**Incomplete Compensation for Self-Motion in the Visual Perception of Object Velocity During a Visual-Vestibular Conflict**

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When observing a moving target while an observer is moving, a given retinal speed can potentially correspond to many vastly different physical object velocities. When an observer moves in the same direction as a target, the retinal speed corresponding to the object is partially cancelled out, and vice-versa when moving in the opposite direction. Observers thus must compensate for their own movement when estimating an object’s velocity. Observer’s speed estimates may be facilitated when visual and vestibular cues are congruent. When self-motion is experienced only visually, compensation may be incomplete, leading to biases in perceived object speed (Hypothesis 1). Self-motion information is noisier than retinal information, especially without vestibular cues. Subtracting noisy self-motion information from retinal motion should thus decrease precision (Hypothesis 2). To test these hypotheses, we presented two motion intervals in a 3D virtual environment and asked participants which motion was faster. In one interval a target moved linearly to the left or right in the fronto-parallel plane during which the observer may or not experience simulated self-motion, and in the other a cloud of ­smaller targets travelled in the same direction. The single target moved at constant speed (6.6 or 8m/s, 6m from the observer), while a PEST staircase controlled the cloud’s speed. In support of Hypothesis 1, we found differences in accuracy between static, congruent and incongruent motion, indicating inadequate compensation for observer motion. Self-motion during target motion decreased precision compared to a static condition in support of Hypothesis 2. Further research is necessary to determine how the availability of vestibular cues can remedy accuracy or precision loss during self-motion.

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