

The Role of Body-based Cues in Navigation and Environmental Learning

Jack Loomis

University of California, Santa Barbara

Sarah Chance, Roberta Klatzky, Andrew Beall and I, along with other colleagues, have done research at UCSB on a form of navigation called path integration (or spatial updating). This refers to keeping track of one's position and orientation with respect to the environment by integrating one's sensed self-movement. Much of this research has used immersive virtual reality to investigate the contribution of optic flow to path integration. We have found in a number of experiments that for small scale environments and over short time scales, body-based cues (proprioceptive and vestibular signals) play an important role in path integration. Several of our experiments indicate that inertial cues alone (e.g., vestibular signals) do provide useful information about self-motion and contribute to path integration, but proprioceptive cues (from movement of the limbs and efference copy of commands to the musculature) are probably much more important. This work also indicates that optic flow is a relatively weak input to path integration.

David Waller, Sibylle Steck, Daniel Haun, and I have done other research looking at the role of body-based cues in environmental learning (learning the spatial layout of a small number of visible landmarks) along a route traveled by car or on foot. The spatial and temporal scales are much larger than in our studies on path integration. In addition, visual information is not restricted to optic flow, for local landmarks and other environmental features are visible. The experiment on environmental learning while traveling by car (Waller, Loomis, & Steck, in press) showed that inertial cues did not contribute to environmental learning. The experiment on environmental learning while traveling on foot (Waller, Loomis, & Haun, in press) showed that body-based cues (proprioceptive and inertial cues) did facilitate environmental learning slightly.

I will briefly present some of the major experiments and their results. I will then discuss some of the reasons that body-based cues might be more important for path integration than they seem to be for environmental learning. I will also discuss the implication of this research for using virtual reality as a tool for studying environmental learning.

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