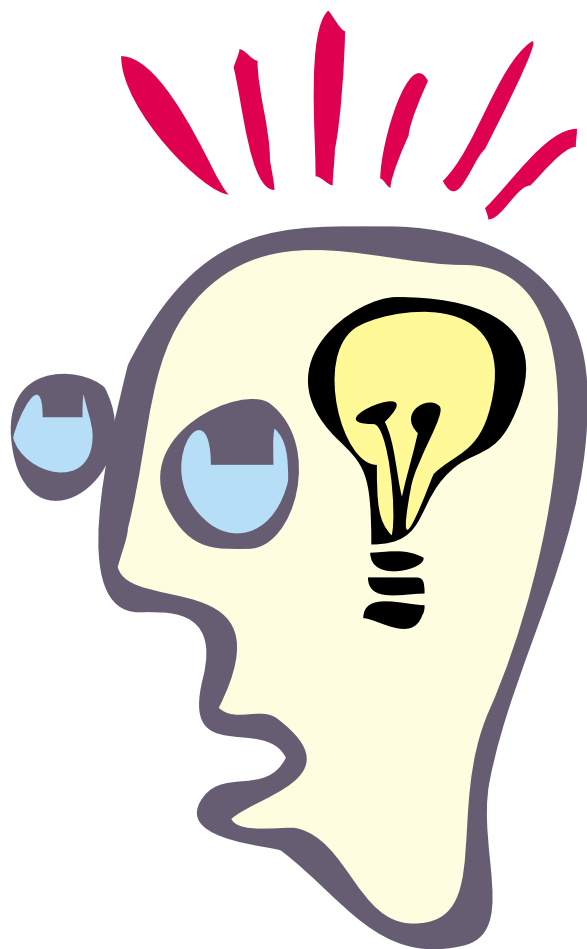


Bulletin of the Applied Vision Association



GJB Travel award winner
AVA2001 annual meeting abstracts/writeup
Natural Images writeup
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://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 2000/2001 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 is the first of the new quarterly Bulletins that are published in late January, late April, late July and late November. This issue of the Bulletin contains abstracts of the AVA annual meeting held at the College of Optometrists in London. We also include a meeting report of this meeting and the natural images meeting held last year. 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 – 2nd July 2001

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:

28th February 2002

for conferences held between 1st March 2002 and 28th February 2003.

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:

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The 2001 award has been given to Julian Wallace from Glasgow University. Julian will be presenting at ARVO on "The efficiency of smooth pursuit for surface motions".

AVA2001

21 March 2001

**College of Optometrists,
London.**

Meeting theme:
Visual Adaptation

The Geoffrey J. Burton memorial lecture was given by:

**Professor Colin Blakemore FRS,
Waynflete Professor of Physiology, University of Oxford.**

“Visual Plasticity: benefits and costs”

ABSTRACTS

Perceived Contrast Following Adaptation: The Role of Spatial Frequency & Stimulus Visibility

Brendan T. Barrett, Paul V. McGraw, Paul Morrill
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Bradford, BD7 1DP.

Background/Aims: In the present experiments, we compare the reduction in perceived contrast following adaptation of test gratings with different orientations. Recent studies¹ suggest that, under certain conditions, orthogonally oriented test gratings show a greater reduction in perceived contrast than those oriented parallel to the adapting stimulus. However, other investigators^{2,3} maintain that the reduction in perceived contrast is never greater than the parallel adapting and test condition. The aim of the present study was to resolve these conflicting findings.

Methods: Using a contrast matching procedure we measured the perceived contrast of test gratings oriented at 45° and 135° following adaptation to a 45° grating of the same spatial frequency. Two experiments were carried

out. *Experiment 1:* The perceived contrast of test gratings ranging in contrast from 1 to 0.45 was measured following adaptation to a grating with a contrast of 0.8. This was carried out at two spatial frequencies (2.25c/deg & 9c/deg). *Experiment 2:* The effects of adaptation upon perceived contrast were assessed for a number of adapting contrasts. A fixed ratio was maintained between the contrasts of the adapting and test gratings (1.33), and a range of spatial frequencies was investigated (2.25-9c/deg).

Results: *Experiment 1:* The pattern of perceived contrast loss for the parallel and orthogonal conditions was very different for the high and low spatial frequency conditions. At the lower spatial frequency, the perceived contrast of the highest contrast test grating was reduced more for orthogonal adapting and test stimuli. This was not observed at the higher spatial frequency. *Experiment 2:* When the adapting stimulus was low in contrast, its effect was greatest upon parallel test gratings. However, when the adapting stimulus was high in contrast, its effect was greatest on test gratings orthogonal to the adapting stimulus. The contrast level above which orthogonal gratings showed more loss in perceived contrast than parallel gratings was found to increase with spatial frequency, suggesting that visibility of the adapting stimulus is the key to whether this effect is observed.

Conclusions: Test gratings oriented orthogonally to an adapting grating can have a lower perceived contrast than parallel gratings of the same physical contrast provided the visibility of the adapting stimulus is high enough.

References:

- 1 Snowden R.J. & Hammett S.T. *Nature*, 355, 248-50, 1992;
- 2 Ross J. & Speed, H. *Proc. Roy. Soc (B)*, 246, 61-9, 1991;
- 3 Ross J. & Speed, H. *Vision Res.*, 36, 1811-18, 1996.

Increased visual after-effects following pattern adaptation in migraine.

Alex Shepherd,
Psychological Medicine, Imperial College School of Medicine, London.

Much previous research into visual processing in migraine has examined

low-level aspects of visual processing, often using detection or discrimination measures and the very stimuli reported to trigger an attack, such as striped patterns or flickering lights. Differences between people with and without migraine have been attributed to abnormal cortical processing in migraine, variously described in terms of interictal hyperexcitability, heightened responsiveness, a lack of habituation and/or a lack of intra-cortical inhibition. Here two experiments are presented that explore a uniquely cortical phenomenon, pattern or contrast adaptation.

Pattern adaptation reflects mutual interactions between groups of neurones and is therefore ideally suited to address proposed models of cortical function in migraine. These models lead to specific predictions in an adaptation study: there should be smaller effects in people with migraine than in people without. Two adaptation experiments, one using the motion after-effect, one the tilt after-effect, however, both revealed larger effects in migraine sufferers than in headache-free control subjects. These results will be discussed in terms of models of cortical function in migraine.

BODMAS: An account of contrast adaptation on contrast perception

Keith Langley,

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Background Snowden and Hammett (1992) proposed that both summative and divisive mechanisms may account for effects of contrast adaptation on contrast perception. Ross and Speed (1996), however, rejected these ideas, proposing instead that adaptation may be described by changes in the exponent and the semi-saturation constant of the Naka-Rushton receptor equation. To help resolve the debate, the parametric effects of contrast adaptation on contrast perception are examined. **Methods** A 2AFC paradigm was used to match the contrast matching spatially adjacent sinusoidal gratings of equal spatial frequency. The adapting pattern was fixed at 88% contrast, while both the contrast and orientation of the test pattern was varied. **Results** Effects of contrast adaptation on contrast perception showed atypical orientation tuning when the test pattern was presented near threshold. For higher test

patterns, however, effects of contrast adaptation on contrast perception did not show orientation tuning, but rather a near isotropic suppression of perceived contrast. To interpret the results, a Naka-Rushton receptor equation that allows for the possibility of changes in exponent, semi-saturation constant, and summative offset was fitted to the contrast matching function. **Conclusions** The model fits suggest, when adapting at high contrast, and testing across a range of different contrasts and orientations, that effects of adaptation may be summarized by BODMAS (Brackets, Order, Division, Multiplication, Addition and Subtraction) as a parameterization of effects of contrast adaptation on contrast perception. This parameterization may be simplified further, if it is assumed that the contrast matching function converges with the line of no-effect at 100% contrast. The latter assumption reveals both a summative (a directionally specific subtractive and an isotropic additive) component and an isotropic amplification of contrast signals because the divisive element counterbalances perceived contrast increases owing to signal amplification. The implications of the results with regard to contrast discrimination are discussed.

Acknowledgement: Some of this research was conducted with the assistance of G. Abbonizio.

