S-cone excitation ratios for reaction times to blue-yellow suprathreshold changes at isoluminance

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Reaction time (RT) can be defined as the latency from the onset of a test stimulus until the execution of a motor response. In colour vision, the measurement of RT as a function of suprathreshold contrast increments and decrements has provided valuable information on the neural conduction time through different pathways from retina to cortex (Díaz, Jiménez del Barco, Jiménez & Hita, 2001, Color Research & Application, 26, 223-233; McKeefry, Parry & Murray, 2003, Investigative Ophthalmology & Visual Science, 44, 2267-2276). Although previous studies have examined alternative metrics to scale achromatic increments and decrements in both fovea and periphery (Zele, Cao, and Pokorny, 2007, Vision Research, 47, 608-611; Vassilev, Murzac, Zlatkova & Anderson, 2009, Vision Research, 49, 524-529), the existence of an appropriate metric at isoluminance is an open issue. Here we examined RT for blue and yellow changes at isoluminance as a function of the Weber contrast, multiples of the detection threshold and the S-cone excitation ratio between the test stimulus and the background. Isolation of the blue-yellow mechanism was done by heterochromatic flicker photometry. Equiluminance was established by an achromatic (x=0.332, y=0.333) and chromatic (x=0.442, y=0.290) reference stimuli. Stimuli were presented at fovea. They were selected in the CIE-1931 chromaticity diagram along two different blue-yellow confusion lines, each one having a different luminance value (15 cd/m^2 and 12 cd/m^2). The hue-substitution method was used to measure RT at isoluminance in four normal observers (two of them for each confusion line). Mean RTs as a function of different metrics were fitted using Piéron-type functions. Our results show that S-cone increments and decrements at isoluminance equate better when using the S-cone excitation ratio. We propose a RT model that combines this metric with the notion of information processing and threshold units.

Supported by the Fundação para a Ciência e Tecnologia and by the Center for Physics, University of Minho, Portugal.