Determination of veiling luminance for peripheral visual objects under mesopic vision

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1. Experimental approach

The evaluation of road and automotive lighting in different lit scenes is part of the standard road safety assessment (e.g. EN 13201-2). Disability glare, which is a consequence of intraocular scattered light induced by the light of glare sources in the field of view, is an important and safety-relevant evaluation parameter for road lighting luminaires. It can be described as an equivalent veiling luminance [1] laying over the whole retina, which adds to the retinal light level and reduces contrast of the retinal image. The foveal equivalent veiling luminance can be calculated with the CIE General Disability Glare Equation [2], but it refers only on targets in the line of sight. Peripheral targets, e.g. dark-clad pedestrians on the sidewalk, are not taken into account in the equations for foveal vision. So the main aim of this investigation is to define a disability glare equation for peripheral vision by determining the equivalent veiling luminance for glare sources in defined positions using psychophysical methods.

A method to estimate the equivalent veiling luminance caused by glare sources is the direct compensation method introduced by van den Berg and Spekreijse 1987 [3]. The presentation of a flickering glare source in the field of view causes a flickering straylight on the retina. It is the result of intraocular light scattering. The flicker is perceived in a foveal test spot position. It can be compensated by adjusting the luminance of the test spot, flickering in counterphase with the glare source, until the flicker perception vanishes. Thus the test spot luminance is equal to the equivalent veiling luminance of the scattered light as a function of the visual angle between glare source and test spot and of the test spot's retinal position.

2. Initial set-up

The experiments will use the direct compensation method in a set-up following the investigations of Uchida and Ohno [4, 5]. The subjects will be placed in front of a liquid crystal display (LCD, Fig.) with their head fixed by a chin rest. The LCD will have a constant adaptation background luminance, so that the subject will reach a defined (mesopic) adaptation state. On the display a central fixation point and a peripheral flickering target will be presented. The target luminance can be adjusted by the subjects via a control dial. A white, moveable LED point source acts as the source of glare in the field of view.

The target luminances marking the extinction of the flicker perception at the target, will be monitored by a computer. Detection thresholds are calculated automatically.

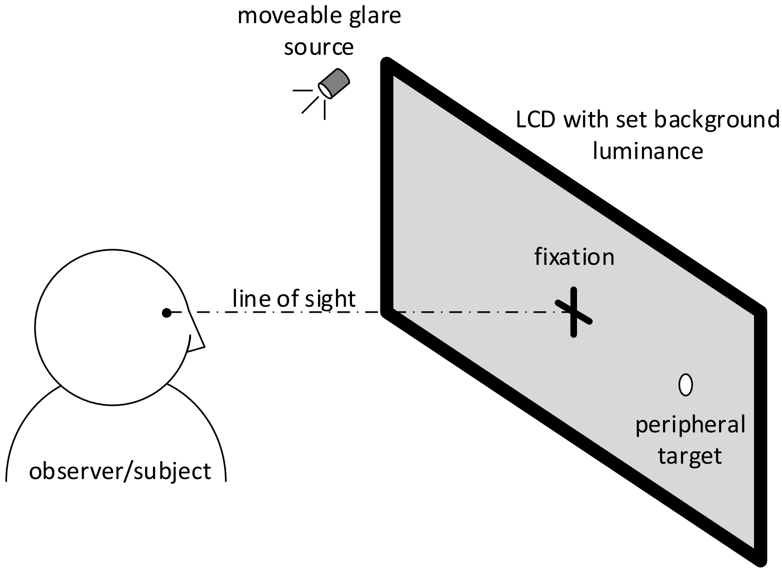

Fig.: Initial set-up of the direct compensation method for a peripheral target position

3. Further research

The final experimental set-up will further be examined. An eye tracking system should be implemented for controlling the subject's eye movements during the trial. Moreover an appropriate adaptation background luminance has to be selected by defining an adaptation state and an adaptation field which is comparable with the situation during nighttime driving. More literature research has to follow to estimate influence of target size, age and pigmentation for peripheral detection tasks.

References

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