USING ADAPTATION TO PROBE THE SOURCES OF CROSS-ORIENTATION SUPPRESSION IN THE PRIMARY VISUAL CORTEX

Tobe C B Freeman, Severine Durand, Daniel C Kiper and Matteo Carandini

We have exploited the phenomenon of visual adaptation to explore the interactions between neurons tuned to different orientations in the primary visual cortex (V1). Neurons in V1 give little response to bars that are orthogonal to their preferred orientation. Such a stimulus, however, can substantially suppress the neuron's responses to optimally oriented bars. This "cross-orientation suppression" is commonly thought to originate from a pool of cortical neurons through intracortical inhibition. We reasoned that if suppression originates from intracortical connections, it should be possible to reduce its effectiveness through selective adaptation. Prolonged presentation of the orthogonal stimulus would strongly reduce (adapt) the responses of those cortical neurons that are selective for it, and thus

reduce the suppression that these neurons can provide. We recorded from neurons in the primary visual cortex of anesthetized and paralyzed cats. Visual stimuli consisted of a drifting grating at the cell's preferred orientation (test) combined with a second orthogonal drifting grating (mask). Responses were measured following adaptation to sustained presentation (30 sec initially, with 4-6 sec 'top-ups' prior to each stimulus presentation) of the test, the mask, or a blank screen. Responses were fitted with a simple divisive model of cross-orientation suppression that depends on test contrast and mask contrast. We tested the prediction that adaptation would diminish cross-orientation suppression and found it to be incorrect: Intriguingly, cross-orientation suppression is immune to adaptation. Because primary visual cortex neurons that do not adapt are observed rarely, our results cast doubt on the view that cross-orientation suppression originates from cortical neurons. We speculate that it may result from depression at thalamocortical synapses.

Supported by Swiss National Science Foundation and Human Frontiers Science Program.

Shading and texture: separate information channels with a common adaptation mechanism ?

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We outline a scheme for the way in which vision may handle information about shading (luminance modulation, LM) and texture (contrast modulation, CM). This scheme aims to reconcile a variety of findings - from experiments on adaptation to LM and CM and on detection and discrimination of LM and CM patterns - that otherwise sit uncomfortably together.

LM and CM gratings (presented in 2-D static spatial noise carriers) appear to be detected independently, and there is no sub-threshold summation between LM and CM. This strongly suggests separate channels for the detection of LM and CM structure (Schofield & Georgeson, *Vision Research* 1999). Adapting to luminance gratings selectively lowers the detectability of luminance gratings but not CM gratings, and vice-versa (Nishida et al, *Vision Research* 1997), again suggesting separate channels. However, we now report experiments in which adapting to LM (or CM) gratings creates

tilt aftereffects of similar magnitude on both LM and CM test gratings, and reduces the perceived strength (modulation depth) of LM and CM gratings to a similar extent. This might suggest a second stage of processing at which LM and CM information is pooled, and such second-stage integration has been a feature of most models for second-order motion processing.

The nature of this integration, however, is unclear and several simple predictions are not fulfilled. Firstly, one might expect the integration stage to signal the spatial structure (orientation, spatial frequency, modulation depth) of both LM and CM patterns but to lose identity information: was the pattern LM or CM? We show instead that sensitivities for detection and for identification of LM and CM patterns are about the same. Thus the identity of even very weak LM and CM patterns is not lost. Secondly, when LM and CM gratings are combined out-of-phase there is no cancellation. Detectability of in-phase and out-of-phase pairings is very similar, and identification of the phase relation is as good as the ability to identify single LM or CM components. These results suggest that information about LM and CM is not pooled or merged. Shading is not confused with texture variation. We conclude that LM and CM signals are carried by separate channels, perhaps because, over an ensemble of images, the first and second-order content of natural images is uncorrelated (Schofield, *Perception*, 2000). These channels share a common adaptation mechanism that accounts for the complete transfer of perceptual aftereffects. The fact that threshold elevation is selective and does not transfer between LM and CM suggests a second, perhaps earlier, site of adaptation within each separate channel.

Evidence for spatio-temporal selectivity in attentional modulation of the motion aftereffect

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When attention is paid to one region of the visual field, and withdrawn

from another, the ignored region still needs to be monitored for potentially interesting events. This might be done by an intermittent full visual analysis or by a more continuous but restricted analysis. We investigated which type of process is more likely in early vision by studying the effects of diverting attention on adaptation to a range of spatial (0.5, 2, 4, and 6 c/deg) and temporal (1.5 and 10 Hz) frequencies. During adaptation, subjects either fixated an unchanging digit (normal attention), or named the sequence of changing digits which formed the fixation point (diverted). The test field was always a static version of the adapting field, and the strength of adaptation was measured through the duration of subsequent Motion Aftereffects (MAEs). When attention during adaptation was normal, MAE durations rose with spatial frequency for the 1.5 Hz stimuli, and declined with spatial frequency for the 10 Hz stimuli. When attention was diverted from the 10 Hz stimuli, MAE durations fell by a similar amount at all spatial frequencies. However, for the 1.5 Hz stimuli, the effects of diversion were very small at 0.5 c/deg, and rose progressively with spatial frequency, so that MAE reductions were largest at 6 c/deg. It appears that diversion hardly affects the encoding of coarse, slow, stimuli, but attenuates the encoding of finer/and or faster stimuli. This is consistent with the idea that during diversion the visual system monitors the scene continuously, but over a restricted range of spatial and temporal scales.

Understanding motion adaptation: What have the physiologists ever done for us?

P Thompson [1], S T Hammett [2], S Bedington[2] ([1] Psychology, University of York, [2]Psychology, Royal Holloway, University of London e-mail: p.thompson@psych.york.ac.uk)

Motion perception involves both speed and direction, whilst research into motion perception lacks both.

Many psychophysical studies have exploited adaptation to probe the mechanisms underlying direction and speed coding. Unfortunately we have a very poor understanding of the physiological underpinnings of adaptation and even less idea about how speed is encoded in the visual system. We can reject the most simple-minded model (Barlow and Hill 1963) that speed is encoded directly in firing rate and that adaptation is a matter of fatigue. However we have found support for the second most simple-minded model.

We have examined the perceived speed of gratings before and after adaptation. using a yes/no matching task informing a PEST routine. Both the build-up of adaptation over time and the recovery from adaptation were examined.

The results show: (i) perceived speed declines exponentially with adaptation duration; (ii) the time constants for 2Hz and 12Hz adaptation rates are different (15.88 and 1.9 seconds respectively). We show that a model that assumes that speed is based upon the ratio of two underlying mechanisms (with time constants of 2-4 seconds) can capture much of these data.

We can conclude very little about the nature of adaptation from these results but a plausible model of speed processing can be fabricated from them.

Changes in the temporal integration due to adaptation.

Robert J. Snowden ,School of Psychology, Cardiff University

During adaptation to decreasing luminance level it is well documented that the response of the visual system changes so as to increase the time over which information about luminance is integrated. It therefore seems plausible that during adaptation to contrast the visual system might also change the amount of time over which information about contrast is extracted. To test this notion temporal integration functions were measured in two ways. Firstly contrast sensitivity was measured as a function of stimulus duration for tests presented on a blank screen or upon a pedestal stimulus. Likewise two-pulse summation thresholds were measured (for a range of pulse intervals) in similar circumstances.

Both experiments show that information is gathered over a shorter time period when presented on a pedestal stimulus. These results suggest the visual system alters its temporal characteristics in response to the presentation of a high contrast pattern.

Obligatory averaging of orientation in crowded stimuli

M. Morgan and J. Solomon , AVRC, City University, London

Classification of a target object in peripheral vision can be impaired when distractor objects appear close to it, even when the observer knows which object is the target.

To determine the cause of this phenomenon (“crowding”), we asked human observers to report the orientation (clockwise or anti-clockwise) of one or more tilted grating patches (the targets) when presented amongst horizontal distractors. Threshold tilts increased linearly with the number of distractors and decreased with the number of targets. This suggests that the estimated orientation of the target is pooled with those of the distractors. An early noise, which corrupts local estimates of orientation and a late noise, which corrupts their average, must be invoked to explain the results. Obligatory averaging was further supported by the finding that distractors with a slight tilt in the direction of the target do not impair performance as much as horizontal distractors, which in turn do not impair performance as much as distractors with a slight tilt in the direction opposite that of the target. We conclude that local estimates of orientation are not degraded by crowding, but observers have no conscious access to these estimates and must rely on an average signal.

