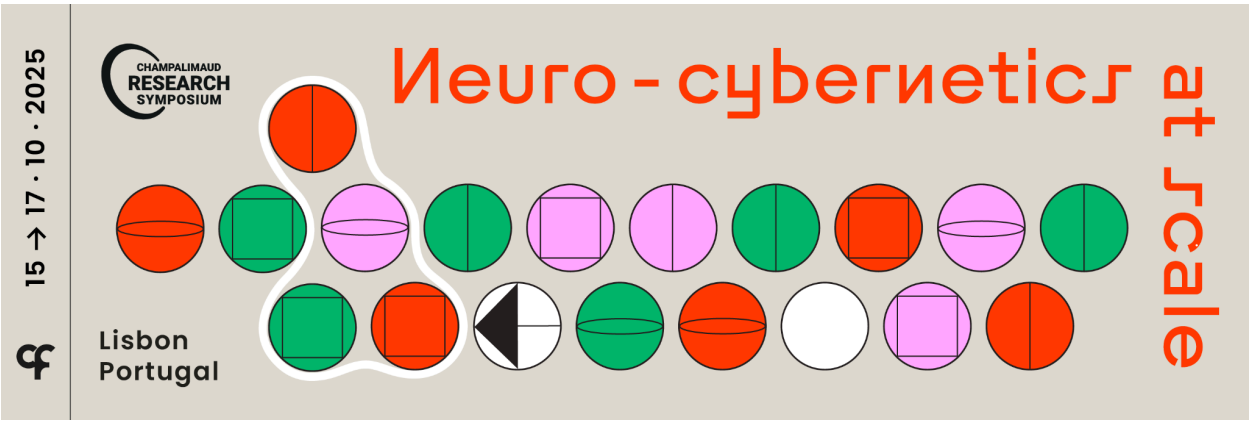

Hallucination of visual instability is promoted by psychedelics and suppressed by gaze shifts

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Substances such as LSD and psilocybin, known as classical psychedelics, cause profound alterations in consciousness, including various alterations in visual experience [1]. Psychophysical analysis of these visual effects could help clarify how psychedelics alter brain function. A key aspect of vision is the interplay between foveal and peripheral processing, orchestrated by saccadic movements and fixations through which visual scenes are constructed [2,3].

In this study, we investigated a visual effect anecdotally reported under psychedelic: the perception of stationary surfaces as unstable, dynamically warping, or drifting [4]. Participants viewed projected still images of natural textures (e.g., grass, gravel) and reported perceived motion. Gaze trajectory was recorded using a wearable eye-tracker [5,6]. Importantly, on half the trials, a fixation cross instructed subjects to hold their gaze steady. Subjects (n = 45) were recruited and tested in a natural environment in which psychedelic use is common, under a protocol approved by our institutional ethics committee. Texture instability was reported markedly more often in the fixation condition, and this effect was stronger in subjects reporting recent use of a classical psychedelic.

The dependence of visual instability on gaze behaviour lends support to enactive sensorimotor theories of visual perception that hypothesize “hallucinations” arise when active exploration of a scene is reduced [7]. Notably, reports of movement without psychedelics [8,9] suggest that psychedelic visual effects do not necessarily require abnormal cortical processing but may arise from attending to normally unattended features of visual processing in embodied sensorimotor loops. These results lend support to the use of visual psychophysics to reveal general principles of psychedelic effects on perception in relation to normal brain function.

simple visual hallucinations, gaze behavior, eye-tracking, psychedelic, attention