VISUAL FIELDS Copyright 1941 Duncan, Okla.

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May – 1941 Vol. 1 No. 8

As has been pointed out previously there are three main functions of the retina in fulfilling its part in the process of gaining and maintain vision. They are differentiating light from dark, or the light sense; the perception of form and line; and differentiation of varying wave lengths or frequencies of energy interpreted as colors. Each of these senses can be quantitatively investigated and many logical reasons found anatomically for their existance. Also many things about these phenomena are pure mysteries to us.

It is well known that there are many cones closely packed together in the macula where we gain detail vision, and as Dr. Samuel Renshaw has pointed out the degree of our learned interpretation from this area is way below the actual acuity and resolving power the structure affords us. Immediately outside the macula the number of cones decreases and rods begin to take places between the cones. At about ten degrees from the center the rods outnumber the cones twenty to one which proportion holds true to the ora seratta. In as much as the proportion of rods and cones is near the same over most the retina there is no light here offered as to why one color may be seen over a larger area than another. More phenomenal still is the fact that the areas of form and color interpretation are not constant and may change radically during the day. One thing is obvious: that anatomical limitations is far from the only factor controlling peripheral limits of these fields. Rather than try to explain these things anatomically we take the observed and reproduceable phenomena and use them even though the exact nature and cause are still unknown.

One thing we do observe is that the area of form recognition often decreases following exhausting physical activity, and/or prolonged and fatiguing use of the eyes. Often on finding these decreased form fields we can find and eliminate the cause thereby increasing the comfort and efficiency of persons thus afflicted.

Among some of the common causes of collapsed form fields are uncorrected fatigues in performing the visual function (which may be relieved by the proper use of lenses, orthoptics, etc.), glaring, flickering, or inadequate light, concentration on fine detail without periods of rest, physical exhaustion, etc.

Employees in the office of a tire manufacturing and distributing company began complaining of eye discomfort shortly after new fluorescent lighting equipment was installed. At the same time the office manager noticed a definite decrease in the amount of work being turned out. Lighting engineers had measured the number of foot candles at the desks and found it to be adequate. Shadows, glare and reflections had all been removed without elimination of visual symptoms. Survey revealed visual fatigue in all the employees and an average form field of 28° in the afternoon compared with 41° in the morning.

When fluorescent lighting was in its early stages of development it had what the engineers

called a stroboscopic effect and this came from the periods of greater and lesser illumination during the “up" and "down" phases of the flicker cycle which was produced by that method of obtaining a fluorescent light. It was recommended that they return to mazda lighting until such time as the lighting engineers could eliminate the stroboscopic effect (which has since been done). When they returned to mazda lamps symptoms of fatigue disappeared among the employees and the work output came up to normal

Visual form fields showed much less restriction in the afternoon, the average now being 36º in the afternoon after a days work.

Similar results were obtained in a clothing store where new “daylight" fluorescent lights were installed in part of the room so customers could see the true colors of cloth without having to take them to the street doorway and daylight. The employees complained of ocular discomfort if they worked under these lights very long and not if they avoided that part of the store. A new improved fluorescent unit was installed in place of the former one which had practically no stroboscopic effect, and employees had no symptoms.

Visual field survey of eighty employees of the California Wire Cloth Co. showed 53.75% of the factory workers had restricted visual fields below 20 degrees. One isolated case of a factory worker, age 37, showed a decreased area of 30% after two hours work. Fields before showed motion at 60 degrees and 90 degrees (nasally and temporally), and form at 16 degrees and 60 degrees. After two hours at work motion was at 35 degrees and 82 degrees. Form was at 15 degrees and 48 degrees.

There is great opportunity for Optometrists to be of real service to employers of workers in pointing out these restrictions and in making suggestions for improvement

A Union Pacific passenger bus driver presented himself at 5:00 P.M. for visual analysis after driving all night and part of the day. He complained of ocular fatigue after driving for four hours or more and said things became “hazy and indistinct” to him. Once he sideswiped the steel girders of a bridge entailing some damage to the bus, but inflicting no harm to any of his passengers. Visual fields revealed a collapse of form and color fields. The following "tunnel vision” graph shows the collapse of his form fields.