Within and between cue-adaptation using motion parallax, stereopsis and luminance.

M.F. Bradshaw, P.B. Hibbard & M.A. Hogervorst
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The processing of luminance, motion parallax and stereopsis appears tuned to particular spatial or corrugation frequencies. Here we investigate the nature of such processing further by determining whether perceived frequency (spatial frequency shift AE) and perceived orientation (tilt AE) can be altered by adaptation to stimuli defined by motion parallax, binocular disparity or luminance. Both phenomena exist in the luminance and stereopsis domains (Blakemore and Sutton, 1969, *Science* **166**, 245-247; Tyler, 1975, *Perception* **4**, 187-192) but have yet to be established in the parallax domain. We also address whether adaptation in one domain (e.g. luminance) affects the perceived size or orientation defined in another

domain (e.g. parallax). Observers adapted to two patterns (5 deg in diameter) arranged in a horizontal ‘dumbbell’ configuration. The 1 cpd adapting patterns differed in either orientation (± 15 , ± 30 , ± 45 or ± 60 degrees) or in spatial frequency (± 0.125 , ± 0.25 , ± 0.5 , ± 0.75 octaves). A staircase procedure was employed to determine when the test surfaces (left and right parts of the dumbbell) appeared to be of equal orientation or spatial frequency. The initial period of adaptation was 120 sec followed by a test-adaptation cycle of 2 sec test and 4 sec adaptation. The phase of the adapting patterns changed every 2 secs to avoid phase dependent aftereffects. Both size and orientation aftereffects were found within the motion parallax domain. The peak magnitude of the aftereffect (~ 3 degrees), the location of its peak (30 degrees) and its estimated bandwidth (30 degrees) were similar to those already established, and replicated here, in the cyclopean domain (Tyler 1975, *op cit*). The peak magnitude of the size aftereffect was $\sim 12\%$ in all three domains and occurred with adapting patterns which differed by 0.75 octaves. Cross adaptation of size and orientation was possible (75% of the within cue effect) between parallax, stereo and luminance defined contours which suggests a common stage in both size and orientation processing.

Orientation Mechanisms from simple cell phase

Tim Atherton

Department of Computer Science, University of Warwick.

The notions of frequency- and orientation-selective filtering adequately describe the “simple” cell stage of processing in visual cortex. Models of the “second stage” mechanisms are less clear. Second stage orientation mechanisms have been proposed that use the “energy” responses of simple cells (Langley & Atherton 1991). These mechanisms might account for some forms of orientation pop-out, they give the correct orientation for a sinusoidal grating image, but as a uniform field, failing completely to account for the percept of light and dark bars.

Many authors have suggested that phase plays an important role in visual processing, see for example (Burr & Morrone 1990; Georgeson & Freeman 1997; Morrone & Burr 1988). The model we propose extends that of Langley, (Langley & Atherton 1991), to process the energy, real, and imaginary responses of simple cells in three parallel streams. The model accurately estimates a family of orientations and, for example, places the

“edges” and centres of light and dark bars of a grating in good agreement with the positions perceived by human subjects. The model explains the checkerboard appearance of “plaids” composed of two or three gratings, provides mechanisms for orientation pop-out, and it reproduces the Mach band effect.

The model goes beyond simple “edge” and “bar” features to detect and quantify the orientation of local patterns with higher-order rotational symmetries. The processing implied by the proposed model is biologically plausible, surprisingly simple, robust, and unifies the processing of energy and phase mechanisms. The second-stage processing results in a family of feature maps that have implications for the understanding of later processing eg pop-out and texture segmentation. The nature of the proposed processing suggests “complex” cells with a variety of properties.

The talk will detail the model and be illustrated by numerous examples of the analysis of test and real-world images, with indications of the expected receptive field properties of some of the second stage mechanisms.

Burr, D. C. & Morrone, M. C. 1990 Feature Detection in Biological and Artificial Visual Systems. In *Vision: Coding and Efficiency* (ed. C. Blakemore), pp. 185-194. Cambridge: Cambridge University Press.

Georgeson, M. A. & Freeman, T. C. A. 1997 Perceived Location of Bars and Edges in One-dimensional Images: Computational Models and Human Vision. *Vision Research* 37, 127-142.

Langley, K. & Atherton, T. J. 1991 The Inference of Structure in Images using Multi-Local Quadrature Filters. In *British Machine Vision Conference 1991* (ed. P. Mowforth), pp. 111-117. Glasgow: Springer-Verlag.

Morrone, M. C. & Burr, D. C. 1988 Feature Detection in Human Vision: a Phase-dependent Energy Model. *Proc. R. Soc. Lond. B* 235, 221-245.

Changes in bias and sensitivity of directional motion judgements in the flicker motion after effect (FMAE) and velocity aftereffect (VAE).

Michael J. Wright and Louise Alston

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Adaptation to moving stimuli changes the perceived velocity of test stimuli, but does adaptation alter differential sensitivity to velocity? Flicker motion aftereffects (FMAE) and velocity aftereffects (VAE) were measured with a single-interval forced choice method, using directionally-ambiguous test stimuli (Ledgeway, T. (1994) *Vision Research*, 34, 2879-2889; Wright, M.J. (1998), *Perception*, 27, 1489). The test stimulus for FMAE was a counterphase grating, generated by superimposing two opposite-motion drifting gratings. The test stimulus for VAE consisted of the same two components spatially separated. Either the relative velocity or the relative contrast of the two components was varied, to produce a set of constant stimuli. The task was to indicate the stronger overall direction of motion in the test stimulus (upwards or downwards). In the unadapted state, motion was seen to predominate in the direction of the faster or the higher contrast component. 9 pairs of contrast values or velocity values were repeated 12 times each in a single run. This generated a psychometric function, fitted by probit analysis, from which sensitivity and bias measures could be obtained. After adaptation to a drifting grating or plaid, motion was biased strongly in the opposite direction. The tuning curves of bias versus grating velocity differed for FMAE and VAE. The tuning of FMAE to the orientation of plaid components was found to be broad, and it was related to the velocity of grating components, rather than plaid pattern velocity. It was found that for both FMAE and VAE there are changes in sensitivity as well as bias. Over a small range, the motion system appears to maintain differential directional sensitivity to motion despite a shift in bias, but with adaptation sufficient to produce strong aftereffects, directional sensitivity is reduced.

PULLING THE ENVELOPE: THE INFLUENCE OF MOTION ADAPTATION ON PERCEIVED POSITION

P. V. McGraw [1], S. Chung [2], D. Whitaker [1], J. Skillen [1]

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Following adaptation to a moving stimulus, texture within a stationary stimulus is perceived to drift in the opposite direction - the traditional motion after-effect (MAE). Until recently, it was thought that the MAE did not produce a concurrent change in object position. However, it has recently been shown that perceived position can be markedly influenced by motion signals (1). In the present study we ask whether position can be modified in the absence of perceived motion. The stimulus elements

(Gabor patches) consisted of Gaussian-windowed (envelope) sinusoidal luminance modulations (carrier), presented in a 2-blob vernier alignment test. Prior to the test phase, subjects adapted to Gabor stimuli in which the carrier gratings drifted in opposite directions. The elements of the adapting stimulus were spatially coincident with the test elements in the 2-blob alignment task. Following adaptation an illusory misalignment of the elements of the test stimulus was perceived, and the magnitude of this perceived offset was established. When the adapting and test stimuli have collinear carrier gratings, the global position of the object shows a substantial shift in the direction of the illusory motion. When the carrier gratings of the adapting and test stimuli are orthogonal (a configuration where no MAE is experienced) a global positional shift of similar magnitude is found. The illusory positional shift was also found to be immune to changes in spatial frequency and contrast. The lack of sensitivity for stimulus characteristics other than direction of motion suggests that the mechanism which produces the shift in spatial position is distinct from that which mediates the traditional MAE.

