal patterns seen in 'Fall'. He found that a simple model that consisted of a two dimensional array of motion detectors predicted appropriate motion when fed by a sequence reflecting saccadic eye movements, suggesting that saccades are indeed the driving force behind the motion illusion in Riloids.

At this point members of the AVA had to suffer that annual delay before lunch - the AGM. This was not the peaceful event of old. Mark Scase gave his third address as chairman in his usual inimitable style, and

Keith Langley presented his first treasurer's report in his involuntary 'the New Statesman' style, but the proposal to rename the Geoffrey J Burton Memorial Fund produced a firework of debate. While there was strong opposition from some members, the proposal, after a lengthy delay to check the postal votes, was announced passed.

After the Geoffrey J Burton Memorial Lecture, Roger Anderson from the University of Ulster continued the afternoon with a presentation on a fourier model of letter acuity in peripheral vision (Co author L N Thibos). His visual task was to distinguish letter pairs presented in the periphery of vision. The first output of the study was data showing a fairly linear correlation between psychophysically obtained threshold letter size and a measure of the difference between the two letters (the RMS energy of the fourier transform of the spatial subtraction of the two letters divided by the sum of the RMS energies of the fourier transform of each of the letters). Later, he went on to show the effects of optical blur on performance. This data suggested that it is the spatial frequency band from 0.6 to 2.2 cycles per letter that is most important in peripheral letter acuity.

Louise Alston (Brunel) followed with a paper on subitization (co-authored by G W Humphreys). Subitization is a subject that I haven't heard discussed in conference for some time, and describes the ability of the human vision system to count up to around 5 objects effectively instantaneously, when for greater numbers of objects the counting time is roughly proportional to number. Louise postulated that for subitization to occur the items must all be in the same feature map, and then went on to describe a number of experiments that attempted to elucidate if motion stopped subitization. The main result was that subitization could occur with moving targets and stationary distractors, but broke down when the targets were stationary and the distractors moved, particularly for eccentric targets. She went on to describe further experiments where the parameters were varied to try to better describe this effect. She finished the presentation with some potential cortical mechanisms for this effect.

Keith Langley presented next. I think it was Tom Troscianko that first admitted publically that he had never understood a single talk that Keith had given, and I am willing to admit that I suffer from the same problem. This is almost certainly because 'Keith is a genius, and I am a moron', and I vainly try to hang onto the belief that one day I'll understand. Imagine my delight, then, when I found Keith's talk to be both erudite

and understandable. His presentation (co-authored by S Anderson) was on experimental evidence for a principal-axis bias for motion adaptation. Keith's talks always promote a healthy debate and this was no exception, with a strong discussion on how the bias might have been created.

In addition to the oral presentations, the meeting had 4 poster presentations that were scrutinised during the breaks. Mike Wright and Tim Ledgeway presented on interactions between luminance and disparity gratings, showing a facilitation that they suggested was due to spatial cueing by the luminance information. Bradshaw, Elliot and Watt presented a poster on the importance of binocular disparity for users of telepresence systems. Barrett, Whitaker and Morrill presented on the effects of contrast on abutted and separated vernier acuity thresholds, and on the effect of adding higher harmonic components to the gratings. Finally, Rose, Bradshaw and Hibbard presented on the effects of attention on motion and depth after-effects.

The meeting closed with the usual drinking of wine and snacks. The party moved to a restaurant down the road with the singular feature of creating its walls out of firewood, although by that point the alcohol was dulling the need for a high-class venue. My recollection of the evening is a bit of a blur from that point, although I distinctly remember a conversation in which Mark Georgeson challenged Keith Langley to explain the mechanistic basis of his model of human vision, and Keith responded with an argument that eventually proved the modelling equivalent of black = white. At least that is how I remember it... From the restaurant we definitely went on to a pub around the corner that hasn't been there before, and isn't there anymore.

