



BRISTOL VISION INSTITUTE

## BVI REFRESH autumn 2015

*Keeping you up to date with the latest news from Bristol's vision community*

### EVENTS

#### Richard Gregory Memorial Lecture

BVI was honoured to welcome Professor Anya Hurlbert to the University of Bristol to deliver the 2015



Richard Gregory Memorial Lecture on 29th October 2015. Anya, who is Professor of Visual Neuroscience and Director of the Centre for Translational Systems Neuroscience at the University of Newcastle, gave a fascinating and entertaining lecture on Colour Constancy.

Colour pervades the world, both inside and outside, made by man and nature. People see and respond to colour in food, furniture, fine art, and fashion; in the ruddy flush of healthy skin or the blue stain on mouldy cheese. Yet although they signify many things, colours are not physical things but the result of perceptual processes that start in the eye and continue in the brain.

In her talk, Prof Hurlbert illustrated the limits of colour constancy by describing experiments using tuneable multi-channel LED light sources, carried out both in the lab and in public installations. The latter include a mass psychophysics experiment at the National Gallery as part of the 2014 Making Colour exhibition, from which the data confirmed previous laboratory findings of better colour constancy for certain natural illumination changes as well as revealed new findings on colour name-changes under artificial illumination changes. These and other experiments also highlight the fact that the colours we see, and the constancy with which we see them, must evolve along with new technology that enables new and ever-changing illuminations.

#### BVI Seminar Series:

**Change of venue:** From October 2015 onwards Bristol Vision Institute's seminar series will take place in the seminar room, Life Sciences Building, Tyndall Avenue, BS8 1TQ.

**Series kick off:** Professor Aaron Sloman opened the 2015-16 seminar series on Friday 2nd October 2015, filling the seminar room to the brim with his talk: 'Why



are the many recent results in statistics-based machine vision misleading? Perhaps because none of the mechanisms used can account for the roles of vision in mathematical discoveries leading to Euclid's Elements 2.5 millennia ago?'

#### Other Autumn Seminars

- Professor Andrew Schofield, Friday October 9th 2015: "Seeing shadows in the twilight of life"
- Professor Craig Evinger, Friday October 23rd 2015: "Photophobia: Is the central nervous system necessary?"
- Professor Charles Leek, Friday November 27th, 2015: "Object recognition in human vision: Evidence from eye movements and event-related potentials"
- BVI Xmas Seminar, Friday December 11th, 2015: a selection of short talks from across BVI, followed by Christmas drinks and nibbles:

All seminars will be followed by an informal drinks reception in the Life Sciences Atrium.

**For further information:** Please contact the BVI administrator, Jen Hawkins: [j.hawkins@bristol.ac.uk](mailto:j.hawkins@bristol.ac.uk) to be added to the mailing list, or see the BVI website for details.

## VISUAL MOVERS AND SHAKERS

### Royal Society University Research Fellow

**Congratulations** to Martin How for winning a prestigious Royal Society University Research Fellowship, giving him up to 8 years of dedicated funding. Martin is currently a Marie Curie Fellow working with Nick Roberts in the School of Biological Sciences, with particular interests in the visual ecology of aquatic animals. Indeed, many of you will have heard Martin's BVI talk earlier in the year on "The bizarre visual world of the mantis shrimp". Martin studies the detection of polarised light in mantis shrimps and fiddler crabs, colour vision in crustaceans and skin camouflage patterns in a variety of species, including nudibranchs, cuttlefish and zebra.



For more information:

<http://www.bristol.ac.uk/biology/people/person/martin-how/overview.html>

### Keynote Lecture at IET Intelligent Signal Processing Conference

Prof Dave Bull will give a prestigious keynote lecture at the forthcoming IET Intelligent Signal Processing Conference, to be held in London in December 2015. Professor Bull will talk about the recent work conducted in BVI's Visual Information Laboratory on the topic of texture synthesis for video compression.

### BVI welcomes:

[The Ecology Of Vision Group](#), Biological Sciences, welcomes: Post-Doc researcher Dr Kate Feller and PhD student, Sam Smithers.

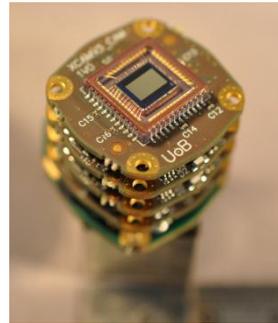
[The Visual Information Laboratory](#), Engineering, welcomes Post Doc researcher Dr Angeliki Katsenou and PhD student – Mariana Afonso, both are working on the group's Marie Curie ITN on Video Compression. A warm welcome also goes to VI Lab PGR's: Hanah Alghamdi, Ranger Fan Farnoosh Heidari, Eduardo Ruiz Libreros Davide Moltisanti and Michael Wray.



Dr Kate Feller, Ecology of Vision & Dr Angeliki Katsenou, Visual Information Laboratory

## RESEARCH NEWS

### A Selective and Intelligent Vision Processing System



The biologically inspired computational vision system, designed and developed within VI-Lab has attracted further funding from DSTL and BVI, with sponsorship from image sensor manufacturer E2V (Gibson, Campbell, Cuthill and Bull). Having been miniaturised, these real-time

vision systems can be employed in a wide range of applications and environments, including robot guidance systems or autonomous vehicles. The system can also be configured as a binocular pair coupling high speed motor control and vision processing enabling autonomous ego motion and depth from vergence.

