23rd Pupil Colloquium, Nottingham, UK, 1999

THE SPECTRAL SENSITIVITY OF THE TRANSIENT COMPONENT OF THE PUPILLARY LIGHT RESPONSE IN COLOUR NORMALA AND DICHROMATS: 'PUPILLARY PROTANOPIA' IN COLOUR NORMALS?

M.I.K. Norrish BSc [1] and J.D. Mollon PhD, FRS [2]

[1] Department of Psychology (HSS), University of Coventry, Priory Street, Coventry, CV1 5FB, UK [2] Department of Experimental Psychology, University of Cambridge, Downing Street, Cambridge, CB2 3EB, UK

The spectral sensitivity of the pupillomotor system has been examined in many studies. In recent years it has been suggested that different components of the pupillary light response depend on different mechanisms and the possibility arises that these mechanisms may have different spectral sensitivities. We used a signal cancellation technique to examine the spectral sensitivity of the transient component of the response.

A maxwellian-view optical system was used to present an adapting background field, a test stimulus and a reference stimulus. The short-wavelength background was used to limit rod intrusion. The test and reference stimuli were modulated sinusoidally in counter-phase at 2.35 Hz. The wavelength of the reference stimulus was 550nm throughout the experiment. The pupillary responses were recorded for eight test stimulus intensities at each test wavelength. There will be a response null and phase reversal when the potencies of the two stimuli are the same. The action spectrum can be calculated from the radiance of the test stimulus required at each wavelength to produce a response null. Psychophysical low-frequency heterochromatic flicker photometry settings were also made on the same apparatus to provide a comparison with the pupillary responses. Three colour normals and four dichromats, two protanopes and two deuteranopes, were tested.

It was found that there are significant differences between the psychophysical and pupillary action spectra for colour normals, but not for the dichromats. In colour normals the sensitivity is lower for the pupil at wavelengths above 580nm. There are no statistical differences between the pupillary action spectra of the colour normals and of the protanopes, although for the psychophysical responses the expected differences remain. The pupillary action spectrum for colour normals is well modelled not by the photopic luminosity function but by the Stockman, MacLeod and Johnson m-cone template. The possibility that the m-cones alone can mediate the transient component of the pupillary light response must therefore be considered, so too must the implications of this for the labelling of M and L cones in the retina.

This abstract complies with the ethical guidelines for human subjects provided by the declaration of Helsinki. Both co-authors have seen and agreed to the above submitted abstract.

m.norrish@coventry.ac.uk