Richard Jones
QinetiQ

AVA - Defective Vision Meeting

10 July 2002

**Anglia Polytechnic University
Cambridge**

Call for Papers

The Applied Vision Association will hold a one-day scientific meeting aimed at highlighting the clinical relevance of quality basic research. It will be hosted by Anglia Polytechnic University (Cambridge) on Wednesday 10th July 2002.

We are now pleased to ANNOUNCE the invited speakers and titles:

RONALD S HARWERTH

John and Rebecca Moores Professor of Optometry, University of Houston,
U.S.A.

“Defective Vision from Glaucoma: Structure-Function Relationships.”

MICHAEL E BOULTON

Professor, Head of Cell and Molecular Research Group, Department of
Optometry and Vision Sciences, Cardiff University, U.K.

“Do Age-Related changes in the Retina contribute to Age-Related Macular
Degeneration?”

GARY S RUBIN

Helen Keller Professor of Ophthalmology, Institute of Ophthalmology,
University College London, U.K.

“Reading without a Fovea”

Vision scientists with backgrounds in all areas including optics, psychophysics, biology, neurophysiology, physiology and computational vision, and from all vision-related disciplines including psychology, optometry and ophthalmology are encouraged to contribute papers/posters

that report research directly or potentially related to any aspect of "Defective Vision".

Abstracts (max length: 300 words) for contributed papers/posters should be submitted by e-mail to Dr Sarah J Waugh (s.j.waugh@apu.ac.uk) by 10th May. Abstracts will be peer reviewed and published in the journal, *Ophthalmic and Physiological Optics*.

Abstract Format: Give Title, full names, affiliations and addresses (including postcodes) of all authors. Please arrange body under the following headings: Purpose, Methods, Results, Conclusions. Avoid use of references and define abbreviations at first mention. If references must be included provide full details of those cited, in a list at the end of the abstract. Acknowledge grant/financial support. The abstract should be intelligible to a broad spectrum of vision researchers.

Abstract submissions should also include:

- 1) a statement of preference for a talk or a poster
- 2) an indication of the mode of presentation for talks (power-point [MAC or PC], slides, OHP)

The Meeting will be run in tandem with BCOVS (British Congress of Optometry and Vision Science) to be held on Tuesday 9th July. (For further information on details/speakers scheduled for this conference, watch further notices or refer to the website noted below.)

There will be a joint conference dinner on Tuesday evening.

Registration will be available for either, or both meetings.

Attendees **should** pay in advance at the registration rate shown below.

REGISTRATION FEES

AVA BCOVS
One Day Rate

Student 12.50 12.50

Other 15 15

28

Both Days Rate

Student 22

Other 27

Please refer to APU website (<http://www.apu.ac.uk/conferences/index.shtml>) for further details and registration form. Alternatively telephone or email June Petrie: (01245) 493 131 ext 3168 (j.h.petrie@apu.ac.uk).

For more information contact:

Dr Sarah Waugh,

Department of Optometry and Ophthalmic Dispensing,

Anglia Polytechnic University,

East Road, Cambridge,

CB4 1QG.

email: s.j.waugh@apu.ac.uk

The following meeting is not organised by the AVA but might be of interest to our members:

Visual Performance of the Human Eye

A Festspiel for W.N.Charman

11th & 12th September 2002

UMIST, Manchester, UK.

A conference to celebrate Professor Neil Charman's extensive contributions to vision science and optometric education.

Programme

Wednesday 11th September

Morning session

09.30 – 10.30: Registration

10.30 – 10.40: Welcome

10.40 – 11.25: Nearwork induced transient myopia

K. Ciuffreda (SUNY, USA)

11.25 – 11.45: Continuous measurement of accommodation in human factor application

J. Wolffsohn (Aston University, UK)

11.45 – 12.05: Accommodation function and ageing

G. Heron (Glasgow Caledonian University, UK)

12.05 - 12.25: Modelling the mechanics of accommodation and presbyopia

S. Judge (University of Oxford, UK)

12.25 – 14.00: Lunch (Harwood Room)

Afternoon session

14.00 – 14.45: Individual variations in the aberration structure of human

eyes.

