Principal Supervisor: Claire Hutchinson

Co-supervisor: David Souto

**PhD project title:** Age-related changes in visual processing: visual behaviour to computational models of the ageing brain

**University of Registration:** University of Leicester

Project outline

1. Project outline describing the scientific rationale of the project

Elucidating the nature of changes in the neural mechanisms underlying sensory and cognitive functioning in ageing has become a key goal of visual and systems neuroscience. Visual deterioration is an inevitable part of normal, healthy (disease-free) ageing. Older adults exhibit reduced sensitivity to image contrast, object orientation and motion. These visual deficits are exacerbated by age-related changes in the ability to accurately deploy attention across the visual field\(^1\text{-}^5\). Such performance impairments have marked deleterious effects across a wide range of everyday tasks, leading to restricted daily functioning and a reduced quality of life. Some aspects of age-related visual decline are accounted for by changes to the optics of the eye but the remainder must necessarily be attributed to age-related changes in the retina, and in the response properties of neurons and neural networks in the areas of the brain responsible for perception and sensory decision-making. However, the precise nature of these changes remains unresolved. For example, few studies have attempted to map age-related changes in visual behaviour onto changes in neural activity in the brain and the computational algorithms underlying them.

This PhD project will follow directly on from Hutchinson’s previous work on vision and visual cognition in the aged. Using a novel combination of visual psychophysics, eye-tracking, electrophysiology (EEG) and computational modeling, we will determine more precisely the neural changes that accompany visual ageing.

Stage 1: We will employ a combination of psychophysical techniques, eye-tracking and EEG to compare visual processing in young (20-30 yrs) and older (>65 yrs) adults.

Stage 2: We will test the hypotheses generated by our experimental data using mathematical modeling techniques. For this component of the PhD, the student will participate in an exciting new interdisciplinary collaboration with the highly ranked Computer Science Research Institute at the University of Ulster.

The budget will be used to cover participants’ expenses (travel and an inconvenience allowance), and EEG consumables. Some funds will be used for the student to present his/her findings at national (e.g. Applied Vision Association, British Machine Vision Association) and international (e.g. European Conference on Visual Perception) conferences, and for research visits to facilitate mathematical modeling of the behavioural data.
References


Relevant BBSRC Strategic Research Priority:
World Class Underpinning Bioscience

Techniques that will be undertaken during the project.

- Psychophysics (experimental psychology)
- Eye-tracking (cognitive neuroscience)
- EEG (cognitive neuroscience)
- Computational modeling (mathematics and computer science)

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