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

Khushbu Patel
York University, Toronto, Ontario, Canada

Laurie Wilcox
York University, Toronto, Ontario, Canada

Laurence Maloney
New York University, New York, New York, United States

Krista Ehinger
The University of Melbourne, Melbourne, Australia

Jaykishan Patel
York University, Toronto, Ontario, Canada

Emma Wiedenmann
York University, Toronto, Ontario, Canada

Richard Murray
York University, Toronto, Ontario, Canada

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±95% confidence interval: 0.87±0.04) than in the flat-panel condition (0.79±0.08). However, lightness constancy levels were not significantly different in the VR condition (0.83±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.

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