**Topic: Variations in visual perception**

**Supervisor:** John Greenwood

[john.greenwood@ucl.ac.uk](mailto:john.greenwood@ucl.ac.uk)

Department of Experimental Psychology

<http://eccentricvision.com>

Our lab examines visual perception, using the techniques of visual psychophysics in order to understand the way that we see the world. I have suggested two projects, but feel free to contact me if you have other interests or ideas. Both projects below will involve a series of behavioural experiments using psychophysical techniques. You will acquire skills in experiment design, programming (in MATLAB), psychophysical testing, and data analysis. Programming experience is a plus but not required in advance.

**Project 1: Visual crowding in dyslexia**

In our visual field, objects are easy to see when we look directly at them and difficult to see in peripheral vision. This is not simply to do with visual resolution – even when a target object is large enough to be seen in isolation, the placement of other objects nearby can make the target become difficult to recognise. This process, known as crowding, is a fundamental bottleneck for visual perception. Crowding has also been argued to be elevated in the central vision of people with dyslexia. These elevations have been found via letter-identification tasks, though evidence with other tasks (e.g. the orientation of line elements) is mixed. We suspect that dyslexic crowding is specific to letters and that other visual domains are unaffected – you could test this by directly comparing the crowding of letter stimuli with those for simpler visual tasks (like line orientation). The project will also touch on broader issues regarding whether crowding is a singular process or a family of independent feature-level processes.

*Relevant publications:*

* Whitney, D, & Levi, DM. (2011). Visual crowding: A fundamental limit on conscious perception and object recognition. *Trends in Cognitive Sciences, 15*(4), 160-168.
* Kalpadakis-Smith, A.V., Goffaux, V., & Greenwood, J.A. (2018). Crowding for faces is determined by visual (not holistic) similarity: Evidence from judgements of eye position. *Scientific Reports, 8* (12556), 1-14.
* Greenwood, JA, Bex, PJ, & Dakin, SC (2010). Crowding changes appearance. *Current Biology*, 20(6), 496-501.

**Project 2: The perception of position in faces vs. simpler objects**

We are experts at face recognition. Our visual system is similarly specialised, with a network of face-selective brain regions. How does this specialisation relate to earlier levels of visual processing? We will examine this via judgements of eye position within faces. Prior work has shown that shifts in eye position are easier to detect along the horizontal dimension than the vertical. This pattern differs to that found in simpler objects – in peripheral vision for instance, shifts in the position of dot elements are easier to detect in the radial dimension (along a circle with equal distance from fixation) than along the tangential dimension (towards/away from fixation). Your project could examine this discrepancy directly by comparing position judgements for eyes within faces and dot elements in peripheral vision. We aim to determine the conditions that lead to the ‘special’ pattern of selectivity observed for faces, and to understand both the development of these specialisations in the visual system and their potential neural basis.

*Relevant publications:*

* Goffaux, V., & Rossion, B. (2007). Face inversion disproportionately impairs the perception of vertical but not horizontal relations between features. *Journal of Experimental Psychology: Human Perception and Performance, 33* (4), 995-1002.
* Greenwood, J.A., Szinte, M., Sayim, B., & Cavanagh, P. (2017). Variations in crowding, saccadic precision, and spatial localization reveal the shared topology of spatial vision. *Proceedings of the National Academy of Sciences, 114* (17), E3573-E3582.