Avoiding Glare

“Glare”, like “noise” is a term that is difficult to define, but we know it when we see it. It refers to unwanted light in the same way that noise is unwanted sound.

Glare produced by lighting has been classified into two types—as “discomfort glare” and as (more severe) “disability glare”. Both of these have consequences in terms of task performance, as described in the Health & Performance section. Both types of glare are caused by a source being much brighter than the background against which it is viewed, and are affected by the size, shape and position of the source, as well as by its brightness.

Glare is usually avoided by restricting the angles at which a light source can emit light, so that the light does not shine into people’s eyes from normal directions of view. Glare can also be avoided by providing a brighter background against which to view the source (as with indirect lighting of offices). Simply reducing the brightness (luminance) of all the sources is often not very effective in reducing glare, because this also reduces the luminance of the background against which the glare source is seen and, as the eye adapts to the new lower light level, each source is still just as bright as it was before.

People’s sensitivity to glare varies very widely—one person’s “glow” or “sparkle” can be another person’s glare. So in “owned” spaces (those in which people feel empowered to control their lighting) it is important to provide people with a means of reducing glare. This can be done by dimming or re-aiming luminaires, or by providing additional background light.

Disability Glare

Disability glare is caused by the cornea and lens of the eye scattering light inside the eye. This produces a “veiling luminance” across the retinal image that reduces its luminance contrast.
Disability glare is usually created by one or two very bright light sources in an otherwise dark environment, such as outdoor floodlights, oncoming car headlights, or one bright window in a darkened room. thereby making it difficult to see details. Disability glare is usually created by one or two very bright light sources in an otherwise dark environment, such as outdoor floodlights, oncoming car headlights, or one bright window in a darkened room. Disability glare becomes more likely with age, as the number and size of scattering centers in the eye increase.

Disability glare is not commonly quantified by designers, but is the basis for restrictions on the luminous intensity distribution of road lighting and car headlights. There are several formulae for disability glare, but they all take the same basic form of a rapid increase in glare as the source approaches the line of sight. The equation below shows the “Stiles-Holladay” form of disability glare equations, to give the reader an understanding of how disability glare is calculated. For detailed information see Gibbons (2007) and Vos (2003a). The formula calculates an equivalent veiling luminance due to the glare source, which is then added to the luminance of the viewed object and its background, the result being a reduction in luminance contrasts across the retinal image. Note that the formula becomes undefined at very small angles, and researchers have proposed various methods to handle angular dependence, along with other factors such as age and eye pigmentation (Vos 2003b).

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Stiles-Holladay Disability Glare Equation

\[ L_{seq} = \frac{kE_{gl}}{\Theta^n} \]

Where:

- \( L_{seq} \) = Equivalent veiling luminance due to scatter (cd/sqm)
- \( k \) = A multiplier that varies with the age of the observer
- \( E_{gl} \) = Illuminance at the eye from the glare source (lx)
- \( \Theta \) = Angle between the glare source and the line of sight (degrees)
- \( n \) = an exponent that varies with angle