1. Nishida, S. & Johnston, A. (1999) *Nature* 397, 610-612.

Contrast masking, adaptation and gain pool summation

(T. S. Meese & D. J. Holmes; Neurosciences Research Institute, Vision Sciences, Aston University, Birmingham B47ET, UK.;
E-mail: t.s.meese@aston.ac.uk)

Foley (1994; *Journal of the Optical Society of America A*, 11, 1710-1719) has proposed an influential psychophysical model of masking in which mask components in a contrast gain pool are raised to an exponent before summation and divisive inhibition. We tested this summation rule in experiments in which contrast detection thresholds were measured for a vertical 1 c/deg (or 2 c/deg) sine-wave component in the presence of a 3 c/deg (or 6 c/deg) mask that had either a single component oriented at -45° or a pair of components oriented at $\pm 45^\circ$. Contrary to the predictions of Foley's model 3, we found that for masks of moderate contrast and above, threshold elevation was predicted by linear summation of the mask components in the inhibitory stage of the contrast gain pool. We built this feature into two new models: the early adaptation model and the hybrid model.

In the early adaptation model, contrast adaptation controls a threshold-like nonlinearity on the output of quasi-linear pathways that provide the

excitatory and inhibitory inputs to a gain control stage. This stage also receives inhibitory input from a constant and a weighted pool of mask pathways that are summed before being raised to an exponent. The hybrid model is a hybrid of Foley's (1994) models 2 & 3 and has been modified to handle adaptation. Specifically, it includes non-adaptable pathways with expansive nonlinearities that provide excitatory and inhibitory inputs to a gain control stage. Adaptation of the excitatory pathway controls the combined inhibitory weight of (1) a semisaturation constant and (2) the linear sum of all other pathways in a gain pool raised to an expansive component.

With only six free parameters, both models provide excellent fits to the masking and adaptation data of Foley and Chen (1997; Vision Research, 37, 2779-2788), where contrast detection was performed in the presence of parallel and orthogonal masks after adaptation to either vertical-, horizontal-, plaid- or no-Gabor stimuli. Furthermore, unlike Foley and Chen's 'two process' adaptation version of Foley's model 3, only one parameter was needed to control the state of adaptation.

Only the hybrid model was able to capture the features of an experiment in which contrast increment thresholds were measured in the presence of an orthogonal mask (Foley, 1994). Only the early adaptation model was able to capture a finding reported here, that masking by a grating is slightly greater than for a plaid at low mask contrast.

We conclude that (1) linear summation of inhibitory components is a feature of contrast masking, and (2) that the main aftereffect of spatial adaptation on contrast increment thresholds can be assigned to a single site.

CONTEXTUAL MASKING IN MARGINAL VISION: ROLE FOR MOTOR TRAINING PURPOSES

ABSTRACT: When focusing to a visual object, peripheral stimuli must be monitored for appropriate control of attention at the surrounding environment. Thresholds for shape recognition of a peripheral stimulus were studied in human subjects with stimuli back-projected on a screen at a viewing distance of 220 cm. First of all object threshold perception for each person was determined, and used as starting point for the subsequent study. Thresholds in nasal retina are lower than for temporal retina.

Results show that both in nasal and temporal 60° eccentricity retinal fields, most subjects correctly recognize shapes when surrounded by

confounding similar forms, recognition of different shapes are sometimes confounded.

We are in agreement with the full paper request for publishing in the journal.

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Can we learn to adapt to enhanced binocular disparities ?

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If the inter-ocular distance (IOD) is increased beyond normal, the magnitude of the disparity information is magnified. We have shown that such a manipulation improves performance in nulling and matching tasks. Here we examine whether observers can learn to use enhanced disparities to accurately perform tasks requiring the recovery of Euclidean geometry (a shape task). Inter-ocular base was adjusted by simulation within a stereoscopic display. The design comprised three phases: pre-adaptation (IOD = 6.5 cm), adaptation (IOD = 3.25 or 13 cm) and post-adaptation (IOD = 6.5 cm). Observers were required to adjust the magnitude of a depth interval (specified by binocular disparity) so that it matched a specified 2D interval specified by two lights (set between 5 and 15 cm) in an otherwise blacked-out scene. In the adaptation phase, the observers adjusted the depth interval repeatedly until a performance criterion was reached. Two forms of feedback were given in the adaptation phase: direct, where another light was shown at the correct disparity; and symbolic, where a signed number indicated the magnitude and direction of the error. Observers were clearly affected by the change in IOD but learned the new IOD rapidly under both feedback conditions.

Luminance adaptation and perceptual filling-in.

Andrew E Welchman & Julie M Harris

A grey target peripherally presented within dynamic random noise (DRN)

perceptually fades from view (or “fills-in”) following a period of steady viewing. The observer’s perception is then one of DRN at the target’s location. To gain insight into the neural mechanisms responsible for this perception we investigated whether luminance adaptation occurs in the presence of perceptual filling-in.

Observers viewed a computer screen filled with DRN. They were instructed to detect the presence of a small, bright test probe presented at the target’s centre (eccentricity = 10 deg). Luminance increment thresholds (the amount of extra luminance needed to detect the probe) were obtained for 2 conditions: (1) No adaptation – test intervals were presented after trial initiation; (2) Adaptation – observers viewed the stimulus until they reported target disappearance, and then viewed the test intervals. Detection thresholds were obtained for a range of target luminance values.

Luminance increment thresholds were lower with adaptation (condition 2) than when observers simply viewed the test (condition 1). In other words, it was easier for subjects to detect the probe when they could not perceive the target, than when they could. This result could indicate gain control in the neurones that encode the presence of the target. Alternatively, it may be related to transient detection and not related to perceptual filling-in per se.

On the latency of visual perception: the role of display parameters

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Features are not all processed at the same speed, and our awareness is not necessarily correlated with the latency of processing. This raises problems for how we perceive and act accurately in a world of moving objects. The recent attempts by Zeki, Moutoussis and Bartels to measure the relative latencies of awareness have led to estimates of asynchronies of the order of 100 msec between, for example, colour and motion awarenesses. However, their displays were complex, and simpler stimuli have been found not to engender any such asynchrony (Nishida and Johnston, ARVO 1999, 2000, ECVF 2000; Rose, ASSC 1999, ECVF 1999, Foursites 1999). Here, I investigate the display characteristics which may

induce asynchronies.

Moving dots changed colour and changed direction of motion at various relative times, and subjects identified which changed first, in a 2AFC task. Surprisingly, asynchronies only occurred when two conditions were simultaneously present: repetitive changes in the display (rather than single changes), and requiring subjects to judge where colour changed relative to the mid-points (rather than the end-points) of the motion trajectory. Neither condition on its own induced asynchrony (which was also not observed with both conditions absent).

Various possible artefacts in displays such as these are discussed. The results pose further problems for theories of perceptual latency.

Perception and action are affected by 2-D tilt and 3-D slant illusions

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Neuropsychological evidence suggests a strong dissociation between visual processing for perception and for the control of action (Milner and Goodale, 1995). Although equivocal, the major source of evidence in normals is that actions such as grasping may be less susceptible than perceptual responses to the influence of common visual illusions (Aglioti et al., 1995; Franz et al, 2000). We investigated the relative effects on perception- and action-based responses of 2-D tilt and 3-D slant illusions, using “posting” tasks similar to those employed originally by Milner and Goodale. In the 2-D tilt contrast condition subjects were required either to post a card through, or set a paddle to match the orientation of, a vertical plane which was surrounded by a striped surface tilted between ± 60 degs. In the 3-D slant contrast condition, subjects performed similar tasks, but the vertical plane was surrounded by a disparity defined surface slanted or inclined in depth between ± 60 degs. Both the 2-D tilt illusion and the 3-D slant illusion influenced perception- *and* action- based responses. If anything, the magnitude of the effect of the illusions was greater for the posting task than for the matching task. We conclude that no qualitative differences exist between perception- and action-based tasks for the 2-D tilt illusion and the 3-D slant contrast illusion.

The effect of temporal delay on the ability to control prehensile movements in 5 to 11 year old children.

