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Some properties of the blue cone mechanism of the eye

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In several properties the blue-sensitive mechanism of the eye differs from the long-wave-length mechanisms: its Weber fraction is greater and its spatial and temporal resolution is poorer (Stiles, 1949; Brindley, Du Croz & Rushton, 1966). The following demonstrations illustrate other anomalies of the response of the blue system.

(1) A thin vertical bar, of which the upper half is red and the lower half blue, is projected on a bright yellow field. The width of the bar corresponds to 20 min of visual angle. The yellow field is provided by a Wratten 12 filter and the upper and lower halves of the bar by Wratten 25 and 47B filters respectively. The conditions are chosen to ensure that the blue part of the bar should stimulate only π_1, Stiles' short-wave-length mechanism. By means of a mirror mounted on a pen motor that is driven by a function generator, the bipartite bar is moved across the field at a rate of 10 degrees of visual angle per second. The observer fixates a stationary point. The red and blue halves of the bar appear spatially dissociated, the blue segment lagging very strikingly behind the red and also seeming broader. This demonstration illustrates the relatively long latency of π_1 and is consistent with psychophysical measurements obtained by a very different method (Mollon & Krauskopf, 1973).

By applying other functions to the mirror it is possible to demonstrate differences between π_1 and π_5 in flicker fusion, in phenomenal persistence and in the threshold for apparent movement.

(2) The eye is adapted for 2 min to a yellow field of 700 cd/m^2. When the field is turned off, a small blue target looks *green*. The illusion fails not only if the field is too dim but also if it is too bright.

(3) Stiles (1949) himself reported that when a red adapting field was turned off the threshold for blue targets actually rose. There was no evidence for this phenomenon in the results reported by Du Croz & Rushton (1966), but we believe that it is related to the supra-threshold after-effect described above (2) and we have prepared the following demonstration to provide clear confirmation of Stiles' observation.

A yellow (580 nm) field of 10^5 td is presented in a newly-constructed, three-channel, Maxwellian-view colorimeter and is interrupted once every 5 sec by a dark interval lasting 1 sec. 445 nm flashes, subtending 1 deg of visual angle, are presented 500 msec after each onset of the field and

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500 msec after each termination of the field. The observer adjusts the intensity of the flashes until they are just visible on the field. The same flashes cannot then be detected in the dark interval. If now a second observer replaces the first, he will initially see the blue flashes only during the dark interval; but after several cycles of the field the flashes will cease to be visible in the dark interval and will become increasingly clear when the field is present.

The optical system is under computer control: interference and neutral density filters, circular in shape, are mounted on stepping motors and allow on-line control of the wave-length and intensity of each beam.

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