

Paul Linton

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INTRODUCTION

My research focuses on 3D visual experience. In my PhD I demonstrate that the visual system does not appear to use vergence (the angular rotation of the eyes) to triangulate the size and distance of objects. This work has significant implications for visual scale, binocular disparity processing, multisensory integration, and object interaction. In my book *The Perception and Cognition of Visual Space* (Palgrave, 2017), I explore inconsistencies in the 3D vision literature and argue that there are still important gaps between leading theories and our visual experience. I initiated, and I am co-organising, a Royal Society meeting on “New Approaches to 3D Vision” in computer, animal, and human vision, with representatives from Facebook Reality Labs, Google DeepMind, Google Robotics, and Microsoft Research. As an Intern at Facebook Reality Labs, I collaborated with deep learning and computer graphics researchers to study naturalistic real-time gaze-contingent defocus blur (the [DeepFocus](#) project). Before vision science I was a Stipendiary Lecturer in Law at St Hilda’s College Oxford, and a Teaching Fellow at University College London.

SUMMARY

- Expert in human 3D vision, author of *The Perception and Cognition of Visual Space* (Palgrave, 2017)
- Extensive knowledge of display systems research for virtual and augmented reality
- 3+ years of prototyping new experimental apparatuses and conducting evaluative studies
- Important experimental results questioning the role of eye movements in 3D vision
- Proficiency in MATLAB, R, and Python, OpenGL rendering, PsychToolbox, and Quest+

EDUCATION

PhD, Vision Science, City, University of London Role of vergence in visual size and distance perception Supervisors: Prof. Christopher Tyler and Dr. Simon Grant	2016 – 2021
Postgraduate Courses, Law and Economics, NYU and Harvard University 3.9 out of 4.0 GPA. Supervisor: Prof. Amartya Sen (Harvard, Nobel Laureate)	2008 – 2011
BA, Law with European Law, University of Oxford Awards: Gluckstein Scholarship, Hanbury Scholarship, Exhibitioner	2004 – 2008

EXPERIENCE

City, University of London, PhD Candidate, now Research Fellow	2016 – Present
<ul style="list-style-type: none">• Vergence is thought to play a key role in size, distance, and shape perception at near distances, but the experimental paradigms currently employed introduce additional retinal and cognitive cues• 1st experiment (published in <i>Attention, Perception, & Psychophysics</i>) manipulates vergence gradually to minimise retinal changes, and shows participants are unable to reach for targets• 2nd experiment (published in special issue of <i>Vision</i> edited by Mel Goodale FRS), controls for distortions in OpenGL, and used new measurement paradigm to demonstrate no effect of vergence on size perception• Experiments required controlling for luminance (using laser projection/OLED displays/filters), vergence / accommodation conflict (using lenses/contact lenses), and utilised Quest+ to reduce experiment time• Data analysed using hierarchical Bayesian modelling / Bayes factor / mixed effects models• Invited talk at Optical Society (OSA), presentations at Vision Sciences Society (Travel Award), European Conference on Visual Perception, British Machine Vision Association, Applied Vision Association• Initiated and organising Royal Society Meeting on “New Approaches to 3D Vision” with representatives from Facebook Reality Labs, Google DeepMind, Google Robotics, and Microsoft Research [link]• Lecturer in Depth Perception for Experimental Psychology Perception Module at University College London	

Facebook Reality Labs, Research Intern, Display Systems Research [[Project Press Release](#)]

Fall 2018

- Collaborated closely with researchers in deep learning, computer graphics, and optics, as part of a small interdisciplinary team, using artificial intelligence for real-time gaze-contingent defocus blur rendering
- Used principles of vision science to inform the development of neural network
- Ran user studies to evaluate neural network and make actionable recommendations

University of Oxford, Teaching positions in Law

2011 – 2015

- At Faculty level (Course Lecturer): Developed and taught new 3rd Year course and postgraduate course, teaching evaluated as “outstanding in both preparation and delivery”
- At College level (College Tutor): Responsible for teaching 3 courses, admissions, and pastoral care
Performance rated “top 5%” out of Oxford law tutors, with disproportionate numbers of students with 1sts

University College London, Teaching Fellow in Philosophy

Spring 2014

- Developed and taught two courses, lecturing to over 150 students, supervising three TAs
- Head of Department evaluation: “contribution to the teaching in our department was unsurpassed”

Skills

Hardware

- Custom built stereoscope apparatus to control for residual luminance cues
- uStepper + Arduino to control linear actuators

Software

- Python + PyTorch for computational imaging
- OpenGL + Psychtoolbox + Matlab or Unity / Unreal for rendering 3D stimuli
- Quest+ for real-time maximum likelihood estimation
- Palamedes Toolbox + Matlab + Stan for hierarchical Bayesian modelling
- LMER + R for generalised mixed effects models
- GgPlot2 + R for data visualisation

BOOK

- Linton, P. (2017). *The Perception and Cognition of Visual Space* (Palgrave Macmillan). Reviewed as “a valuable contribution to the scientific literature on visual perception” by Prof. Casper Erkelens in *Perception* [[link](#)]

PAPERS

- Linton, P. (2021). ‘Does Vergence Affect Perceived Size?’, *Vision*, 5(3), 33, special issue of *Vision* on size constancy for perception and action edited by Mel Goodale FRS and Robert Whitwell [[link](#)]
- Linton, P. (2021). ‘V1 as an Egocentric Cognitive Map’, for special issue of *Neuroscience of Consciousness*, contributors including Stanislas Dehaene, Catherine Tallon-Baudry, Biyu Jade He, and Axel Cleeremans [[link](#)]
- Linton, P. (2021). ‘Conflicting shape percepts explained by perception cognition distinction’, *PNAS*, 118(10) e2024195118. [Letter to the Editor] [[link](#)]
- Linton, P. (2020). ‘Does Vision Extract Absolute Distance from Vergence?’, *Attention, Perception, & Psychophysics*, 82, 3176–95. [[link](#)] Featured on the Psychonomic Society’s “All Things Cognition” podcast [[link](#)]; featured in Wei Ji Ma’s undergraduate ‘Psychological Science and Society’ course at NYU
- Linton, P. (2019). ‘Would Gaze-Contingent Rendering Improve Depth Perception in Virtual and Augmented Reality?’. *ArXiv Preprint* [[link](#)] First to propose method for gaze contingent ocular parallax

ABSTRACTS

- Linton, P. (2020). ‘No Vergence Size Constancy’, *Journal of Vision*, 20(11), 1048 [[link](#)]
- Linton, P. (2020). ‘Does Vergence Explain the Taylor Illusion?’, *Perception*, 49(6), 703-703 [[link](#)]
- Linton, P. (2019). ‘Re-evaluating Vergence as a Distance Cue’, *Perception*, 48, 206-206 [[link](#)]