

Judgements of Eye Level in outdoor scenes

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Abstract

Illusions of apparent pitch and height in undulating scenery imply changes in visually perceived eye level (VPEL). Measurements of VPEL on level ground showed a small positive error, and no effect of viewing distance. In varied terrain VPEL was biased towards the dominant ground pitch. Downhill frontal slopes of 15 deg were less effective than shallower slopes. Views from a height raised VPEL by 0.4-0.7 deg compared to ground views. Most errors are explained by the dominant perspective of the foreground.

Introduction

Illusions of apparent pitch and height are often reported in mountainous scenery, implying changes in visually perceived eye level (VPEL). Such illusions can affect decisions when driving, flying or skiing, and may contribute to accidents. The early perceptual literature is reviewed by Howard and Templeton (1966), and some outdoor findings are described by Ross (1974, 1994). Recent laboratory studies show that VPEL is determined about equally by proprioceptive factors and by the slope of the visual scene. The optical or perspective tilt of the display is more influential than the perceived pitch (Li & Matin, 1998). Laboratory studies using pitch rooms fail to replicate complex outdoor scenes, so we conducted some experiments in natural environments.

Experiments

We measured VPEL in various environments. Experiment 1 was conducted on level ground (an indoor corridor and an outdoor playing field at the University of Stirling), using an adjustment method on a target at three distances (15, 30 or 45 m). 96 observers took part in one condition each. The results showed a mean VPEL of + 0.05 deg, with no significant effect of viewing distance or of locations. Large illusions are therefore not caused by a baseline bias or by extended viewing distances.

Experiment 2 was conducted in varied terrain in the city of Dunedin, New Zealand. 36 observers marked the judged location of VPEL over copies of photographs of the scene they were viewing. The results showed that VPEL followed the dominant pitch