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Neuropsychological evidence suggests a dissociation between the visual systems involved in perceptual processes and those involved in the control of action (Milner and Goodale, 1995). According to this account information for the control of action needs to be updated rapidly, as object properties such as egocentric distance change continuously as an observer moves around the world. Therefore this system may only retain information for a brief period. Consistent with this, it has been reported that reaching and grasping performance in adults deteriorates when a delay is introduced between target presentation and response (Bradshaw et al., 1998; Hu et al., 1999; Watt and Bradshaw, 2000). Here we investigate whether temporal delay similarly affects the control of prehensile movements in middle childhood. Twenty five children aged 5-11 years made open-loop reaches to 2 different sized objects placed at 15 and 25 cm along the midline. We compared reaches where subjects' vision was occluded at movement onset (using LCD goggles) and where there was a 2 second delay between occlusion of subjects' vision and their response. A MacReflex motion analysis system was used to record kinematic and spatial parameters of the movements. Temporal delay affected principal indices of both the transport and grasp components of children's reaches. Compared to the no-delay condition, peak wrist velocity was slower and grip apertures were wider following a 2 second delay. Delay also resulted in a longer time spent in the final slow movement phase of the reach. In a further analysis the subjects were divided into three age groups to examine whether the effects of delay varied with age. However, no differences were found across age groups. We conclude that visual information for the control of prehension in children deteriorates rapidly, and in a similar fashion to that reported previously for adults.

Annual Meeting Report

21 March 2001, College of Optometrists, London.

Adaptation: why familiarity shouldn't breed contempt

A few years ago I understood adaptation. I knew it was the thing that meant I could go from a dingy cave to the bright lights of Piccadilly and still be able to see. I seem to remember that the words 'optimisation' and 'Barlow' were somehow relevant. Then there was that bloke Blakemore who'd done all that stuff that proved that spatial frequency channels existed: you could make them adapt, because the neurones just got knackered and stopped firing, and that meant you couldn't see contrast so well any more. That was about all you needed to know, because there wasn't anything else on the reading list, and it wouldn't be right if they gave you a question that wasn't in the textbooks. Alas, those days of certainty have now gone. Fortunately, what you loose on the swings, you gain on the roundabouts: I can no longer remember what *social attribution theory* is, nor do I worry about what it is that IQ tests actually measure.

The term 'adaptation' is one of dangerous simplicity. Use it, and most people will know what you're driving at; yet how it works, and the consequences it has, are issues that will probably not be fully understood until many more generations of nervous undergraduates have crammed the names of Blakemore and Barlow into their heads in order to discuss adaptation in terms of simple neural fatigue. The topic is vast, and the levels of explanation range from psychophysical models to intracellular mechanisms [see Sanchez-Vives *et al.*, 2000. *J Neurosci*, 20, 4267 for an excellent paper on cellular mechanisms]. The AVA's annual spring meeting attracted both psychophysicists and physiologists to tackle the issues of visual adaptation, and, whilst I can't report that the problem is solved, the journey to the solution contains some fascinating science.

Brendan Barrett opened the proceedings with a new look at how adapting to a test grating affects the perceived contrast of that grating, and other gratings that have an orthogonal orientation. Previous studies have suggested discrepancies in the magnitude of perceived contrast reduction for orthogonal gratings. However Barrett and his colleagues were able to reconcile previous data by showing that the magnitude of contrast reduction is dependent on both spatial frequency and contrast. These findings were related to the visibility of the test gratings. They reported

that contrast reduction was greatest for parallel test gratings if the test gratings had low visibility, whilst contrast reduction was greatest for orthogonal gratings at high visibility. The issue of contrast perception following adaptation was raised subsequently when Keith Langley presented a model of data on perceived contrast. Tobe Freeman also addressed cross-orientation interactions. He reported experiments aimed at revealing interactions between primary visual neurones through the use of selective visual adaptation.

Professor Colin Blakemore delivered the Geoffrey Burton Memorial Lecture entitled “Visual plasticity: benefits and costs”. He presented a perspective on 30 years of research that has pointed to flexibility in neural function, particular evident in the early stages of life. He considered classic results on the plasticity in the development of ocular dominance columns in the cat, but stressed that these results point to the selective effects of abnormal visual environments, rather than suggesting that visual input determines the subsequent structure of the cortex. He went on to address the genetic component of visual plasticity, arguing that if sensory experience is valuable and adaptive, it must have been selected for. He asked the provocative question: “Which genes have been selected for nurture?” and then described a fascinating set of experiments performed in mice to isolate the particular protein whose presence appears to mediate the brain’s ability to show the plasticity evident in early stages of life. By studying gene knockout mice he was able to show that presence of the protein [PLC- β 1] was crucial in the development of normal cortical structure. His wide-ranging lecture was a lesson in the value of many and varied approaches to a complex problem.

Peter Thompson appeared not to have been listening to Colin’s talk. He advised the assembly that they should “never talk to a physiologist”; however, his point was more subtle as he discussed the dangers of psychophysical models being constrained and dictated to physiological evidence. Mark Georgeson considered the mechanisms responsible for the adaptation of texture contrast and luminance contrast, proposing separate channels for each, but a common gain mechanism involved in their adaptation. Bob Snowden discussed changes in temporal integration due to adaptation; John Harris considered attentional modulation of motion after effects; and Alex Shepherd discussed increased motion after effects in migraine sufferers. In the final session, Mike Morgan discussed experiments he has conducted into crowding phenomenon; Mark Bradshaw used adaptation to probe common stages in the processing of motion

parallax, stereopsis and luminance; and Tim Atherton presented a model of orientation mechanisms.

The meeting, held in the majestic surroundings of the college of Optometrists, was a great success. The food, wine and the science met the expectations produced by the high standards of previous years' meetings. I still don't understand adaptation, but I think I'm getting used to the idea that I don't.

Many thanks to Keith Langley, David Simmons, Theresa Murtagh and the College of Optometrists.

Andrew E. Welchman

Meeting Report: Natural Images III

The third AVA meeting on Natural Images took place at the Department of Psychology, university of Bristol on the 15th September 2000.

This was a particularly inauspicious choice of day as it succeeded in coinciding with the latter stages of the UK fuel crisis! The organisers therefore had some concerns about attendance of both speakers and delegates.

However, to the organiser's surprise and delight 31 people turn up to hear the talks. This added a degree of consternation however as the catering arrangements and programme production had been based on an expected number of 25. A prospect of delegates being both fuel and food starved, but this turned out to be not the case.

Nine papers were presented, included the invited lecture given by Anya Hurbert from the University of Newcastle. Anya's paper, entitled Colour Constancy and the Natural Image discussed how colour constancy processes were affected by the many additional cues that can be found in natural images, but which are missing from the traditional laboratory stimuli such as Mondrians. She covered a considerable number of aspects of colour constancy.

The second paper entitled Measurement of Illumination in Natural Scenes should have been presented by Daniel Osorio from the University of Sussex, but due to personal reasons he was unable to do so. Roland Baddley bravely and boldly stepped in and not only gave Daniel's talk but also wrote it (with an incorporation of some of his own work). The paper discussed the two themes of the distribution of illuminants in the natural world and how human colour categories depend upon illuminants and natural reflectances and provide the maximum classification abilities.

He found that, based on the spectra of German fruits, 11 prototype categories evolved and these were more saturated than those measured perceptually. However there were many caveats to this conclusion that Roland will be happy to discuss at length I'm sure.

Emma Smith from the University of Bristol then moved us from human vision to bird vision and presented a paper entitled Perception of Ultraviolet by Birds. Bird vision is significantly different both in numbers

of cone types and the presence of oil droplet filters. One of the conclusions she reported was the attraction of female birds to male birds with UV plumage. The goal of the work was to provide proper object evidence for the use of UV light by birds. The audience was introduced to the technical challenges of designing and running experiments with Quail and Starlings with a video to demonstrate the “subjects” doing an experiment. The conclusion was that birds can use UV as a discriminatory cue in a foraging task

David Young from the University of Sussex asked the question, Can Image Statistics Explain the Distribution of Retinal Receptor Cells? This looks like a very simple question but of course the answer was not! The paper provided a link to the British Machine Vision Association meeting, which the AVA meeting was a satellite to, since the answer to the question can be recast as a question about the design of a machine vision system.

