

Acquisition of Route and Survey Spatial Knowledge in Transparent and Opaque Virtual  
Environments: Effects of Goals, Alignment, and Secondary Tasks

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Two experiments used opaque and transparent virtual environments to assess the emergence of route and survey spatial knowledge. Experiment 1 examined how route and survey goals modified spatial knowledge acquisition on route and survey tasks. In addition, it assessed the role of egocentric and exocentric viewpoints in the environments on learning. Experiment 2 used secondary tasks to examine the relative role of categorical (route) and coordinate (survey) knowledge acquisition. Both experiments showed more rapid learning of survey knowledge in a transparent than in an opaque environment, and quality of map drawings indicated that transparency led to a more integrated spatial mental model than did opaque navigational learning. Furthermore, both experiments indicated the presence of both exocentric and egocentric properties in the development of a spatial mental model. Exocentric viewpoints aligned with the main building axis produced the greatest performance on an object location task. However, this benefit developed over experimental trials, suggesting that an exocentric reference frame required a period of time to develop. Route and survey goals crossed with transparent and opaque learning environments indicated a route goal benefited transparent learning on a route distance estimation task, but that a survey goal did not benefit opaque learning on a straight-line distance estimation task. Experiment 2 crossed categorical and coordinate based secondary tasks with transparent and opaque learning. Greater interference was

produced by the categorical task – indicating that a strong route-based component was present for navigational learning in both transparent and opaque environments. Results are discussed within a framework of spatial learning that accounts for dual encoding strategies and spatial representations, and argues against a strictly sequential model of spatial knowledge acquisition.