

Simulated travelled distance in an immersive virtual environment is better estimated when adding biological oscillations to the optical flow

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Distance estimation from visually simulated self-motion is imprecise. Depending on the evaluation method, travelled distance can be under- or over-estimated. One particular method consists of asking a stationary observer, exposed to an immersive optical flow, simulating forward self-motion, to indicate when s/he thinks s/he has reached the remembered position of a previously seen distant target. In this case, subjective evaluation of travelled distance is generally overestimated (i.e., the subject undershoots the target). Recent studies suggest that a translational optical flow with biological additional oscillations (simulating the optical effects of natural locomotion) would increase the sensation of walking and improve spatial perception, as compared to a purely translational optical flow. In the present study we tested this hypothesis, by measuring travelled distance estimation, according to two conditions of visual simulation of forward self-motion, at constant speed, in a CAVE setup: (1) an optical flow simulating pure forward translation (2) an optical flow with added “biological” oscillations, reproducing the optical effects of the natural motion of the head during walking. Our results show that an optical flow containing additional biological information enhances the accuracy of travelled distance estimation. The perceptual advantage provided by the biological oscillations in the optical flow is discussed.

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