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Effects of gravitational and optical stimulation on the perception of target elevation.

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To examine the combined effects of gravitational and optical stimulation on perceived target elevation, we independently altered gravitational-inertial force and both the orientation and the structure of a background visual array. While being exposed to 1.0, 1.5, or 2.0 Gz in the human centrifuge at NASA Ames Research Center, observers attempted to set a target to the apparent horizon. The target was viewed against the far wall of a box that was pitched at various angles. The box was brightly illuminated, had only its interior edges dimly illuminated, or was kept dark. Observers lowered their target settings as Gz was increased; this effect was weakened when the box was illuminated. Also, when the box was visible, settings were displaced in the same direction as that in which the box was pitched. We attribute our results to the combined influence of otolith-oculomotor mechanisms that underlie the elevator illusion and visual-oculomotor mechanisms (optostatic responses) that underlie the perceptual effects of viewing pitched visual arrays.