

David Kane | Vision Scientist

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David is a visual psychophysicist working at the intersection of vision science and visual technologies. David's background is in low-level psychophysics but he is primarily motivated by applied problems and believes that a combination of basic and applied research is needed to develop effective visual technologies. David thinks independently about problems and has a reputation for collecting clean data and designing experiments that directly answer the question of interest.

Employment History

- **Universitat Pompeu Fabra** **Barcelona, Spain**
Post-doctoral researcher *2014–onwards*

David is working as the in-house vision science expert in the image processing laboratory of Marcelo Bertalmío. The overarching aim of the lab is to generate technologies that can allow the automated capture and presentation of content across a variety of different consumer devices. The main focus of David's work is on the extension of the image processing pipeline for high Dynamic Range (DR) content and in particular, the problem of displaying high DR scenes on low DR monitors [5]. This work has led to a promising tone mapping operator (TMO) that operates on high DR content and RAW images to produce natural looking images with good detail and color reproduction [6]. The algorithm is rapid and could work within the processing pipeline of a camera. The TMO is patented [1] and close to market, example images can be viewed [here](#) [4]. Ongoing work is testing the use of adaptive or static encoding-decoding nonlinearities for HDR content. This has led to the development of a nonlinearity that is particularly effective when applied to manually graded HDR content [7]. In conjunction with Nippon Hōsō Kyōkai a patent application is being made [2]. On a more theoretical level, David is developing a model of luminance/contrast perception that can operate over any given luminance range and can accurately estimate perception when real world images are viewed (i.e., not just when simple, highly constrained laboratory stimuli are used). The ultimate aim of this research is to develop the theory to allow one to reproduce, as best as possible, the appearance of the original scene, on any given display device.

Other topics of interest include: *the impact of optical scatter and monitor reflectance on scene appearance, the statistics of real world images as a function of dynamic range, the difference between real world images and manually graded content and the inverse tone-mapping problem.*

- **University of California, Berkeley** **California, USA**
Post-doctoral Researcher *2010–2013*

At UC Berkeley David worked under the stewardship of Professor Martin Banks and conducted research into stereo-3D perception. Prolonged viewing of stereo-3D displays can give rise to discomfort. David investigated the minimum frequency of disparity oscillations that can give rise to discomfort and this information can help the design of content that minimizes discomfort [8]. Additionally, David investigated discomfort head-roll which can cause a mis-alignment between the viewer and the display and can result in large vertical vergence angles [9]. Low level research involved investigating the limits of stereo-vision as a function of space and time [10]. This latter research detailed both when there is too little and too much disparity for reliable perception of stereo cues. This research can help one configure stereo content so that desirable content is seen in depth, but undesirable stereo artifacts go undetected.

Other topics of interest include: *the visibility of artifacts such as judder and flicker in displays, the range of different stereo-3D technologies and perspective issues in photography.*

Education

Academic Qualifications.....

- **University Collage London** **London, UK**
PhD in psychophysics, Steven Dakin, Peter Bex *2007–10*

- **University of Sussex**
○ *Masters in Evolutionary and Adaptive Systems, Awarded with distinction*
- **University of Sheffield**
○ *Bachelor with Honors degree in Psychology and Cognitive Science*

Brighton, UK
2011–2015
Sheffield, UK
2003–2006

Technical and Personal skills

- **Programming Languages:** Proficient in: Matlab, Psychtoolbox, Latex. Learning: Python.
- **Journal reviewed for:** Journal of Vision, Vision Science, Displays, Journal of Electronic Imaging, Journal of Selected Topics in Signal Processing.
- **Talks:** University of Glasgow (invited). Smith-Kettlewell (invited). Vision Science Society (2). European Conference on Visual Perception. (2) Applied Vision Association (3). Electronic Imaging (5).

Patents

- [1] Bertalmío, Kane & Cyriac. Method, system and device for generating more natural images. European Patent Application 3054416(A1), issued February 6, (2015). [\[link\]](#)
- [2] Yasuko, Bertalmío, Kane & Cyriac. Patent application in progress. This is a joint venture between University Pompeu Fabra (UPF) and Nippon Hōsō Kyōkai (NHK).

Useful links

- [3] David Kane, Google Scholar Publications [\[link\]](#)
- [4] A database of image produced by applying our TMO to RAW and HDR images (Ongoing). [\[link\]](#)

Selected publications

- [5] Kane and Bertalmío. System gamma as a function of image- and monitor-dynamic range. Journal of Vision (2016). [\[link\]](#)
- [6] Cyriac, Bertalmio, Kane & Vazquez-Corral. A tone mapping operator based on neural and psychophysical models of visual perception. SPIE/IS&T Electronic Imaging (2015). [\[link\]](#)
- [7] Yasuko, Cyriac, Kane & Marcelo Bertalmío Improved High Dynamic Range Video Coding with a Nonlinearity based on Natural Image Statistics. Submitted to the MMSP 2017 IEEE 19th International Workshop on Multimedia Signal Processing.
- [8] Kim, Kane & Banks. The rate of change of vergence–accommodation conflict affects visual discomfort. Vision research (2014). [\[link\]](#)
- [9] Kane, Held & Banks. Visual discomfort with stereo 3D displays when the head is not upright. IS&T/SPIE Electronic Imaging (2012). [\[link\]](#)
- [10] Kane, Gaun & Banks. The limits of human stereopsis in space and time. Journal of Neuroscience (2014). [\[link\]](#)

References

- Martin Banks. Professor of Optometry and Vision Science, Affiliate Professor of Psychology and Bioengineering, University of California, Berkeley, USA. [\[lab webpage\]](#) martybanks@berkeley.edu ✉
- Marcelo Bertalmío. Associate Professor, Information and Communication Technologies, Universitat Pompeu Fabra, Barcelona, Spain. [\[personal webpage\]](#) marcelo.bertalmio@upf.edu ✉