

The psychometric function for letter recognition at varying contrast at different eccentricities in the visual field

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The so-called adaptive methods for measuring psychophysical thresholds - i.e. methods, in which the independent stimulus parameter is changed at each trial based on the subject's previous responses - have gained increasing importance in recent years (Treutwein, 1995, Vision Res.). These methods owe their high efficiency to the fact that the shape of the underlying psychometric function is assumed as known. However, the precision of the measurements thus depends on how accurate these shape assumptions are. Unfortunately, few data on critical parameters of psychometric functions have been published compared to data on thresholds themselves.

We have now investigated the psychometric function for the recognition of singly presented numerical characters, dependent on pattern contrast, and asked whether the function's shape changes with the position of the stimulus in the visual field. Corresponding contrast recognition thresholds have been reported previously (Strasburger, Rentschler & Harvey, 1994, Europ. J. Neurosci. 6: 1583-1588). The task constitutes a ten-alternative forced-choice situation. In each experimental run, contrast has been changed according to a maximum-likelihood principle and a complete psychometric function, with samples clustering around the threshold, has been recorded. Psychometric functions have been obtained at 2-degree spaced positions along the horizontal meridian from foveal view out to an eccentricity of 40 degrees of visual angle, and under both monocular and binocular viewing conditions.

Psychometric functions could be well described by either a Weibull or a Logistic function. Steepness parameter b , for the Logistic function, had a value of around 9 for both monocular and binocular view and independent of visual field position within the central 20 degrees. There was a slight decrease of steepness at more eccentric positions which we attribute to lower performance reliability resulting from high task difficulty at far eccentric positions. Thus, across the visual field, a single psychometric function - centered around the individual threshold - can well describe the percentage of correct recognition responses to singly presented digits at varying contrast. This justifies the use of efficient adaptive methods for measuring recognition contrast thresholds.

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