Proceedings of the Iowa Academy of Science

Volume 48 | Annual Issue Article 96

1941

A Preliminary Study of the Visual Field in Athletics

Robert Hobson
Grinnell College

M. T. Henderson
Grinnell College

A PRELIMINARY STUDY OF THE VISUAL FIELD IN ATHLETICS

ROBERT HOBSON AND M. T. HENDERSON

PROBLEM

If a basketball player sees an area half as large as another player, he has less chance of sizing up the entire situation on the floor at any moment. Likewise, if one player sees less at a given time than he did previously or will in the future, he is probably less effective at that given time.

This study attempts first to discover whether or not there is a reason to suspect a measurable relationship between the size of the visual field and successful basketball playing. If there is, obviously a test of visual fields would be advantageous to a coach deciding which inexperienced candidates should be trained. Secondly, this study investigates the effects of fatigue upon the size of the visual field, i.e., does a tired man actually see less? If he does see less, what are the characteristics of the recovery of normal vision?

Rather than prepare and conduct an extensive survey immediately, this study was designed to precede a more complete research, to suggest tentative conclusions, and to reveal the difficulties and uncontrollable variations in such work.

PROCEDURE

The problem was approached by mounting a traditional hand perimeter (Schweigger's) on a base, and by providing an adjustable chin rest for the subject's comfort. The perimeter has a radius of 6 inches and a range of 180°. The sliding clip carried a white cardboard 7mm. square.

In all tests, four determinations were made for each eye. The positions were: (1) in the horizontal plane; (2 and 3) 45° in each direction from the horizontal; and (4) in the vertical plane at the top.

Six of the first eight basketball players on the 1940-41 Grinnell College squad submitted to trial testing, during which tests both the players and the experimenter became acquainted with the equipment and the procedure to be used. In this, and subsequent testing, the clip was moved from the periphery toward the center of vision until motion was first reported by the subject. The reading in degrees was noted, and the clip was then moved, from a position near the center toward the periphery of vision, until its disappearance was reported by the subject. If these two readings were less than 4° apart, they were averaged and recorded. If the discrepancy were greater, the determination was repeated.

Next, the experimenter interviewed the basketball coach. The coach gave a report, based on his own statistics where possible, and on subjective data otherwise, of the relative merits and weak points of the squad members. Since only a few comments can fairly be made concerning indications of a relationship between size of visual field and successful playing, they can best be made here. First, it was interesting to note that the player who was rated by the coach as best in ability to conceal passes, had a visual field subtending in the horizontal plane an angle at least 15° larger than the other players. Secondly, the two best "shots" on the squad, judging from the basketball statistics of the year, each had peripheral vision in the vertical plane which was more than 10° higher than normal as indicated on the American Optical Company's charts for use with AO perimeters. Thirdly, all of the players had visual fields larger than normal as indicated by the same charts.

These observations suggest that further study might reveal a large visual field as one of the necessary characteristics of successful basketball players.

The third step of this study was to determine the effects of fatigue upon visual field size. For each subject, a measurement of the visual field was made, and the subject was then asked to exercise vigorously for approximately 12 minutes. In all but one case this exercise consisted of energetic dribbling and shooting on the basketball floor. (In the one dissimilar case, the subject was "warming up" for a track meet by running and doing calisthenics.) Three more measurements of the visual field were then made: (1) immediately following the exercise period, (2) eight minutes after the end of the exercise period, (3) sixteen minutes after exercise. Since each measurement took about four minutes, a complete rest of four minutes was allowed before each of the last two trials.

The measurements were recorded by the experimenter upon circular co-ordinate paper. This paper allowed a larger range than the customary 90° limit of stock perimeter charts. Later, the data were tabulated from these graphs.

Suggestions

Since this study is really a preliminary research, it might be well to pause now to criticize the procedure and make suggestions for future work. Then the results and conclusions given subsequently may be seen clearly in respect to the shortcomings of the experiment.

1. The equipment is inadequate. It would be advisable to discover some means of being certain the subject's head is in exactly the same position for each trial. Schweigger's perimeter has only an eye-rest which does not prevent horizontal or vertical turning of the head. Since peripheral vision seems to be partly determined by the facial contour about the eye socket, turning the head would alter the measurements. Possibly a mouth bit, eye-rest, and adjustable chin and upper jaw rests would solve the problem. The equipment is further inadequate because determinations beyond 90° from the center of vision must be estimated. The range of the perimeter should extend 120° each direction from the fixation point.

