These findings show that during co-contraction (condition III) disynaptic RI is decreased, in agreement with Nielsen & Kagamihara (1992). They also show that presynaptic RI is reduced. The RI decrease is even more pronounced during the electromyographic silent period (condition IV) obtained by inhibiting the motor cortex. We speculate that the central command for RI reduction during co-contraction is uncoupled from the activity of the motor cortex because it sets the spinal machinery for co-contraction even while the motor cortex is silenced. The reduction of the H reflex size during the silent period would suggest that the decreased RI could be associated with a reduced afferent input to the spinal cord arising from presynaptic inhibition of muscle afferents.

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A signal cancellation technique for the study of the transient pupillary light reflex

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The input to the pupillomotor system is thought to be organized into phasic and tonic pathways and the response of the pupil into transient and sustained components. We have used a method of signal cancellation to measure the relative potency of various stimuli as inputs to the transient response. Two non-overlapping circular stimuli, each with a diameter of 0·77 deg, are presented to the subject in maxwellian view. The consensual pupillary light response is measured with a PM-SCAN pupillometer. During the experiment the subject fixates the centre of one of these stimuli, the reference. The stimuli are sinusoidally modulated in intensity and are in antiphase. The frequency of modulation for most of the experimental conditions was 2·6 Hz. This frequency is high enough to isolate the transient component of the pupillary light response whilst still giving a measurable pupillary response, a factor of 10 greater than the amplitude resolution of the pupillometer. Amplitude is measured at the fundamental frequency using a Fast Fourier Transform. The reference stimulus is fixed in intensity and modulation depth throughout the experiment. The intensity of the other stimulus is varied so as to establish the response null at which the transient component of the pupillary light response is minimized. The luminance of this stimulus required for a response null indicates the potency of the stimulus.

The variation of responsivity of the transient component of the pupillary light response with stimulus eccentricity was investigated over the central 12 deg. This function is conical and is centred at the foveola. The potency of a stimulus decreases as eccentricity is increased. Reducing the stimulation frequency to 1·0 or 0·7 Hz results in a flattening of the function. This shows that the function is specific to the transient response.

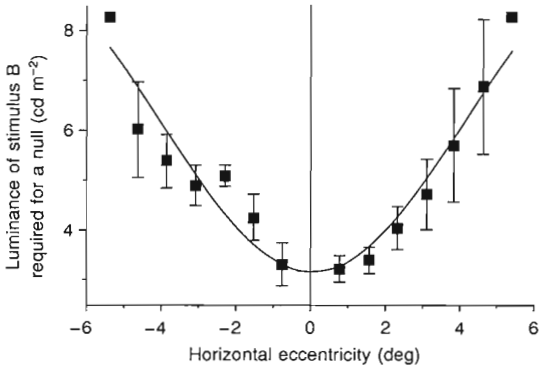

Fig. 1. Luminance required for a null at various eccentricities at 2·6 Hz (mean ± S.E.M.) The wavelength of both stimuli was 500 nm.

The method is a general one and could be used to measure the transient pupillary light response as a function of other stimulus variables, such as chromaticity or spatial frequency. Consequently, the method resembles flicker photometry but the difference is that the mutually cancelling stimuli are not superimposed.