Human cone cells have a spatial distribution on the retina such that their density, as a function of eccentricity, is closely approximated by a power law. The factors that have determined this distribution presumably include the capabilities of the eye movement system, the information transmission properties of the retina and optic nerve, the nature of the visual information needed for survival, and the statistical structure of retinal images. I argue that the last of these might provide the key to understanding retinal layout, since the cone density function is what would be expected if scale-free statistics determine the optimal distribution. This suggests that it might be possible to find a general theory of spatially-variant image sampling which would depend more on the statistical structure of the input than on the details of subsequent processing strategies or the tasks to be performed. Such a theory would be applicable to active computer vision systems, once the technology allows a more flexible approach to the design of the sensor arrays used in cameras. This talk discusses the question of whether it might be possible to link retinal design to image statistics, and the central difficulty of how to incorporate the temporal dimension, which is needed to take account of eye or camera movements, into such a theory.

After lunch, David Tolhurst, from the University of Cambridge also posed a question:- can a Linear Model explain a Simple Cell's Responses to Natural Images?

The experiments involved presenting parts of digitised natural images to

ferrets whilst recording from simple cells in the visual cortex. The aim was to investigate whether non-linear behaviour, such as proposed “contextual influences” from outside the “classical receptive field” may play some special role in the coding of information in natural scenes. Might these non-linear processes make simple-cell responses sparser, perhaps? However, first analyses of the responses of ferret simple cells seemed to suggest that a linear model of spatial summation explained most of a simple cell’s responses.

Tom Troscianko who was co-organising this meeting on his last day at the University of Bristol told us about Natural Image Statistics and Human Vision. He began by presenting results based on the second-order (Fourier) statistics of natural scenes, in which amplitude falls off inversely with spatial frequency. The slope of this fall-off (known as the spectral slope) can be manipulated to render the images progressively less natural. He described the results of measuring discrimination thresholds for subtly morphed objects. The results suggest that performance is indeed optimal when spectral slopes are normal. A model of local contrast discrimination predicts the thresholds well, suggesting that performance is mediated by units early in the visual pathway. However, second-order statistics do not explain some other characteristics of natural images, particularly their perceived contrast. By performing contrast-matching experiments, he showed that perceived contrast is mediated, at least in part, by higher-order statistics. These statistics may determine the ability of the visual system to segment the scene into regions of illumination.

Jan Lauritzen from the University of Cambridge then presented a paper entitled The sources of contrast masking in natural images. Contrast masking is the elevation in detection threshold for a test stimulus in the presence of another stimulus over the threshold for the test stimulus alone. Such effects are well documented for simple masking stimuli like sine-wave gratings. However, masking by compound stimuli such as plaids is more difficult to interpret, and truly complex stimuli like natural images have so far eluded attempts to quantify their masking properties.

The author described studies masking by natural images psychophysically by embedding a Gabor patch test stimulus into a set of natural images. The natural images were filtered both in the frequency and space domains to restrict the overlap with the structure of the test Gabor.

Each scene was filtered using band-pass and notch filters of two different bandwidths for the same spatial frequency and orientation as the test stimulus, as well as filters that selectively only affected either orientation or spatial frequency. In the space domain images were multiplied by Gaussians of the same size as the test Gabor to create image patches and images with the area missing in which the Gabor is displayed.

He found that a significant proportion of the masking in natural scenes is contributed by components outside the frequency and orientation bands of the test stimulus, though there seems to be no clear indication of a dominance of orientation or frequency. In the space domain, regions beyond the extent of the test stimulus contributed significantly to masking.

Michael Wright, Brunel University then described research concerned with understanding how observers identify the orientation of 3-D shapes from 2-D views

The purpose of the research was to test observers' understanding of the relationships of 2D views to 3D shape. The task investigated was "object understanding" rather than "object recognition". In the training phase, a location on the surface of a simple 3D object was marked with a red strip, and observers had memorise its position. In the test phase, 2D views of the object were presented in a tachistoscope, and with the red strip removed, the task was to indicate whether the memorised location was visible or invisible. The difficulty lay in the discrimination of the (left) side view of the object from its mirror-image (right) side view. A strong effect of "upright" versus "inverted" views was found on reaction times and errors, likewise for "front" and "back" views. Thus, although observers could turn the object freely during training they consistently imposed a standard orientation. Most observers exploited end views (where both the target side and its opposite were occluded). Block and cylinder variants of the same shape gave differing patterns of response RT reflecting the different aspect graphs of block and cylinder objects. Classic mental rotation effects were not obtained. It is concluded (a) observers can discriminate views of an object in terms of which surfaces are visible (b) this is based on representations of prototypical views (c) error rates and reaction times (as a function of view) show consistencies which are determined by object shape.

The final paper by Neil Campbell, University of Bristol entitled 4D

Swathing to automatically inject character into animations was not a traditional “vision” paper, but rather described some novel techniques being investigated by the computer graphics community. These techniques are concerned with automatically extracting and emulating motion in films. Some of the motions can be extremely subtle such as changes in facial expression. The paper provided an unusual and interesting end to the conference.

This was a very enjoyable meeting and there was considerable discussion around each presentation.

This was the last of the Natural Images meetings being directly organised by the Applied Vision Association. However, there will be a Symposium on Natural Images as part of the 2001 European Conference on Visual Perception. So if you have an interest in any aspect of natural Images and want to hear more or talk about your work contact: _

Tom Troscianko (T.Troscianko@bristol.ac.uk) or
Ian Moorhead (ian_moorhead@dera.gov.uk)

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., Krusysse, 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



- Afshari, M. A., Afshari, N. A., & Fulton, A. B. (2001). Cortical visual impairment in infants and children. *International Ophthalmology Clinics*, *41*(1), 159-169.
- Balcer, L. J., Baier, M. L., Kunkle, A. M., Rudick, R. A., Weinstock-Guttman, B., Simonian, N., Galetta, S. L., Cutter, G. R., & Maguire, M. G. (2000). Self-reported visual dysfunction in multiple sclerosis: results from the 25-Item National Eye Institute Visual Function Questionnaire (VFQ-25). *Multiple Sclerosis*, *6*(6), 382-385.
- Bar, M., Tootell, R. B. H., Schacter, D. L., Greve, D. N., Fischl, B., Mendola, J. D., Rosen, B. R., & Dale, A. M. (2001). Cortical mechanisms specific to explicit visual object recognition. *Neuron*, *29*(2), 529-535.
- Barth, E. (2000). A geometric view on early and middle level visual coding. *Spatial Vision*, *13*(2-3), 193-199.
- Bhidayasiri, R., Somers, J. T., Kim, J. I., Ramat, S., Nayak, S., Bokil, H. S., & Leigh, R. J. (2001). Ocular oscillations induced by shifts of the direction and depth of visual fixation. *Annals of Neurology*, *49*(1), 24-28.
- Bridgeman, B. (2000). Neuroanatomy and function in two visual systems. *Behavioral and Brain Sciences*, *23*(4), 535-+.
- Briscoe, G. (2000). Vision as temporal trace. *Spatial Vision*, *13*(2-3), 215-229.
- Buck, S. L. (2001). What is the hue of rod vision? *Color Research and Application*, *26*, S57-S59.
- Carroll, J., Neitz, M., & Neitz, J. (2001). Testing hypotheses about visual pigments underlying deutan color vision. *Color Research and Application*, *26*, S106-S111.
- Cavonius, C. R., Knoblauch, K., Lee, B. B., & Pokorny, J. (2001). The proceedings of the International Colour Vision Society. *Color Research and Application*, *26*, S1-S1.

