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THE RELATIONSHIP OF THE CENTRAL VISUAL FIELD TO THE SPEED OF VISUAL PERCEPTION*

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Observations of the eye characteristics of children who have trouble in learning to read has shown that there is a higher incidence of central visual field restriction and slower speed of visual perception among them than in the general school population. This has suggested a probable relationship between these factors.

Earlier studies have shown that both the macula and perimacular areas in the retina are involved in reading and that the eye typically make far fewer fixations per line of print than would be the case if each portion of each word or phrase had to be focused successively on the macula.

Since the eye fixates, takes in a certain amount of text during the fixation and then moves on to a new one, the extent of the central field may influence the speed of perception in reading, by limiting the extent of line perceived at each fixation.

The same line of reasoning appears to have been followed by Hincks[1] who suggested that limitation of peripheral vision might have some relation to perceptual span.

The present study explored such a relationship. Measurements of the central field and the speeds of both object (picture) and word perception were made in 50 subjects, ranging in age from five through 17 years. The central fields were plotted with an ordinary campimeter, while the speeds of visual perception were measured with a tachistoscope and by a method previously described by me. [2-3]

Since the study was made particularly to explore the relationship between field restriction and the speed of visual perception in reading, only the horizontal diameter of the central field was considered, this being the part on which fall the images of words and lines of print.

The central visual field is considered to be the inner 30 degrees of the visual field. The field measurement values used in the study were as follows:

Uninterrupted 30 degree central areas were assigned the value of 0, and each 10-degree restriction as 1.0, so that a restriction of five degrees received the value 0.5; 20 degrees 2.0.

If prior assumptions are correct a 0 field would permit more to be taken in at a given fixation, while a 2.0 field would permit apprehension of a smaller amount, due to the smaller extent of responding retina and its central connections. This would imply the necessity for making more fixations per line of print and therefore resulting in slower, more mechanical reading. A considerably restricted central field could make necessary more than one fixation per word, especially in longer words. Such restrictions could influence the speed of perception. A person needing to make more than one fixation per word, for example, would fail on tachistascopic tests until the exposure had been slowed sufficiently to permit him to do so. This is consistent with the clinical observation that exposure time must be longer for long words than for short ones.

The two sets of measurements of speed of perception were correlated with those of the central fields by the rank-difference-squared-method and marked correspondence was indicated by the coefficients, both of which were three points apart and each within the range of its probable error and that of the other. The coefficient of correlation for the speed of word perception and central field measurement was 0.68 ± 0.05, and that of the speed of object (picture) perception was 0.65 ± 0.05.

To the extent that this is representative, limited as it is by its comparatively small number of cases, the results indicate that central field restrictions vary indirectly with the speed of visual perception for objects and words in an appreciable number of cases.

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It supports the results of an earlier study[4] that demonstrated smaller horizontal (and vertical) field diameters in a group of educational disability cases as compared with unselected and normal groups.

The probability that restrictions of the central field may tend to limit the speed of visual perception in both general vision and in reading raises the question of what can be done to improve the extent of the central visual field, when smaller than normal.

The earlier study, referred to in Reference 4, involved medical treatment of a number of cases of field restriction. Favorable responses to this were accompanied by an improvement in school achievement in most of the cases.

Restrictions of the visual field result from three main causes: (1) Congenital influences; (2) pathologic processes, and (3) hysteria. Congenitally restricted fields may improve with exercises for developing eye span. They involve the attempt on the part of the subject to take in as much as possible at a given fixation. When the condition is due to congenital defectiveness the outlook for improvement is less favorable than when due to maturational deficiency or retardation. In this type, time is on the favorable side and the process of maturing may, perhaps, be facilitated somewhat by the exercises.

Pathologic restrictions require medical treatment, which can be accompanied by eye span developing exercises at the physician's discretion. My experience leads me to expect improvement in school work to follow a favorable response to medical treatment in a reasonable large number of cases. When medical treatment is concluded in such instances, there appears to be no contraindication to employment of eye-span exercises.

Hysteric restrictions differ from the others in their symmetrically round or tubular field tracings and in the spiral tendency often observed. The hysteric field does not exhibit the usual changes in size with the distance from the campimeter. An earlier study of tubular and spiral central fields in hysteria[5] showed that 83 percent of the unselected school children exhibiting such hysteric fields were failing in their work. Treatment of the hysteric field falls to the ophthalmologist, psychiatrist, or clinical psychologist who attempts to locate and correct the underlying cause of the hysteria.

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