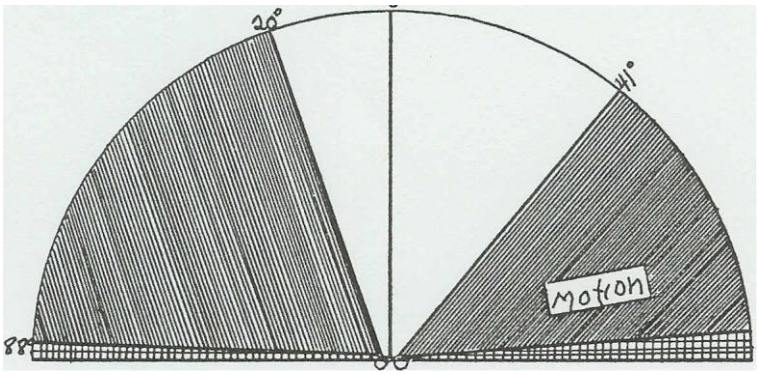
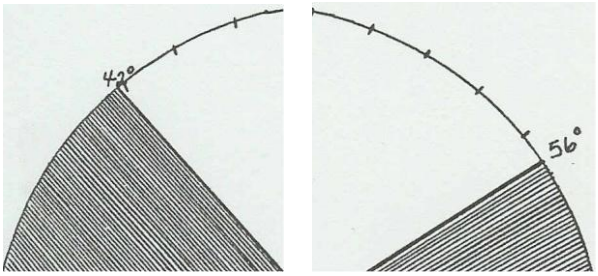


Figure 1.

The next afternoon after being up since six A.M. but having had nine hours sleep during the night the form fields proved to be much larger.



Upon advice given he quit his job as a driver carrying public passengers and opened an automobile repair garage. In the new occupation he was not subject to the loss of peripheral vision, and he was not endangering his life, and that of his fellow passengers.

ATHLETICS

An interesting variation of visual filed service is that of examining football, basketball and baseball players and letting the information be of assistance to coaches and trainers. This has been done with great success. It is not only very advantageous to a coach to be able to more effectively place his players but it becomes popular with players and fans. The case of the full back at the University of San Francisco proves to be interesting if not equally unprecedented in sports history.

This man was referred for visual care by the school staff physician. He was about to be discharged from school for low scholarship. Each eye alone or both together showed normal acuity. Adduction (No. 10) was 20/-1; abduction (No. 11) 3/2; positive fusional reserve (16B) 4/2; negative fusional reserve (17B) 4/0. He complained of fronto-basal headaches. In football he had difficulty in locating his receiver when throwing the ball. He had never completed a pass when he was the receiver. He had been assigned the position of fullback, and though he seemingly knew all the intricacies of the game, his activity was purely that of a line plunger. He admitted great difficulty in judging the speed of an approaching tackle and would rather run directly into him than try to avoid him. Visual fields showed a decided restriction for form, color and motion, which interfered with normal ability to perceive moving objects. Of course it was difficult to find the ball as it was passing through the air.

Figure No. 3 shows his areas of form and motion vision when first reporting for care.

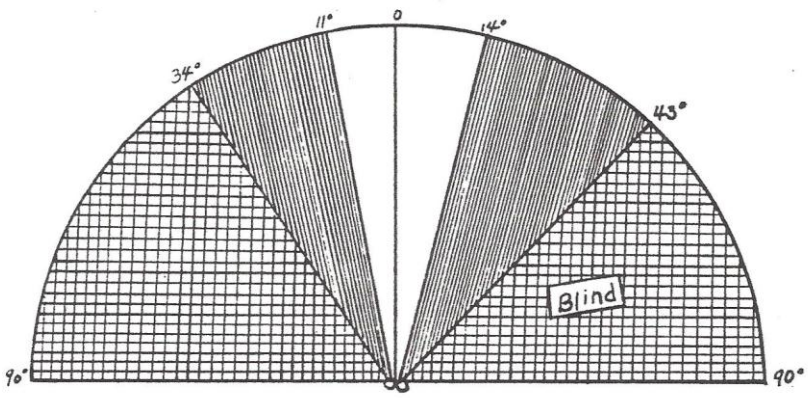


Figure 3

Orthoptic procedures were instituted and after sixteen sessions the ductions had improved to: Convergence (No. 10) 18/12; abduction (No. 11) 6/4; positive fusional reserve (16B) 16/18/8; negative fusional reserve (17B) 16/22/9. He reported decided improvement in his studies, and memory and ability to concentrate improved. Fields showed great improvement as recorded in graph No. 4.

