

## **LUMINOUS DANCING FAIRIES IN WEIGHTLESSNESS: HOW GRAVITY SHAPES CONSCIOUS EXPERIENCES**

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**Background:** Gravity is one of the pivotal aspects of human life. On Earth, gravity is always there: it is stable, it is permanent, it is unchanging. The vestibular otoliths – sophisticated receptors inside the inner ear – constantly detect the magnitude and direction of gravitational acceleration. Gravity is therefore the most persistent sensory signal in the brain. Since the early Apollo missions, astronauts reported regular flashes or streaks of light that seemed to come out of nowhere, depersonalisation/derealisation sensations and alterations in the state of consciousness. Weightlessness-Induced Psychotic-Like Experiences (WIPLs) may be caused by a mismatch between the information signalled by the vestibular receptors and our lifelong experience with the terrestrial gravity prior. When such conflict occurs, the boundary between “reality” and “unreality” fades away. This process could explain the well-known, but poorly understood, psychiatric phenomena in astronauts.

**Aims:** In this study, we investigated WIPLs for the first time in controlled laboratory conditions. Specifically, we were interested in understanding how gravity serves as a reference point for anchoring organisms to the physical world.

**Method:** Visually Evoked Auditory Responses (vEAR) refer to illusory phenomena wherein silent visual stimuli trigger an auditory sensation. In this study, 26 participants (Age:  $M \pm SD = 25.54 \pm 6.84$ ) were asked to rate the strength of the auditory sensations triggered by 20 video sequences and 20 static images. Each stimulus was presented for 10 seconds at the center of a screen within an occluded visual field. To investigate whether the intensity of vEAR increases during alterations in gravity, we artificially simulated changes in gravity in a controlled lab setting using stochastic Galvanic Vestibular Stimulation (sGVS). The sGVS was administered through an alternating sum-of-sines voltage waveform with frequencies at 0.16, 0.32, 0.43, and 0.61Hz, applied to the mastoids. Sham stimulation was used to control for non-specific effects.

**Preliminary results:** The intensity of Visually Evoked Auditory Responses exhibited a significant increase during alterations of gravity. Specifically, sGVS enhanced the strength of visually evoked sounds in both vEAR videos and frames. These findings provide support for changes in cortical excitability in altered gravity conditions.

**Keywords:** Gravity, Vestibular system, Hallucinations, Consciousness

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