Filters and Shooting Sport Optics

General Comments

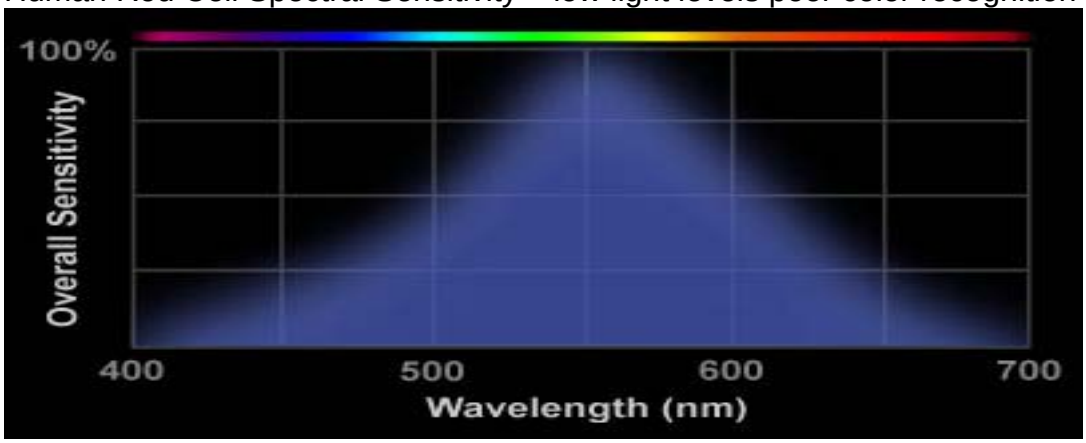
Filters have a long history of use in both photography and astronomy. They are used primarily to enhance the image as viewed by the human eye or as captured on film that has similar response to the human visual system. Modern digital imaging devices have spectral response characteristics quite different than the human so require very different filters to produce similar results.

Shooting sport optics devises are almost always used for direct human visual observation. Therefore, an understanding of human visual response is needed to understand the effects of filters on the perceived image.

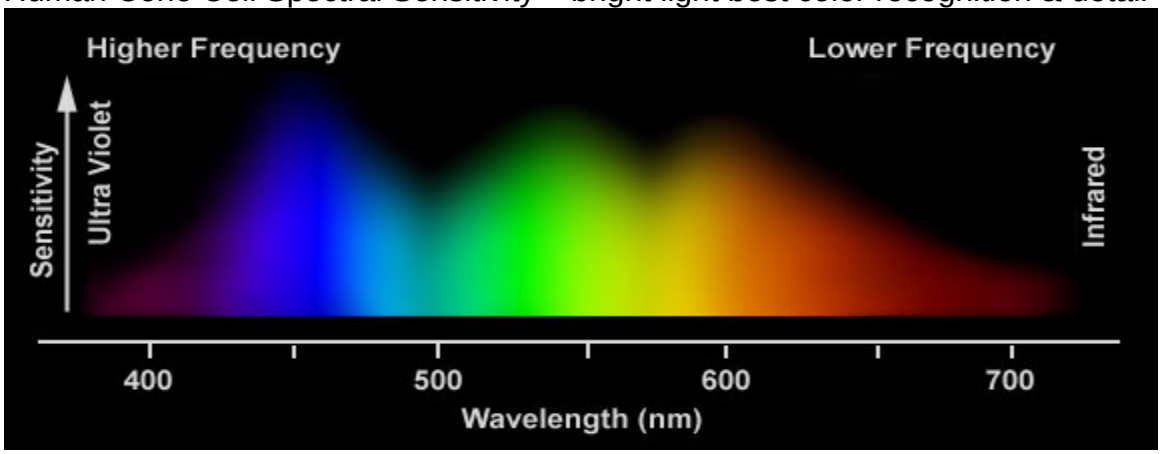
All humans have some variance in visual response (particularly color response). In the following sections the illustrations of relative response are for the average or so called “normal” human response.

Human Visual Response

Human Rod Cell Spectral Sensitivity – low light levels poor color recognition



Human Cone Cell Spectral Sensitivity – bright light best color recognition & detail



Color Filters

Typical Color Filter Set

The above illustration is for the type of color filters used in astronomy for planetary observation and often for film photography. The light blue, light yellow and bronze are very similar to those offered in the Leupold Alumina Intensifier Kit.

Possible beneficial uses:

- Yellow – contrast enhancement by reducing the blue (<450nm) haze commonly caused by reflections off water vapor.
- Bronze – contrast enhancement by reducing the mixed (<600nm) reflections from particulates in polluted air and smog.
- Blue – reducing the strong emission known as air glow (558nm) under very bright high temperature conditions.

Detrimental effects:

- All filters work by reducing the transmission of some range of light wavelengths that in part includes light that is reflected from the target. This alone can negate any perceived contrast enhancement of the overall field of view.
- Because of variations in individual visual spectral response, the effects of using filters vary greatly among users. Note that persons that have significant color blindness (general or specific color bands) can even experience visual disorientation by using color filters.
- The effectiveness of filter use varies greatly with the atmospheric conditions including temperature, pollutant content (concentration and types of particulates) and sunlight (brightness and angle).

Fred Bohl – 9/1/2007

Polarizing Filters

Unlike color filters, polarizing filters are not wavelength dependent over the visual spectrum but instead work by excluding light transmission except for a narrow angular orientation (aka – polarization).

Possible beneficial uses:

- Glare reduction from sky glow (particularly hazy sky behind target).
- Glare reduction from specular sources such as foliage and water.
- A form of mirage known as glitter or shimmer most common with sun angles from the sides or near overhead can be significantly reduced.

Detrimental effects:

- A single linear polarizer typically transmits only 30 to 40% of the incident light. This alone can negate any perceived benefit of glare reduction except under extreme conditions.
- Glare reduction is most at about 90 degrees from the sun angle and least at sun angles from behind the shooter.

Protective Filters

UV – Ultra violet (<400nm) is potentially dangerous to the human eye and UV protection is normally included in the supplied lens coating.

IR – Infra red (>700) causes heating of components but is not normally dangerous and is also not normally filtered.

UV-IR Block – For use with digital imagining devises which are sensitive to both, should be used if not provided with the imaging devise. If uncertain add as double filtering is even better.

Lumicon UV-IR Block Filter Characteristic