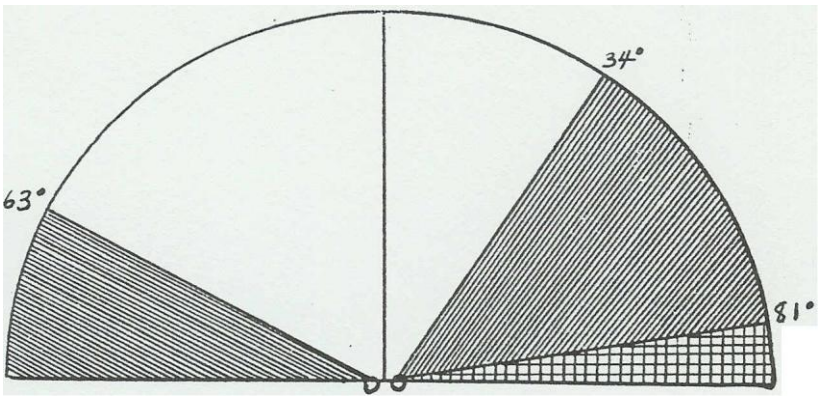


Figure 4.

At completion of the orthoptic work he showed a normal visual status and fields as shown in figure No. 5. His newly developed ability to throw and receive a pass, and general improved ability on the gridiron greatly surprised his teammates and coaches, and he was touted as a possible all round star.

A

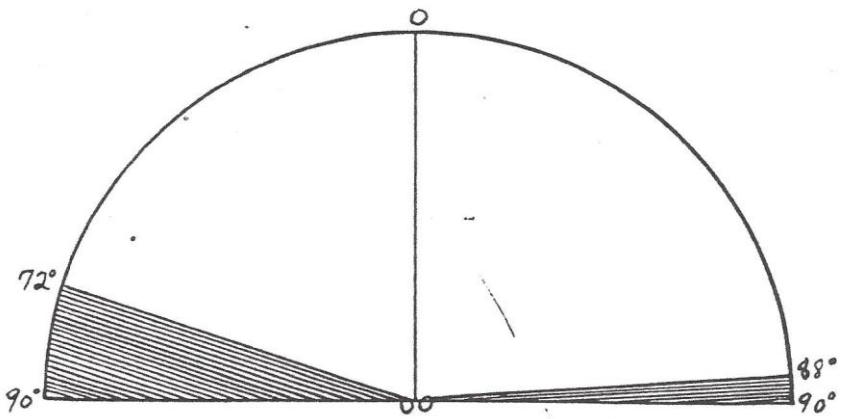
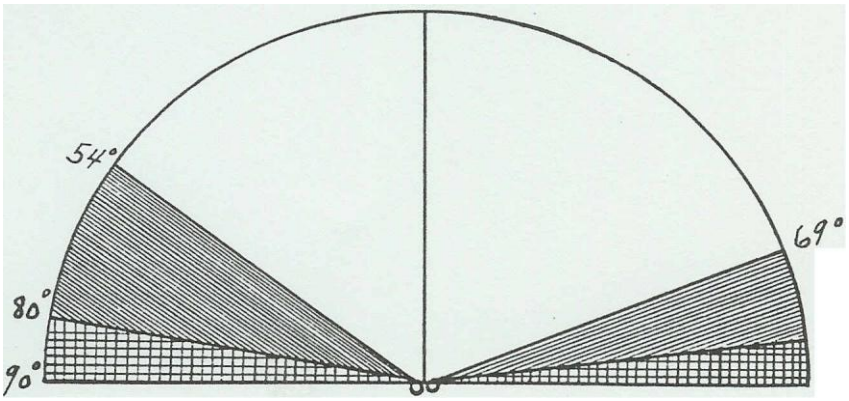


Figure 5

Three halfbacks showed the following visual fields:



A.

Figure 6.

B.

