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VISUAL SENSORY UNITS AND THE MINIMAL ANGLE OF RESOLUTION*

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It is now 100 years since Aubert and Förster demonstrated that visual acuity is better centrally than peripherally and that the decline of sensitivity is gradual and orderly. Although this relation is now generally recognized and is known to apply to other capacities of the retina, the details and the underlying mechanism are far from being satisfactorily explored. The importance of this gradient is well recognized. Polyak, in his monumental work on the retina, gives as the seventh reason for undertaking such a task the fact that the "known structures are inadequate to explain the retinal gradient. Even such an apparently elementary problem as to what anatomical factors are responsible for the striking difference between the central and the peripheral acuity . . . remains unsolved. . . ." (Polyak, 1941, p. 186). It is only necessary to point out the relation of the gradient to such clinical problems as the loss of acuity due to central scotomas, small angle squints, and amblyopia, for example, to show the practical importance of a detailed knowledge of the retinal gradient. Despite interest, the difficulties of the experiments have limited the number of attempts and have prevented wholly satisfactory results.

A contributing cause to the difficulty of analysis has been the absence of any simple mathematical characterization of the curve of acuity as a function of distance from the fovea. The curves are often described as a fall of acuity "at first very rapid but later progressively slower" or some similar expression which could apply with equal vagueness to several distinct mathematical curves. Precision is necessary for effective comparison of curves from different individuals or obtained under different conditions.

Gradient in terms of minimal angle of resolution

It is, therefore, of interest that the minimal angle of resolution, the reciprocal of the visual acuity, presents a much simpler picture of the gradient than does the acuity. The eye is unique in that the sensitivity has been used for its rating rather than the threshold, as is customary with other sense organs, but the minimal angle of resolution (MAR), a true threshold, is now coming into general use. In Figure 1 are presented the visual acuity and the minimal angle of

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