

Temporal threshold measures

Temporal threshold measures relate to the speed of the response of the human visual system and its ability to detect fluctuations in luminance. The ability of the human visual system to detect fluctuations in luminance can be measured as the frequency of the fluctuation, in hertz, and the amplitude of the fluctuation, for the stimulus that can be detected on 50 percent of the occasions it is presented. The amplitude is expressed as

$$M = (L_{\max} - L_{\min}) / (L_{\max} + L_{\min})$$

where: M = modulation

L_{\max} = maximum luminance

L_{\min} = minimum luminance

This formula gives modulations that range from 0 to 1. Sometimes, modulation is expressed as a percentage modulation, calculated by multiplying the modulation by 100.

Colour threshold measures

Colour threshold measures are based on the separation in colour space of two colours that can just be discriminated, usually measured on the CIE 1931 chromaticity diagram and the related uniform chromaticity scale diagrams.

2.3.2 Factors determining visual threshold

There are three distinct groups of factors that influence the measured threshold; visual system factors, target characteristics and the background against which the target appears.

Important visual system factors are the luminance to which the visual system is adapted, the position in the visual field where the target appears, and the extent to which the eye is correctly accommodated. As a general rule, the lower the luminance to which the visual system is adapted, the further the target is from the fovea, and the more mismatched the accommodation of the eye is to the viewing distance, the larger will be the threshold values.

Important target characteristics are the size and luminance contrast of the target and the colour difference between the target and the immediate background. All three factors interact. For example, the visual acuity for a low luminance contrast, achromatic target will be much larger than for a high luminance contrast, achromatic target when expressed as minutes of arc but will be reduced if there is a colour difference between the target and the background.

As for the effect of the background against which the target appears, the important factors are the area, luminance and colour of the background. As a general rule, the larger the area around the target that is of a similar luminance to the target and neutral in colour, the smaller will be the threshold measure.

2.3.3 Spatial thresholds

One of the simplest visual tasks is the detection of a spot of light presented continuously against a uniform luminance background. For such a target the visual system demonstrates spatial summation, i.e. the product of target luminance and target area is a constant. This relationship between target luminance and target area is known as Ricco's Law. It implies that the total amount of energy required to stimulate the visual system so that the target can be detected is the same, regardless of whether it is concentrated in a small spot or distributed over a larger area.