- Chavane, F., Monier, C., Bringuier, V., Baudot, P., Borg-Graham, L., Lorenceau, J., & Fregnac, Y. (2000). The visual cortical association field: A Gestalt concept or a psychophysiological entity? *Journal of Physiology-Paris*, *94*(5-6), 333-342.
- Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review*, *108*(1), 204-256.
- Conlon, E., & Hine, T. (2000). The influence of pattern interference on performance in migraine and visual discomfort groups. *Cephalalgia*, *20*(8), 708-713.
- Dobelle, W. H. (2000). Artificial vision for the blind by connecting a television camera to the visual cortex. *Asaio Journal*, *46*(1), 3-9.
- Facoetti, A., & Molteni, M. (2001). The gradient of visual attention in developmental dyslexia. *Neuropsychologia*, *39*(4), 352-357.
- Fasick, J. I., & Oprian, D. D. (2001). Spectral tuning in the mammalian short-wavelength sensitive cone visual pigments. *Biophysical Journal*, *80*(1), 2714.
- Findlay, J. M., Brown, V., & Glichrist, I. D. (2001). Saccade target selection in visual search: the effect of information from the previous fixation. *Vision Research*, *41*(1), 87-95.
- Fiser, J., & Biederman, I. (2001). Invariance of long-term visual priming to scale, reflection, translation, and hemisphere. *Vision Research*, *41*(2), 221-234.
- Fulk, G. W., Cyert, L. A., & Parker, D. A. (2000). A randomized trial of the effect of single-vision vs. bifocal lenses on myopia progression in children with esophoria - Response. *Optometry and Vision Science*, *77*(12), 631-632.
- Good, W. V., Jan, J. E., Burden, S. K., Skoczenski, A., & Candy, R. (2001). Recent advances in cortical visual impairment. *Developmental Medicine and Child Neurology*, *43*(1), 56-60.

- Gross, C. G. (2000). Coding for visual categories in the human brain. *Nature Neuroscience*, 3(9), 855-856.
- Haegerstrom-Portnoy, G., Schneck, M. E., Lott, L. A., & Brabyn, J. A. (2000). The relation between visual acuity and other spatial vision measures. *Optometry and Vision Science*, 77(12), 653-662.
- Hammond, B. R., Wooten, B. R., & Curran-Celentano, J. (2001). Carotenoids in the retina and lens: Possible acute and chronic effects on human visual performance. *Archives of Biochemistry and Biophysics*, 385(1), 41-46.
- Hartmann, E. E., Dobson, V., Hainline, L., Marsh-Tootle, W., Quinn, G. E., Ruttum, M. S., Schmidt, P. P., & Simons, K. (2001). Preschool vision screening: Summary of a task force report. *Ophthalmology*, 108(3), 479-486.
- Hayashi, S., Ueyama, H., Tanabe, S., Yamade, S., & Kani, A. (2001). Number and variations of the red and green visual pigment genes in Japanese men with normal color vision. *Japanese Journal of Ophthalmology*, 45(1), 60-67.
- Hayashi, T., Yamaguchi, T., Kitahara, K., Sharpe, L. T., Jagle, H., Yamade, S., Ueyama, H., Motulsky, A. G., & Deeb, S. S. (2001). The importance of gene order in expression of the red and green visual pigment genes and in color vision. *Color Research and Application*, 26, S79-S83.
- Heim, S., Freeman, R. B., Eulitz, C., & Elbert, T. (2001). Auditory temporal processing deficit in dyslexia is associated with enhanced sensitivity in the visual modality. *Neuroreport*, 12(3), 507-510.
- Holcombe, A. O., & Cavanagh, P. (2001). Early binding of feature pairs for visual perception. *Nature Neuroscience*, 4(2), 127-128.
- Hong, J. Y., Cho, K. J., & Han, K. H. (2000). The effect of color differences on the detection of the target in visual search, *Biologically Motivated Computer Vision, Proceeding* (Vol. 1811, pp. 353-358).
- Hull, C. C., Liu, S. C. S., Sciscio, A., Eleftheriadis, H., & Herold, J. (2000). Optical cylinder designs to increase the field of vision in the osteo-odonto-

keratoprosthesis. *Graefes Archive for Clinical and Experimental Ophthalmology*, 238(12), 1002-1008.

Iester, M., Mennoud, A., & Schnyder, C. (2000). Frequency doubling technology and Octopus visual field. *Acta Ophthalmologica Scandinavica*, 78, 23-24.

Ishihara, Y., & Morita, S. (2000). Computation model of eye movement in reading using foveated vision, *Biologically Motivated Computer Vision, Proceeding* (Vol. 1811, pp. 108-117).

Jordan, K., Heinze, H. J., Lutz, K., Kanowski, M., & Jancke, L. (2001). Cortical activations during the mental rotation of different visual objects. *Neuroimage*, 13(1), 143-152.

Klein, I., Paradis, A. L., Poline, J. B., Kosslyn, S. M., & Le Bihan, D. (2000). Transient activity in the human calcarine cortex during visual-mental imagery: An event-related fMRI study. *Journal of Cognitive Neuroscience*, 12, 15-23.

Knoblauch, K., Mazoyer, V., Koenig, F., & Vital-Durand, F. (2001). Facilitated visual search at low color contrast. *Color Research and Application*, 26, S157-S160.

Kohly, R. P., & Regan, D. (2001). Long-distance interactions in Cyclopean vision. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 268(1463), 213-219.

Lee, T. S., & Nguyen, M. (2001). Dynamics of subjective contour formation in the early visual cortex. *Proceedings of the National Academy of Sciences of the United States of America*, 98(4), 1907-1911.

Leonards, U., Sunaert, S., Van Hecke, P., & Orban, G. A. (2000). Attention mechanisms in visual search - An fMRI study. *Journal of Cognitive Neuroscience*, 12, 61-75.

Li, W. H., Boissinot, S., Tan, Y., Shyue, S. K., & Hewett-Emmett, D. (2000). Evolutionary genetics of primate color vision - Recent progress and potential limits to knowledge, *Evolutionary Biology*, Vol 32 (Vol. 32, pp. 151-178).

Logi, F., Pellegrinetti, A., Bonfiglio, L., Baglini, O., Siciliano, G., Iudice, A., & Sartucci, F. (2001). Effects of grating spatial orientation on visual evoked potentials and contrast sensitivity in multiple sclerosis. *Acta Neurologica Scandinavica*, *103*(2), 97-104.

Maar, N., Tittl, M., Stur, M., Zajic, B., & Reitner, A. (2001). A new colour vision arrangement test to detect functional changes in diabetic macular oedema. *British Journal of Ophthalmology*, *85*(1), 47-51.

Maioli, C., Benaglio, I., Siri, S., Sosta, K., & Cappa, S. (2001). The integration of parallel and serial processing mechanisms in visual search: evidence from eye movement recording. *European Journal of Neuroscience*, *13*(2), 364-372.

Martin, P. R., Grunert, U., Chan, T. L., & Ghosh, K. K. (2001). Retinal pathways for colour vision: Studies of short-wavelength sensitive ("blue") cones and their connections in primate retina. *Color Research and Application*, *26*, S112-S117.

Massof, R. W., & Fletcher, D. C. (2001). Evaluation of the NEI visual functioning questionnaire as an interval measure of visual ability in low vision. *Vision Research*, *41*(3), 397-413.

McCourt, M. E., & Garlinghouse, H. (2000). Asymmetries of visuospatial attention are modulated by viewing distance and visual field elevation: Pseudoneglect in peripersonal and extrapersonal space. *Cortex*, *36*(5), 715-731.

Minut, S., Mahadevan, S., Henderson, J. M., & Dyer, F. C. (2000). Face recognition using foveal vision, *Biologically Motivated Computer Vision, Proceeding* (Vol. 1811, pp. 424-433).

Monnier, P., & Nagy, A. L. (2001). Uncertainty, attentional capacity and chromatic mechanisms in visual search. *Vision Research*, *41*(3), 313-328.

Moore, C. M., & Brown, L. E. (2001). Preconstancy information can influence visual search: The case of lightness constancy. *Journal of Experimental Psychology-Human Perception and Performance*, *27*(1), 178-194.

Moreland, J. D., & Westland, S. (2001). Efficacy of a color conversion filter

in color-vision testing. *Color Research and Application*, 26, S258-S260.

Mulleners, W. M., Chronicle, E. P., Palmer, J. E., Koehler, P. J., & Vredeveld, J. W. (2001). Suppression of perception in migraine - Evidence for reduced inhibition in the visual cortex. *Neurology*, 56(2), 178-183.

Murakami, I., & Cavanagh, P. (2001). Visual jitter: evidence for visual-motion-based compensation of retinal slip due to small eye movements. *Vision Research*, 41(2), 173-186.

