

Yellow lessens discomfort glare: physiological mechanism(s)

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Abstract

A long standing mystery is the improved visibility people report with yellow glasses. Car drivers and pilots claim reduced discomfort of oncoming head lamps at night and the blue sky during the day respectively. While people clearly benefit, scientists have not been able to pin down the causal mechanism(s). Several hypotheses have been proposed regarding the physiological origin of this “blue sensitivity” including scotopic (rod) response, excessive iris contraction, blue (S) cone response, brightness perception, and circadian receptor response. These hypotheses were compared by measuring the discomfort glare to four lights differing in their spectra. The results show that more S-cone stimulation corresponds to more discomfort, while more rod stimulation does not. This is consistent but does not prove a causal relation between the S-cones and discomfort glare and it is not consistent with a major role for either the pupillary constriction hypothesis or the circadian photoreceptor. The modified spectral efficiency function $V_m(\lambda)$ and large field photopic spectral sensitivity $V_{10}(\lambda)$ do not significantly change these conclusions based on the standard $V(\lambda)$. The present study has therefore been successful in eliminating several physiological mechanisms of discomfort glare, leaving the S-cones as the primary candidate.

Introduction

There is a long standing paradox regarding the effects of yellow filtering on the sensation of glare. On the one hand scientists claim it has no objective positive effect, on the other hand users claim to benefit. The USAF and many other air forces have decided to limit the use of yellow visors because of the reduction in colour vision (Young et al., 2000). This, while scientifically defensible, leaves the user with an unsatisfied feeling because an apparently good thing (a yellow filter) is not allowed. Kooi and De Vries (2002) have shown that a yellow filter does not have a positive effect on any objective measure like visual acuity or contrast sensitivity, but does turn out to greatly reduce the so-called discomfort glare. Clearly the blue part of the spectrum is disproportionately important in causing the sensation of visual discomfort.