Independent stores for relative and absolute spatial location in visuospatial working memory

David Aagten-Murphy
Paul M Bays

Introduction

- Visual spatial working memory (VSWM) helps us to deal with interruptions in sensory input - such as blinks, saccades, transient stimuli or environmental occlusions.
- However, the capacity of VSWM is limited, with recall precision decreasing as the number of items increases.
- While visual information is typically encoded retinotopically, relative to the current gaze direction (egocentric), this poses challenges when the eyes move.
- Objects may additionally be encoded relative to other objects in the environment (allocentric) with this information contributing to localisation.

We proposed that allocentric information represented an additional source of spatial information, optimally integrated with egocentric spatial estimates.

The precision of allocentric information depends on the distance of the remembered items from the visual landmark, with smaller object-landmark distances more precise.

By comparing conditions with visual landmarks to those without, we can quantify both:
- For all set sizes we observed a substantial decrease in localisation variability for items near a landmark.
- Performance at far locations was identical to that with no landmark - no suggestion of a cost from encoding allocentric.
- Both egocentric and allocentric precision decreased as set size increased, suggesting there was competition for limited resources within both representations.

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Conclusions

- The presence of visual landmarks enables the encoding of allocentric information about the distance between objects and the landmark.
- This information, depending on its precision (which decreases with increasing distance) is then integrated with egocentric estimates to form localisation estimates.
- We provide a computational and experimental framework for how egocentric and allocentric memory representations interact and their integration into a single spatial estimate.

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