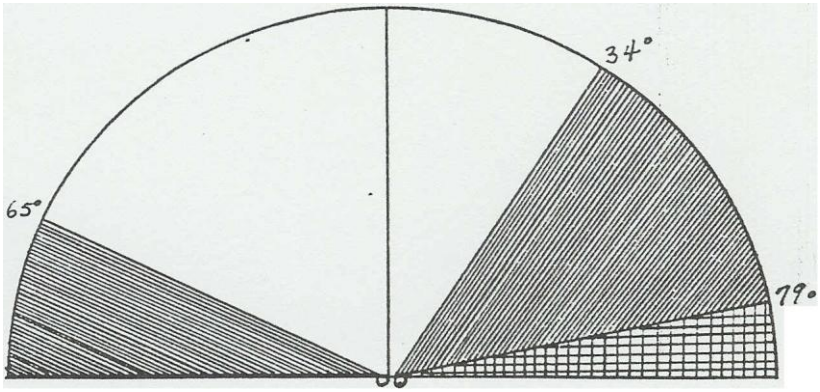


Figure 7,

C.

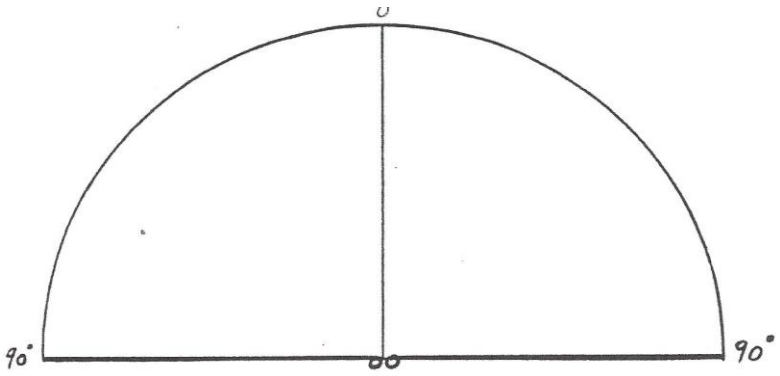
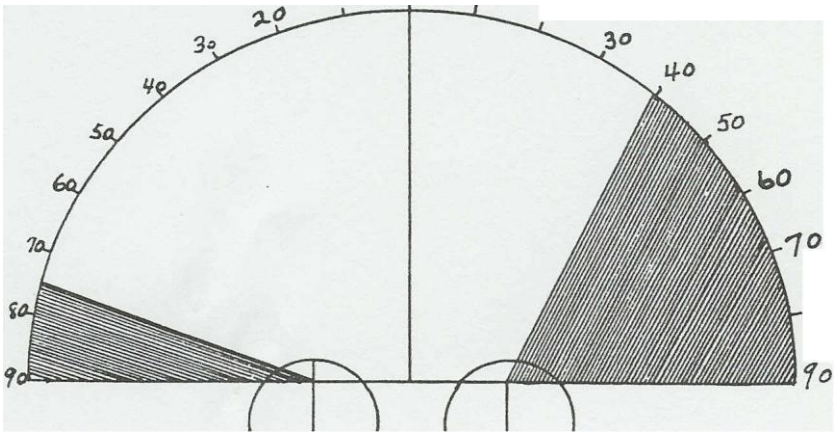


Figure 8.

Halfback "A" would be a better player in the left part of the field. Halfback “B” would be a better player in the right position. Halfback "C" could play either position with equal ability so far as his visual field would influence it. This kind of information may be of great value to coaches wishing to make a substitution at a critical moment of play. The same information would be equally valuable for end, tackle or guard positions.

Consider in a hypothetical case the following graph to represent the visual field of a halfback.

Figure 9.



Letting the black figure represent him on the field of play it is readily observed where he will be most efficient with such a visual field.

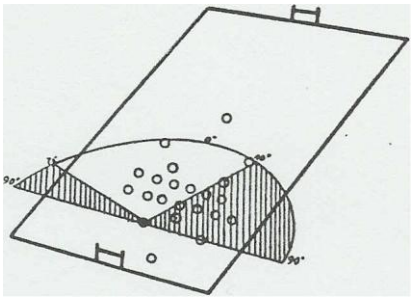


Figure **10.**

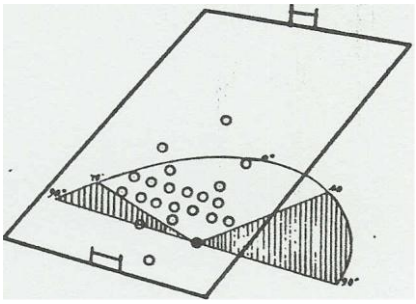


Figure 11.

*Football cases taken from "Visual Fields" by T. A. Brombach published by Distinguished Foundation of Optometry - 1936.

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