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Lightness constancy in reality, in virtual reality, and on flat-panel displays

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Abstract

Virtual reality (VR) technology is being used in an increasing number of applications, but we sometimes perceive surface properties differently in real and virtual environments. To evaluate how well virtual platforms support realistic lightness perception, we measured lightness constancy for 12 observers in three conditions - in a physical scene, in VR, and on a 2D flat-panel display. Observers performed a lightness matching task where they adjusted the match patch until it appeared to be the same shade of gray color as a reference patch. We found significantly greater Thouless ratios in the physical condition (mean \pm 95% confidence interval: 0.87 \pm 0.04) than in the flat-panel condition (0.79 \pm 0.08). However, lightness constancy levels were not significantly different in the VR condition (0.83 \pm 0.08) than in the physical condition or the flat-panel condition. Our results suggest that VR can be a flexible alternative to flat panel displays and a reasonable proxy for real environments.