(21) Circular vection is facilitated by a consistent photorealistic scene

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Abstract

It is well known that large visual stimuli that move in a uniform manner can induce illusory sensations of self-motion in stationary observers. This perceptual phenomenon is commonly referred to as vection. The prevailing notion of vection is that the illusion arises from bottom-up perceptual processes and that it mainly depends on physical parameters of the visual stimulus (e.g., contrast, spatial frequency etc.). In our study, we investigated whether vection can also be influenced by top-down processes: We tested whether a photorealistic image of a real scene that contains consistent spatial information about pictorial depth and scene layout (e.g., linear perspective, relative size, texture gradients etc.) can induce vection more easily than a comparable stimulus with the same image statistics where information about relative depth and scene layout has been removed. This was done by randomly shuffling image parts in a mosaic-like manner. The underlying idea is that the consistent photorealistic scene might facilitate vection by providing the observers with a convincing mental reference frame for the simulated environment so that they can feel "spatially present" in that scene. That is, the better observers accept this virtual scene instead of their physical surrounding - i.e., the simulation setup - as the primary reference frame, the less conflict between the two competing reference frames should arise and therefore spatial presence and ego-motion perception in the virtual scene should be enhanced. In a psychophysical experiment with 18 observers, we measured vection onset times and convincingness ratings of sensed ego-rotations for both visual stimuli. Our results confirm the hypothesis that cognitive top-down processes can influence vection: On average,we found 50% shorter vection onset times and 30% higher convincingness ratings of vection for the consistent scene. This finding suggests that spatial presence and ego-motion perception are closely related to one another. The results are relevant both for the theory of ego-motion perception and for ego-motion simulation applications in Virtual Reality.

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