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Virtual Travel Does Not Enhance Spatial Working Memory For Landmark-Free Paths

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When people read driving directions (e.g. turn left and go one block, then turn right, etc.), they may attempt to visualize the route. But suppose the same route (without landmarks) is presented in a very different way -- by depicting first-person-perspective travel along the route using a virtual motion display. Would the resulting spatial representation be different? Does human spatial memory 'prefer' verbal description, or virtual motion? A case could be made for either method. Virtual motion provides a rich visual experience that verbal description lacks. This experience may leave a useful visual episodic memory trace. On the other hand, since virtual motion is an inherently visuospatial experience, it might interfere with visualizing a cognitive map of the path. We compared virtual motion and text description of 3D paths using a new technique, path visualization (PV). This technique forces people to use a visuospatial path representation, and measures its accuracy.

Method

Twelve paid participants were each given ten 30-trial PV sessions, five using text, and five using virtual motion. On each trial, a sequence of 15 path segments was presented (3 sec. each). For text, each segment was described in a phrase giving its egocentric direction and distance (e.g. 'Left 1'; all distances were 1). For virtual motion, each segment depicted a first-person, left or right turn-and-move. For both methods, the participant decided whether the endpoint of each new segment intersected with any previously presented part of the path, and responded yes or no with a keypress.

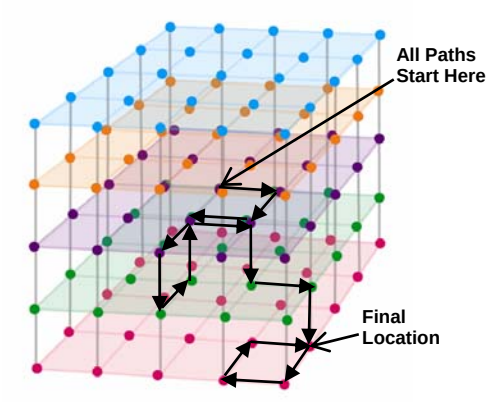

Figure 1: Depiction of a 3D path in an imaginary space.

Results and Conclusion

As predicted (Lyon, Gunzelmann & Gluck, 2006), intersection-detection accuracy declined steadily as memory load (length of prior path) increased. However accuracy for verbal description and virtual motion did not differ ($F(1,11)=0.16$, n.s.; Fig 2).

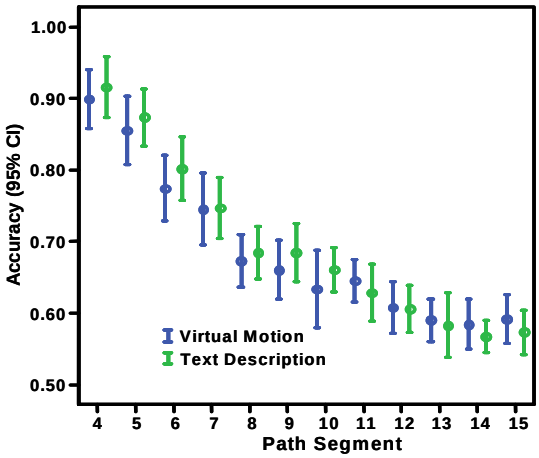

Figure 2. Visualization accuracy by path segment for virtual motion and text description conditions.

This result suggests that the ability to visualize a path within a 3D grid is not enhanced by simulating the experience of traveling along it. Virtual travel doubtless helps with other aspects of orientation (such as recognizing landmarks), but spatial working memory for the path itself is no better for virtual motion than for verbal description, when an appropriate verbal description exists.

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Reference

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