**University of Leicester**

**BBSRC MIBTP Studentship Project 2025-6 entry.**

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**Section 2 – *Project Information***

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| **Project Title** | Visual Adaptation: a key to understanding the sensory mechanisms of reading ability |
| **Project Summary**  |
| Our visual system continuously adjusts to changes in the external world, allowing for optimal perception in widely varying contexts. Visual adaptation occurs when exposure to a particular visual stimulus alters how we perceive subsequent stimuli. This phenomenon helps the brain efficiently process visual information by reducing sensitivity to constant, unchanging stimuli and enhancing sensitivity to new or different ones. Visual adaptation has been called “the psychologist’s microelectrode”, as it allows us to link behavior to the response dynamics of specific neuronal populations. In this project, we aim to use adaptation to fast visual flicker to investigate vision-specific components of reading abilities. This type of stimulation allows the brain to regulate sensitivity to rapidly alternating stimuli, maintaining perceptual stability in dynamic environments. Adaptation to fast flicker could be critical in tasks that require rapid visual decoding, such as reading, where visual information is presented in a quick and continuous manner. Reading is a complex cognitive function requiring the coordination of various neural processes, including visual perception, eye movement control, and language comprehension.   Emerging evidence suggests that efficient sensory processing may be fundamental for reading fluency, while deficits in temporal visual processing have been associated with reading difficulties, such as dyslexia. It was found that adaptation to fast visual flicker can enhance acuity in fine visual recognition tasks, including word recognition, in individuals with typical reading abilities (Arnold et al., 2016), arguably by weakening the influence of the magnocellular system on form perception. The magnocellular system is an anatomical visual pathway linked to specialized functions such as processing rapidly changing visual stimuli (like motion or flicker). It has also been associated with text perception and reading (Chase et al., 2003). However, the relationship between visual adaptation to temporally modulated stimuli and reading proficiency remains underexplored.  This project aims to use a combination of psychophysical, electrophysiological (EEG) and eye-tracking paradigms, as well as computational modelling, to probe whether and how visual flicker stimulation can modulate reading performance. While the final set of research goals will be shaped by the interests of the PhD student, they will fall into three broad categories:  1. To examine the relationship between visual adaptation to fast flicker and reading speed, accuracy, and comprehension.
2. To investigate whether individual differences in visual adaptation to fast visual flicker are linked to reading abilities, with the goal of identifying neurophysiological markers for reading proficiency.

 1. To explore whether visual adaptation efficiency can serve as a biological predictor of reading performance and a potential target for sensory-based interventions.

Techniques that will be undertaken during the projectAdvanced psychophysical techniques High precision eye tracking Electroencephalography (EEG) Psychophysiology Computational modelling Machine Learning (Decoding) Linear mixed effects modelling, Bayesian analyses in the R programming environment (stats) Programming in Matlab/Python  |
| **References** |
| Arnold, D. H., Williams, J. D., Phipps, N. E., & Goodale, M. A. (2016).  Sharpening vision by adapting to flicker. Proc Natl Acad Sci U S A, 113(44), 12556-12561. doi:10.1073/pnas.1609330113  Chase, C., Ashourzadeh, A., Kelly, C., Monfette, S., & Kinsey, K. (2003). Can the magnocellular pathway read? Evidence from studies of color. *Vision Res, 43*(10), 1211-1222. doi:10.1016/s0042-6989(03)00085-3. |