L. Thibos (Indiana University, USA)

14.45 – 15.05: Reaction time – an index of visual conspicuity.

S. Plainis (Volos, Greece)

15.05 – 15.25: Visual functionality entering the mesopic range.

L. Ronchi (AOI, Italy)

15.25 – 16.05: Break. Tea/Coffee/Biscuits

16.05 – 16.25: Design parameters for precision tinting.

A. Wilkins (University of Essex, UK)

16.25 – 17.10: Ocular optics, electroretinograms and primary open angle glaucoma.

N. Drasdo (Cardiff University, UK)

19.00 – 19.30 Dinner (Harwood Room)

Thursday 12th September

Morning session

09.30 – 10.15: Crystalline Lens Development: The influence of genetics vs the visual environment.

J. Sivak (University of Waterloo, Canada)

10.15 – 10.35: Sympathetic control of accommodation: evidence for inter-subject variation.

B. Gilmartin (Aston University, UK)

10.35 – 10.55: Effect of beta adrenoceptor antagonists on autonomic control of ciliary smooth muscle

B. Winn (University of Bradford, UK)

10.55 – 11.30: Break. Tea/Coffee/Biscuits

11.30 – 11.50: Dynamic properties of near triad of 3D-display observers measured by aid of video refraction unit

K. Ukai (Nihon Fukushi University, Japan)

11.50 – 12.35: Optics and vision unlimited
M.Freeman (Derbyshire, UK)

12.35 – 14.15: Lunch. (Harwood Room)

Afternoon session

14.15 – 15.00: Monochromatic aberrations of the eye.
H. Howland (Cornell University, USA)

15.00 – 15.20: The contrast sensitivity function for detection and resolution of blue-yellow gratings in foveal and peripheral vision.
R. Anderson (University of Ulster, UK)

15.20 – 15.50: Break. Tea/Coffee/Biscuits

15.50 – 16.20: Neurotoxic effects of GABA: Transaminase inhibitors in the treatment of Epilepsy; Ocular perfusion and performance.
S. Hosking (Aston University, UK)

16.20 – 17.05: New developments in supra-threshold perimetry.
D. Henson (Manchester Royal Eye Hospital, UK)

17.05: Close

Fees

Faculty and others £80.00* Yes/No

Graduate Students and Post Docs £30.00* Yes/No

Wednesday, September 11th Conference dinner £26.00 Yes/No

*Cost for the two day meeting including lunches

UMIST Accommodation

Accommodation is available on campus at the Manchester Conference Centre.

Single room with breakfast, £56.50.

Double/Twin room with breakfast, £65.80.

Hotel Accommodation in Manchester

Nearby hotel accommodation is available at the Ibis Hotel on Charles Street (0161 272 5000), the Palace Hotel on Oxford Road (0161 288 1111), the Britannia Hotel on Portland Street (0161 228 1361), or the Jarvis Piccadilly Hotel (0161 236 8414).

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AVA books for sale

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

Payment can be by credit cards (*yes we can now accept them!*) cheque or postal order in UK pounds to "Applied Vision Association". Send your payment with the order to:

AVA Secretariat,
Applied Vision Association,
College of Optometrists,
42 Craven Street,
London WC2N 5NG.

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., 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).



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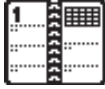
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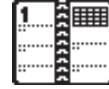
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Mark Scase



Meetings Calendar



2002

- May 5-10 ARVO, Ft Lauderdale, FL.
<http://www.arvo.org>
- May 10-15 VisionSciences, Sarasota, FL.
<http://www.vision-sciences.org/>
- July 9-10 BCOVS and AVA Defective Vision, APU
<http://www.apu.ac.uk/conferences/bcovs.shtml>
- August 25-29 ECVP, Glasgow, Scotland
<http://www.ecvp.org>
- September 11-12 Optical Performance of the Eye, UMIST
<http://www.umist.ac.uk/optometry/conference.htm>