ABSTRACT

Human colour perception - A psychophysical study of human colour perception for real and computer-simulated two-dimensional and three-dimensional objects

Monika Hedrich

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The human visual system achieves colour constancy due to the interaction of several mechanisms and cues that provide information about the illuminant in the observed scene. Previous studies often investigated the influence of specific cues or mechanisms, however, nobody has actually compared observers' performance for a cue-poor and a cue-rich stimulus configurations directly. The hypothesis was that, if illuminant cues play an important role in achieving colour constancy, then observers' performance should be better when colours are learned as part of a cue-rich (three-dimensional) than a cue-poor (two-dimensional) setup.

In vision research it is common practice to use computer-generated and displayed stimuli instead of real ones. The present study also aims to investigate whether this substitution is valid by comparing observers' performance for real and computer-simulated stimuli. Therefore, a series of colour memory, colour constancy and colour categorisation experiments is conducted.

A set of 2D and 3D stimuli was created by using exclusively real coloured surfaces and lights, which were used throughout the study. Four different lights, mimicking phases of daylight, tungsten light and a highly artificial looking light were used. Exactly the same stimuli and lights were then replicated using computer rendering and displayed on a monitor.

It was found that that colour constancy was better when colours were learned as part of a cue-rich 3D scene than in a 2D setup. The comparison of observers' performance for real and displayed stimuli revealed similar behaviour for both presentation media for the colour memory and colour categorisation but not for colour constancy experiments. This last finding was likely due to non-identical viewing conditions under which both kinds of stimuli were presented.