Osman, E., Pearce, A. R., Juttner, M., & Rentschler, I. (2000). Reconstructing mental object representations: A machine vision approach to human visual recognition. *Spatial Vision*, 13(2-3), 277-286.

Peli, E., & Geri, G. A. (2001). Discrimination of wide-field images as a test of a peripheral-vision model. *Journal of the Optical Society of America A-Optics Image Science and Vision*, 18(2), 294-301.

Polonsky, A., Blake, R., Braun, T., & Heeger, D. J. (2000). Neuronal activity in human primary visual cortex correlates with perception during binocular rivalry. *Nature Neuroscience*, 3(11), 1153-1159.

Press, L. J. (2000). A randomized trial of the effect of single-vision vs. bifocal lenses on myopia progression in children with esophoria. *Optometry and Vision Science*, 77(12), 630-631.

Prinzmetal, W., & Beck, D. M. (2001). The tilt-constancy theory of visual illusions. *Journal of Experimental Psychology-Human Perception and Performance*, 27(1), 206-217.

Reich, D. S., Mechler, F., & Victor, J. D. (2001). Formal and attribute-specific information in primary visual cortex. *Journal of Neurophysiology*, 85(1), 305-318.

Ress, D., Backus, B. T., & Heeger, D. J. (2000). Activity in primary visual cortex predicts performance in a visual detection task. *Nature Neuroscience*, 3(9), 940-945.

Rivadulla, C., Sharma, J., & Sur, M. (2001). Specific roles of NMDA and AMPA receptors in direction-selective and spatial phase-selective responses in visual cortex. *Journal of Neuroscience*, 21(5), 1710-1719.

- Robson, A. G., & Kulikowski, J. J. (2001). The effect of pattern adaptation on chromatic and achromatic visual evoked potentials. *Color Research and Application*, 26, S133-S135.
- Rubin, G. S., Bandeen-Roche, K., Huang, G. H., Munoz, B., Schein, O. D., Fried, L. P., & West, S. K. (2001). The association of multiple visual impairments with self-reported visual disability: SEE project. *Investigative Ophthalmology & Visual Science*, 42(1), 64-72.
- Rumberger, A., Tyler, C. J., & Lund, J. S. (2001). Intra- and inter-areal connections between the primary visual cortex V1 and the area immediately surrounding V1 in the rat. *Neuroscience*, 102(1), 35-52.
- Rushton, S. K., & Salvucci, D. D. (2001). An egocentric account of the visual guidance of locomotion. *Trends in Cognitive Sciences*, 5(1), 6-7.
- Schofield, A. J. (2000). What does second-order vision see in an image? *Perception*, 29(9), 1071-1086.
- Schrauf, M., & Stern, C. (2001). The visual resolution of Landolt-C optotypes in human subjects depends on their orientation: the 'gap-down' effect. *Neuroscience Letters*, 299(3), 185-188.
- Sheinberg, D. L., & Logothetis, N. K. (2001). Noticing familiar objects in real world scenes: The role of temporal cortical neurons in natural vision. *Journal of Neuroscience*, 21(4), 1340-1350.
- Sheth, B. R., & Shimojo, S. (2001). Compression of space in visual memory. *Vision Research*, 41(3), 329-341.
- Shevelev, I. A., Kamenkovich, V. M., Bark, E. D., Verkhlutov, V. M., Sharaev, G. A., & Mikhailova, E. S. (2000). Visual illusions and travelling alpha waves produced by flicker at alpha frequency. *International Journal of Psychophysiology*, 39(1), 9-20.
- Shute, R. H., & Westall, C. A. (2000). Use of the Mollon-Reffin Minimalist color vision test with young children. *Journal of Aapos*, 4(6), 366-372.
- Stark, L. W., Privitera, C. M., Yang, H. Y., Azzariti, M., Ho, Y. F., Blackmon, T., & Chernyak, D. (2001). Representation of human vision in

the brain: How does human perception recognize images? *Journal of Electronic Imaging*, 10(1), 123-151.

Suder, K., Worgotter, F., & Wennekers, T. (2001). Neural field model of receptive field restructuring in primary visual cortex. *Neural Computation*, 13(1), 139-159.

Super, H., Spekreijse, H., & Lamme, V. A. F. (2001). Two distinct modes of sensory processing observed in monkey primary visual cortex (V1). *Nature Neuroscience*, 4(3), 304-310.

Szlyk, J. P., Seiple, W., Fishman, G. A., Alexander, K. R., Grover, S., & Mahler, C. L. (2001). Perceived and actual performance of daily tasks: Relationship to visual function tests in individuals with retinitis pigmentosa. *Ophthalmology*, 108(1), 65-75.

Talcott, J. B. (2001). Reading and dyslexia: Visual and attentional processes. *Trends in Cognitive Sciences*, 5(1), 44-44.

Tanaka, K. (2000). Mechanisms of visual object recognition studied in monkeys. *Spatial Vision*, 13(2-3), 147-163.

Tucker, V. A. (2000). The deep fovea, sideways vision and spiral flight paths in raptors. *Journal of Experimental Biology*, 203(24), 3745-3754.

Ueyama, H., Hayashi, S., Tanabe, S., Tanaka, Y., Hayashi, T., Deeb, S. S., Yamade, S., & Ohkubo, I. (2001). Number and arrangement of the red and green visual pigment genes in color-normal Japanese males. *Color Research and Application*, 26, S84-S88.

Verney, S. P., Granholm, E., & Dionisio, D. P. (2001). Pupillary responses and processing resources on the visual backward masking task. *Psychophysiology*, 38(1), 76-83.

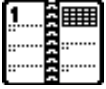
Vrbancic, M., Burbridge, B., & McIlwrick, J. (2000). Comparison of visual perception skills of medical students, radiology residents, and radiologists. *Archives of Clinical Neuropsychology*, 15(8), 692-692.

Walline, J. J., Bailey, M. D., & Zadnik, K. (2000). Vision-specific quality of life and modes of refractive error correction. *Optometry and Vision Science*, 77(12), 648-652.

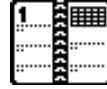
- Wang, L., & Stern, J. A. (2001). Saccade initiation and accuracy in gaze shifts are affected by visual stimulus significance. *Psychophysiology*, *38*(1), 64-75.
- Wehrhahn, C., & Rapf, D. (2001). Perceptual learning of apparent motion mediated through ON-and OFF-pathways in human vision. *Vision Research*, *41*(3), 353-358.
- Westheimer, G. (2001). Is peripheral visual acuity susceptible to perceptual learning in the adult? *Vision Research*, *41*(1), 47-52.
- Winner, E., von Karolyi, C., Malinsky, D., French, L., Seliger, C., Ross, E., & Weber, C. (2001). Dyslexia and visual-spatial talents: Compensation vs deficit model. *Brain and Language*, *76*(2), 81-110.
- Xu, S. Z., Meyer, D., Yoser, S., Matthews, D., & Elfervig, J. L. (2001). Pattern visual evoked potential in the diagnosis of functional visual loss. *Ophthalmology*, *108*(1), 76-80.
- Young, M. P. (2000). The architecture of visual cortex and inferential processes in vision. *Spatial Vision*, *13*(2-3), 137-146.
- Yu, C., & Levi, D. M. (2000). Surround modulation in human vision unmasked by masking experiments. *Nature Neuroscience*, *3*(7), 724-728.
- Zetzsche, C., & Krieger, G. (2001). Nonlinear mechanisms and higher-order statistics in biological vision and electronic image processing: review and perspectives. *Journal of Electronic Imaging*, *10*(1), 56-99.

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Meetings Calendar



2001

April 29-May 4

ARVO 2001

<http://www.arvo.org/arvo>

May 4-8

Vision Sciences meeting

Sarasota, Florida

Abstract deadline: 15 December

<http://chuma.cas.usf.edu/~sanocki/vssupdate.html>

August 26-30

ECVP, Kusadasi, Turkey

<http://www.ecvp.org>

September 7-11

24th Pupil Colloquium, USA

Contact: P.A.Howarth@lboro.ac.uk

<http://www.mailbase.ac.uk/lists-p-t/pupil/files/>