The project will focus on adaptive space-time sampling and unsupervised learning for intelligent security systems that adapt to the scene being surveyed. The state-of-the-art E2V sensors (the same used on the comet lander Philae) supports extended sensor programmability, improved image quality and higher resolution (up to 1600x1200) and will provide an excellent platform for investigating learning, foveation and visual resource allocation. *For further details contact David Gibson:*

[david.gibson@bristol.ac.uk](mailto:david.gibson@bristol.ac.uk)

### Finding hope in the dark

Advances in stem cell transplantation and gene therapy have been pioneered in vision research. An international team of researchers from Bristol, Toronto, Pittsburgh, Dallas and Montreal have identified a gene that could be responsible for some cases of human night blindness. Often genes that affect the function or survival of the principal light-sensitive cells in the retina, the rod and cone photoreceptors, are responsible for early onset night blindness. In contrast, PRDM8 appears to influence the inner neural circuitry of the retina that connects the photoreceptors with the rest of the central nervous system.

Dr Denize Atan, Consultant Senior Lecturer in Ophthalmology from the University of Bristol's School of Clinical Sciences and first author on the paper, said: "Our findings suggest that PRDM8 might be responsible for some cases of human night blindness and that PRDM8 is a potential candidate for gene therapy. In addition, our discovery of the importance of this gene to inner retinal circuitry could help researchers in their efforts to generate these neurons for transplantation studies."

See more at:

<http://www.bristolhealthpartners.org.uk/latestnews/2015/06/10/finding-hope-in-the-dark/366#sthash.xdO7rHp7.dpuf>

## Detecting risk of age related macular degeneration with Haidinger's brushes

Dr. Shelby Temple from the Ecology of Vision research group, School of Biological Sciences has invented a device that detects someone risk of developing age related macular degeneration (AMD).



His work exploits the fact that humans detect polarized light using Haidinger's brushes, which result from differential absorption of polarized light by carotenoid pigments in the macula. Low macular pigment optical density (MPOD) is one of the key predictors of risk of developing AMD. Now funded in part by the BVI EPSRC Platform Grant, Shelby has taken his device to the Macular Carotenoids Research Group clinic in Waterford Ireland, and, with Prof. John Nolan, has demonstrated that it can estimate MPOD. To support translation of his invention, Dr. Temple has just been awarded a BBSRC Impact Acceleration Account award. He is now looking to build a team to commercialize the technology and help protect people's vision into the future.

## Treacherous Pavements: Paving Slab Patterns Modify Intended Walking Directions

*Ute Leonards, John G. Fennell, Gaby Oliva, Alex Drake, David W. Redmill*

Current understanding in locomotion research is that, for humans, navigating natural environments relies heavily on visual input; in contrast, walking on even ground in man-made environments that are obstacle and hazard-free, is so highly automated that visual information derived from floor patterns should not affect locomotion and in particular have no impact on the direction of travel.

The vision literature on motion perception would suggest otherwise; specifically that oblique floor patterns may induce substantial veering away from the intended direction of travel due to the so-called aperture problem.

The BVI team tested these contrasting predictions by letting participants walk over commonly encountered floor patterns (paving slabs) and investigating participants' ability to walk "straight ahead" for different pattern orientations. Results showed that, depending on pattern orientation, participants veered considerably over the measured travel distance (up to 8% across trials), in line with predictions derived from the literature on motion perception. These findings are



important to the study of locomotion, and, if also observed in real world environments, might have implications for architectural design.

## New EPSRC Grant - Computer Vision for Novel Visuo-Control Architectures for Agile Exploration.



A new four year £1.6M project involving Bristol and Manchester Universities aims to explore vision and control algorithms for novel vision sensors and how these can be used in agile robot exploration.

The project will investigate how vision algorithms change when every pixel has its own processor; how processing at source helps to reduce sending irrelevant information through the visual pipeline; and how these features benefit a tighter integration with the control architecture. Aiming to demonstrate better and more agile operation of autonomous flying robots, the project involves various aerospace companies from the UK as well as academic collaborators overseas. The novel vision sensors are a result of a long term research initiative at the University of Manchester while the Bristol's team contribution is based on our extensive work on real-time visual mapping, tracking and flight control and systems integration. One unique feature of this project is that complete sensor chipsets will be offered to promote development by external interested parties.

The work is lead at Bristol by Drs Walterio Mayol-Cuevas and Tom Richardson from the Departments of Computer Science and Aerospace Engineering, respectively.

## How to measure perceived image quality

Fan (Aaron) Zhang and David Bull from VI-Lab have recently published a paper in IEEE Transactions on Circuits and Systems for Video Technology entitled: "A Perception-based Hybrid Model for Video Quality Assessment". Visual masking effects play an important role in video distortion perception, especially within spatial and temporal textures. In this paper, a novel perception-based hybrid model for video quality assessment is presented. This simulates the HVS perception process by adaptively combining noticeable distortion and blurring artefacts using an enhanced non-linear model. All stages of the model exploit the orientation selectivity and shift invariance properties of the Dual Tree Complex Wavelet Transform. This not only helps to improve performance but also offers the potential for new low complexity in-loop applications. The approach has been evaluated on both the VQEG FRTV Phase I and the LIVE video databases and the resulting overall performance is superior to existing metrics.

## BVI Platform Grant funding

The first round of research awards associated with the BVI Platform Grant were awarded in August 2015. Amongst stiff competition, the following awards were made:

- Felix Mercer Moss and Fan Zhang: Modelling modern content: Building video databases shaped on the BBC archive.
- David Gibson: Adaptive multi-scale spatio-temporal sampling: learning visual distributions of activity.
- Guarav Malhotra: Understanding noise processing using perceptual decision making.
- Paul Hill: Perceptual Denoising.
- Pui Anantrasirichai: A Bio-inspired Visual Framework for Autonomous Locomotion.
- Shelby Temple: Detecting risk of age related macular degeneration with Haidinger's brushes.