

From Memory to Attention: Dissociating Functional Representations in Visual Working Memory

Background

Visual search for familiar objects is guided by mental target representations. For example, when looking for a banana in a supermarket, we activate a mental representation of a banana that helps us direct our attention towards matching objects in the visual scene (e.g., anything banana-like). These representations, referred to as attentional templates, are thought to be maintained in visual working memory, a short-term storage with limited capacity. Previous research suggests that attentional templates primarily encode basic target features (e.g., yellow, curved), rather than fully integrated object representations (i.e., an actual image of a banana). But this finding contrasts sharply with evidence from visual working memory studies demonstrating that memory can support holistic object representations. Together, these results imply that although both processes rely on visual working memory, there may be qualitative differences between representations used for short-term storage and those that guide attentional selection.

Aims and Methods

This empirical project aims to disentangle the cognitive and neural mechanisms underlying two potentially distinct types of working memory representations: those that support information maintenance and those that are used to actively guide attention across the visual scene. To address this question, the experiments will combine psychophysical paradigms (e.g., visual search and change-detection tasks) with behavioural and electrophysiological measures, specifically event-related potentials (ERPs) derived from the human electroencephalogram (EEG).

Relevance

This project addresses the fundamental question of the role of working memory (the storage of target information) in

attentional guidance (the selection of relevant targets) and therefore addresses how two core cognitive systems interact to shape goal-directed human behaviour. The cognitive neuroscientific approach will advance understanding of the cognitive and neural underpinnings of memory and attention and refine existing theoretical accounts in both domains.

Training

This research will be conducted in the EEG lab in the Department of Psychology at Durham. The PhD student will receive comprehensive training in core research skills, including research ethics, experimental design, data interpretation, manuscript preparation, and scientific communication. In addition, they will gain specialised expertise in EEG data acquisition and ERP analysis. At the conceptual level, the PhD student will gain a deep understanding of the cognitive and neural processes underlying visual attention and working memory.

Requirement and suitability

This project is suitable for a PhD. The applicant should be familiar with statistical analysis software (e.g., JASP) and experimental programming platforms (e.g., PsychoPy). Prior experience with EEG methods is not required.

References and Further Reading

Eimer M, Grubert A (2014) *Journal of Experimental Psychology: Human Perception and Performance* 40:1819-31

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Grubert A, Eimer M (2018) *Journal of Neuroscience* 38:9527-38

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