2. A more rapid method of recording the data should be devised. The time saved would then allow measurements to be made more frequently than at eight minute intervals. Consequently, a more complete picture of the restriction and expansion of the visual field after fatiguing activity might be obtained.

3. As a control measure, it would be advisable in half the cases to test the left eye before the right.

4. The subjects should be more completely fatigued. The exercise used in this experiment tired them, but allowed them to recover more rapidly than is probable during or after an actual game.

5. Accuracy would be improved by using a numerical instead of a graphical system for recording.

6. Finally, it would be valuable to know the extent of fluctuation around the true score. Schiff[1] found that subjects were able to distinguish geometrical forms at points on the perimeter ½° and 1° farther than the periphery previously reported. If 1° is the limit of fluctuation, then any larger differences may be considered meaningful. However, this extent of fluctuation should be determined for the particular appartus in use.

1. Schiff, H., "Expanding the Limits of the Visual Field," Arch. f. d. ges. Psychol. 1934, 90, 187-226. (Abstract)

Results

The results were transferred from the graphs to numerical tables in such a way that the determinations for each subject could be read from left to right in their chronological sequence, and so that average constrictions for each eye of each player, and average group constrictions for each determination could be made. See Table I. Similar tables were made comparing the other 2 trials after exercise, with the trial preceding.

Table I. Constriction of Visual Field Immediately After Exercise. Recorded in Degrees.

Player	DR	R	UR	U	Average	U	DL	L	UL	Average
1	10	0	10	5	6	5	5	0	5	4
2	0	0	15	15	7.5	5	10	0	5	5
3	10	10	0	5	6	0	5	5	5	4
4	0	5	0	0	1	0	0	0	10	2.5
5	0	5	−10	0	−1	0	0	0	0	0
6	0	5	5	0	2.5	0	5	0	0	1
7	0	0	10	15	6	5	5	0	0	2.5
Average	3	3.5	4	6	4	2	4	1	3.5	3.5

Note: DR indicates the position at down-right; UR at up-right, etc.

Table II summarizes the average columns of each player for these three tables. It seems to indicate quite consistently two possible conclusions. One is that fatigue does constrict the visual field. In this experiment, the constriction ranged up to an average of 7.5° for one eye, or 15° for one position. (Note the first columns for each eye.) The other possible conclusion is that recovery, under these conditions, is quite rapid.

Table II. Average Constriction of Visual Field After Exercise. Recorded in Degrees.

Player	Right eye			Left eye		
	Immediately	After 8 Minutes	After 16 Minutes	Immediately	After 8 Minutes	After 16 Minutes
1	6	0	7.5*	4	5*	6*
2	7.5	6	5	5	2.5	0
3	6	2.5	1	4	0	0
4	1	0	0	2.5*	0	0
5	−1*	−1	−1	0*	−1	−1
6	2.5	1	−1	1	0	0
7	6	2.5	0	2.5	−4	−4

This conclusion is suggested in two ways. First, the constriction of the right eye's field is greater in 5 of the 7 cases than the left eye's. Since the right eye was always tested first, recovery may have begun in the left eye by the time it was checked. Secondly, each succeeding trial indicated a lessened average constriction. Where two successive trials had the same score, it was assumed that a temporarily stable field had been attained.

Each inconsistency of the data with the two tentative conclusions is indicated by an asterisk in Table II. Some of the negative figures in Table II suggest a phenomenon observed by Z. Bujas[2] in his study of the narrowing of the visual field following mental work. This phenomenon was an "occasional slight enlargement of the visual field beyond the normal limits" after recovery from the initial constriction. Bujas' work also re-enforces the two conclusions suggested by this study. G. Petronio[3] further substantiates the conclusion that there is a reduction of the visual field following fatigue, which in his study, was fatigue from rowing exercises.

A summary for this preliminary study, ignoring suggestions for further investigation, may therefore be as follows: fatigue decreases the size of the visual field, but recovery is rapid when fatigue is not great.

Department of Psychology,
Grinnell College,
Grinnell, Iowa.

2. Bujas, Z., "Narrowing of the Visual Field as a Test of Fatigue," Année Psychol., 1938, 38, 186-197. (Abstract)

3. Petronio, G., "Behavior of the Light-Stimulus Threshold and the Field of Vision in Fatigued Subjects," Arch. Ottatmol. 1940, 47, 19ff. (Abstracted review; original not seen.)