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Visualizing Egocentric vs. Exocentric Path Descriptions

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A path in space can be described from an external viewpoint as if viewing a map (exocentric description), or from the point of view of a traveler moving along the path (egocentric description). Which description is easier to visualize accurately?

In previous research (Lyon, Gunzelmann & Gluck, 2006) we developed an ACT-R model of human visualization capacity for complex, exocentrically-described spatial paths. According to this model, the capacity to visualize a complex exocentric path description is limited primarily by decay and spatial interference in an exocentric, map-like image constructed in visuospatial working memory. However when people must visualize a map-like image of the path given *egocentric* descriptors, we predict that visualization accuracy will be lower because additional cognitive processing will be required to convert the segment descriptions from egocentric to exocentric reference frames. Here we test this prediction by using a relatively new technique, path visualization (PV), which forces people to use a visuospatial representation of complex paths, and provides an objective measure of visualization accuracy (see Lyon et al., 2006).

Method

Thirteen paid participants were each given ten 30-trial PV sessions, five with exocentric path descriptions, and five with egocentric. On each trial, a sequence of 15 path segments was presented (2 sec. each). Each segment was described in a phrase giving its direction and distance (e.g. 'Left 1'; all distances were 1). In the exocentric condition, directions were relative to a fixed reference frame, so that 'Left' would always refer to the left of an imaginary 5 x 5 x 5 three-dimensional space within which the paths were generated. In the egocentric condition, directions were relative to the current facing of a hypothetical traveler on the path, so that if a traveler were facing the back of the space, a 'Left' segment would face the traveler toward the right of the space. In both conditions, the participant read each path segment description in turn, decided whether the endpoint of that segment intersected with any previously presented part of the path, and responded *yes* or *no* with a keypress. Half of the paths could wander randomly through three dimensions; the other half were 2D paths constrained to either a coronal, sagittal, or horizontal plane through the center of the space

Results and Conclusion

As predicted, paths described exocentrically were visualized more accurately than paths described egocentrically ($F(1,12)=18.5$, $p<0.001$; Fig. 1).

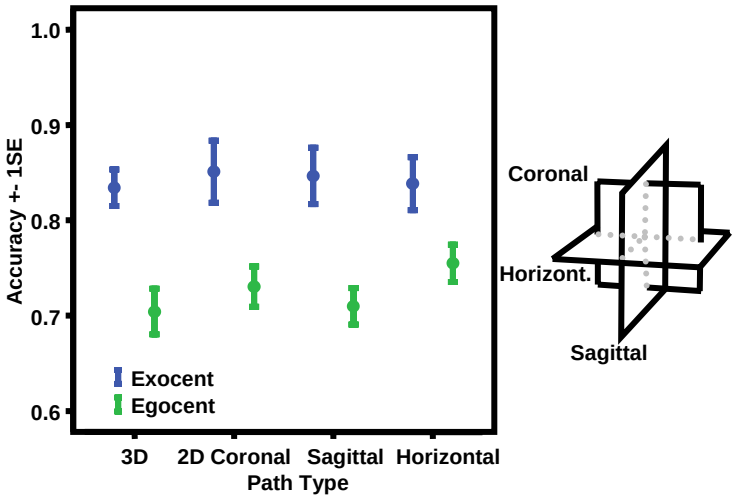

Figure 1. Visualization accuracy for exocentrically- and egocentrically-described 3D and 2D paths.

There was no overall effect of path type. However there was a significant interaction between path type and description type ($F(2,24)=8.90$, $p<0.001$), perhaps because visualizing horizontal-plane egocentric-described paths, (which only involve left and right turns) is somewhat easier than the other egocentric conditions (which require upward or downward rotations). Nevertheless, even horizontal-plane paths appear to benefit from exocentric description.

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Reference

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