Simulated Gravitational Physics Shapes Time Perception in Virtual Reality

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In this study, we investigate how simulated gravitational conditions affect time perception within a virtual reality environment. Using a within-subjects design, we developed a virtual reality task in which participants actively and passively experienced Earth’ s gravity, microgravity, and hypergravity. Thirty-seven healthy young adults participated in the experiment, which involved performing a motor action and place a virtual sphere into a chamber while judging whether auditory tones were shorter or longer than a baseline duration under each gravity condition. The results reveal that microgravity significantly distorted time perception, leading to increased perceptual bias and decreased temporal sensitivity. In contrast, hypergravity produced minimal distortion and, in some cases, improved temporal discrimination. These findings support the hypothesis that gravity-related bodily cues influence the perception of time and underscore the utility of VR as a potential tool for cognitive and perceptual research. Though future studies using possibly more realistic virtual environments are also required to substantiate these effects. The implications of this work extend to understanding human perception in altered gravity environments, optimizing performance in space missions, and expanding the role of virtual reality in gravity-based experimentation.

Keywords: Time Perception, Gravitational Physics, Virtual Reality, Tempo Discrimination, Perceptual Bias