Poster: Subjective time dilation in optic flow: effects of visual gravity and motion speed on duration estimation

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Abstract

Neuroimaging studies suggest overlapping neural mechanisms for processing time and motion, pointing to a potential interconnection between psychological representations of space and time. Prior research has shown that increasing perceived velocity can lead to subjective time dilation—an expansion of perceived duration. Building on this, Conway et al. (2016) proposed a psychological spacetime framework, suggesting that subjective time dilation may function as a perceptual analogue to relativistic effects in physics, wherein higher velocity or gravitational fields slow the passage of time. In this study, we investigated whether visual cues mimicking gravitational acceleration—operationalised as linearly accelerating radial optic flow—would similarly modulate subjective time perception. We hypothesised that stronger visual acceleration would increase perceived duration. Thirty-six adults (M_age = 32.67 years, SD = 11.14) viewed animations of forward-motion radial optic flow under varying levels of simulated gravitational acceleration (1g, 2g, 3g) and constant linear optic flow velocities (9.8, 19.6, 29.4 m/s), across durations of 500, 1000, 2000, and 3000 ms. Participants reproduced each duration following stimulus presentation. Results revealed robust effects of both visual acceleration and velocity on reproduced durations: higher levels of acceleration and faster speeds significantly increased subjective duration estimates ($p < .001$; partial $\eta^2 = .73$ and .67, respectively), with effects magnified at longer durations ($p < .001$, $\eta^2 = .57$ and $p = .007$, $\eta^2 = .20$, respectively).These findings provide strong empirical support for the psychological spacetime framework and demonstrate that visual simulations of gravitational-like acceleration can influence subjective time perception

Keywords

Optic flow, Time dilation