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Measuring the Brightness of the Retinal Reflex to Study the Accommodative Response of Stimuli with Various Spectral Distribution

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It is known that that the retinal brightness depends on the refractive state of an eye. Therefore, the retinal brightness is a function of the accommodative state of an eye. Infrared photorefraction method [1] measures the intensity gradient across the pupil of an eye. In this study, we describe a method using the brightness of the retinal reflex to measure the accommodative response.

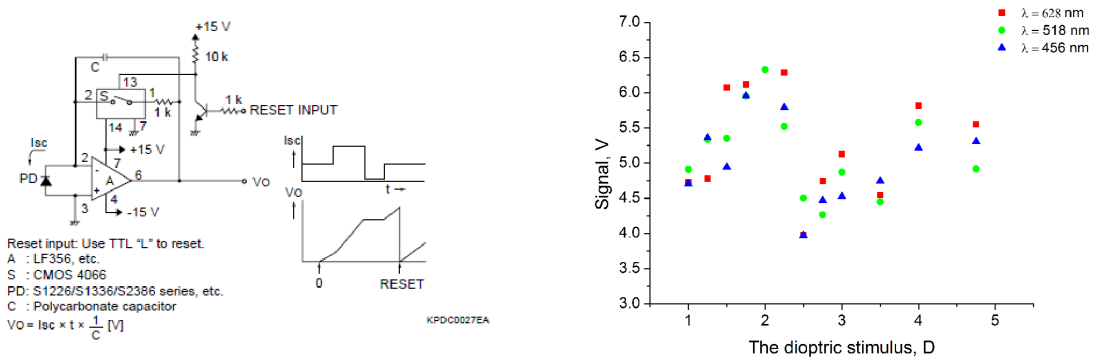

Fig.1 Left - the electronic circuit of the light integrator. Right - the accommodative response to stimuli in three primary colors.

As the retina reflects only 4 % of the incident light we designed a light integrator [2] to measure the light reflected from the retina. The light integrator is schematically shown in Figure 1 (left). A light coming out of an eye falls onto a photodiode charging a capacitor. The used integration time is 60 [ms].

Initial results show that there are differences in response to accommodative stimuli in three primary colors (see Figure 1 right). The value of the dioptric stimulus corresponding to the peak in the response may be somewhat shifted for stimuli of different colors. This difference may be due to chromatic aberration in the human eye equal to about 1.5 [D].

Acknowledgment

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Adaption of Liquid Crystal Shutters for Infrared Binocular Eye Pupil Tracking

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Eye pupil is a relatively slow acting system, which is a part of neural system and can be used as indicator of neural load and visual fatigue. To study the eye pupil cooperation we developed the system incorporating high frame rate CCD equipped with IR band pass filter and narrow angle optical objective. Band pass filter is chosen to transmit the light other 850 nm wavelength. The sensitivity of CCD to infrared illumination is shown in fig1. Our system consists of two capturing cameras for each eye and electronic ferroelectric shutters [1], which separate the stimuli for each eye. Studying illumination influence on visual fatigue it is prevalent to block the specific spectral signal by shutter, in cases then cannot control directly. Liquid crystal shutter holds also beneficial light polarization properties. Signal separation allows tracking the eye pupil latencies in fellow eye while stimulating other. Real time tracking and analysis of pupil parameters is provided to reduce the amount of data.

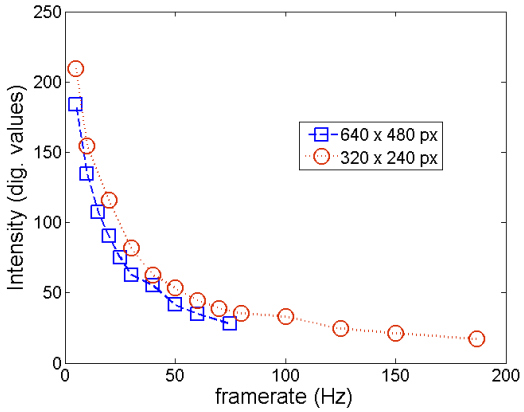

Fig.1 Sensitivity of IR band pass filter equipped camera to infrared (850 nm) light source.

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