

Remaining oriented with abstract or intermittent visual information

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Introduction

Continual access to very simple visual information (e.g., a lightness gradient) during motion can allow people to keep track of unseen targets with relatively high precision. This benefit is not apparent when the same visual information is presented before and after the movement, allowing people to re-orient (Wang & Spelke, 2000). This loss of pointing precision has implications for the type of memory system that governs behavior (Waller & Hodgson, 2006). The present experiments investigated the role of visual cues in (a) maintaining precise spatial knowledge of landmarks and (b) regaining this precision once it has been lost.



Basic Task

- Learn locations of 6 physical targets
- Point to targets from memory while wearing an HMD
 - pre-test (point 4x each)
 - rotate extensively
 - post-test (point 4x each)



Layout of testing room. Six pseudo-randomly selected target locations surrounded the participant. Participants completed several layouts with thematically-different targets (e.g., kitchen objects) in different arrangements.

Manipulations (all within participants)

- Visual cues about participant's current orientation presented inside the HMD
- Exp.1: Visual gradient either (a) always visible or (b) visible during testing but not rotation
- Exp.2: Virtual model of the testing room either (a) always visible or (b) visible during testing but not rotation
- Exp.3: Virtual room briefly displayed every 75°, 150°, 225°, or 300°



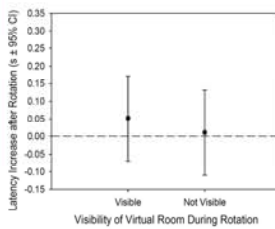
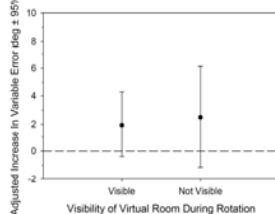
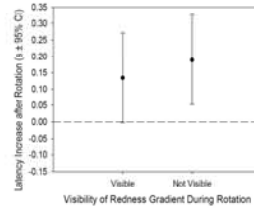
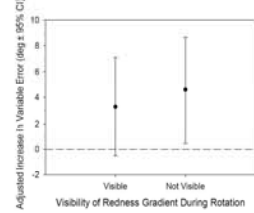
Left: A 360° panoramic view of the redness gradient. Participants were aware that the brightest point of red corresponded to the physical (red) exit sign in the room.
Right: A screenshot of the virtual lab model. The physical and virtual rooms corresponded in scale and alignment. Targets were not included.

Experiment 1

- Aims:** (1) Replicate the finding that simple visual information must be continually available to preserve pointing precision (Wang & Spelke, 2000).
- (2) Generalize this effect to latency.

Results

When visual information was present during rotation, post-rotation pointing was not significantly slower or less precise than pre-rotation performance. After rotating blindly, participants reorient well but their performance still suffered in both measures.



Experiment 2

- Aim:** Can richer information restore pointing precision and recall efficiency after they have been disrupted?

Results

With rich visual information, there was no disruption in pointing precision or latency when rotating blindly. Precise knowledge of targets' egocentric positions is not "lost" when disorientation occurs. It can be recovered with sufficient contextual information.

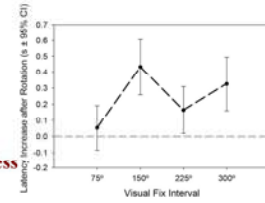
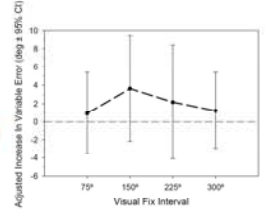
Experiment 3

No visual cues were present during testing. Brief (450 ms) glimpses of virtual room presented every 75°, 150°, 225°, or 300°

- Aims:** (1) If no visual information is available after rotation, can intermittent reminders during rotation be effective?
- (2) How frequently must reminders be displayed to be effective?

Results

Intermittent reminders were effective in some conditions at preserving pre-rotation levels of performance. Latency results suggest reminders were effective every 75°, but not when presented less frequently (error pattern similar, but high variability).



Conclusions

- Previous work indicated that people have both precise transient and coarse enduring spatial systems (e.g., Burgess, 2006), and switch readily between them with as little as 135° of blind rotation (Waller & Hodgson, 2006). The present experiments suggest...
 - (1) Simple visual-spatial information presented continuously during motion can prevent transient spatial knowledge from being disrupted.
 - (2) Rich visual information can re-establish precise transient spatial knowledge once it has been lost (e.g., after disorientation).
 - (3) Rich visual reminders during motion can be as effective as continuous information if presented before transient knowledge is disrupted.

References:

Burgess, N. (2006). Spatial memory: How egocentric and allocentric combine. *Trends in Cognitive Sciences*, 10, 551 – 557.
 Waller, D., & Hodgson, E. (2006). Transient and enduring spatial representations under disorientation and self-rotation. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 32, 867 – 882.
 Wang, R. F., & Spelke, E. S. (2000). Updating egocentric representations in human navigation. *Cognition*, 77, 215 – 250.
 Hodgson, E., Waller, D., Greenauer, N., & Mello, C. (2008, Nov.). Remaining oriented with abstract or intermittent visual information. Poster presented at the annual meeting of the Psychonomic Society, Chicago, IL, USA.