Research on Eye Movement Characteristics of Different Level Basketball Defenders in Sports Decision-making Scenarios

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Abstract. Based on the study of basketball and the cognitive psychology, using the eye tracker to study the eye movements of high-level and average level basketball guard athletes, the results show that when looking at different sports situations, The ordinary basketball guard has different ways of watching, different ways of processing information and information processing efficiency. There are obvious differences in the accuracy and speed of decision-making of athletes with different levels, and the differences of sports decisions are drawn:the high-level athletes are integrated Type decision-making, while ordinary level athletes are analytical decision-making.

Keywords: Basketball Defender, Eye Movement Characteristics, Movement Decision

1.Study Subjects and Methods

1.1 Research Subjects
The subjects were divided into 2 groups, high level group and ordinary level group, 20 teams, respectively selected from Chengdu Sport University basketball team and basketball special class two athletes and non basketball special, but selected basketball course undergraduate students[1]. The high level group: exercise level two level 10 athletes, the average training time for more than 7 years, the average age is 24.5 years old; non basketball 10 undergraduate students, no training experience, the average age of 23.5 years, have a certain understanding of the basic knowledge and basic skills of basketball [2].

1.2. Research Methods
1.2.1. Experimental Instruments
Eye-trac6 eye tracker from the American Applied Science Laboratory (ASL). Eye tracker is composed of two computers, one is to attack the scene presented to the scene, the other is the main test subjects to monitor and record experimental data. The distance between the subjects and the monitor was 60cm, and the head was fixed on the U-shaped bracket [3].
1.2.2. Experimental Materials
The experiment is based on Adobe Premiere pro cc software from the CBA calendar year's finals video and CBA classic video capture at 3 times each frame, according to the amount of information on the picture level of division: the number of offensive and defensive players in 5 or less Contains 5) as a simple situation map, a total of 15; 5 or more complex situation map, a total of 15. Situation map players have a clear position, and three types of scenario diagrams of shooting, breaking and passing, Experimental procedures using E-Prime2.0 preparation [4].

1.2.3. Experimental Design
Experiments using 2 × 2 × 2 mixed design.
Independent variables: inter-test variables (exercise level: high level group, general level group)
The dependent variable includes two types of indicators: (1) correct rate and reaction time: when the subjects in the experiment to see the picture to make judgments, decision-making the correct number of keys and the reaction time. (2) Eye movement index: The subjects recorded automatically during the experiment, including fixation time, fixation frequency, fixation frequency, gaze trajectory, eye movement distance and so on [5].

2. Experimental Results

2.1. Comparison of Fixation Time

| Movement level          | pictures of sports scenes | fixation time (M±SD ) |
|-------------------------|---------------------------|-----------------------|
| The high level group    | Complex                   | 3.60±0.55             |
|                         | Simplicity                | 2.44±0.49             |
| General level group     | Complex                   | 5.96±1.72             |
|                         | Simplicity                | 3.54±1.65             |

Athletes in the process of looking at the picture, the eye movement is not continuous, but the way to jump movement. There is a relatively static state between the two jumps, which is called gaze. The length of time spent watching each point of fixation is called fixation time.First of all, K-S distribution test data, two sets of data are subject to normal distribution, on this basis, an independent sample T test. Table 1 shows that there is a difference between high-level and average-level guard athletes at fixation time.

2.2. Look at Frequency Comparison

| Movement level | pictures of sports scenes | frequency (M±SD ) |
|----------------|---------------------------|-------------------|

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The high level group & Complex & 3.20±1.32  
& Simplicity & 2.89±1.25  

General level group & Complex & 5.36±2.35  
& Simplicity & 4.39±1.34  

Watching frequency refers to the number of athletes per second watching. Gazing frequency more reflects the athlete's processing speed of information on the situation graph for a limited time. Using the K-S sample distribution test, the high-level combination common level group follows the normal distribution, and based on this analysis. According to the data in Table 3, the fixation frequency in the complex situation graph was higher (P <0.05) than the simple situation graph, regardless of whether it was a high level group or a general level group laterally [6].

2.3. Comparison of High-Level and Ordinary Level Athletes' Decision-Making Speed

The speed of the reaction determines the decision speed. First of all, two sets of sample data KS test, the test results are evenly distributed from the normal distribution, independent sample test, Table 4 found that after the horizontal comparison analysis, the complex exercise scenarios ordinary level group decision-making speed than the high level group (P <0.05). In the simple exercise scenario, the decision-making time of the high-level group was significantly less than that of the normal level (P <0.05).

**Table 3.** Comparison of high level and general level movement decision-making speed (S)

| Movement level      | pictures of sports scenes | speed of decision making (M±SD) |
|---------------------|----------------------------|---------------------------------|
| The high level group| Complex                    | 2.28±1.67                      |
|                     | Simplicity                 | 1.78±0.37                      |
| General level group | Complex                    | 3.81±5.32                      |
|                     | Simplicity                 | 2.31±0.75                      |

3. Analysis and Discussion

3.1. The Difference and Analysis of Eye Movement Characteristics of High Level and Average Level Basketball Guard Athletes

(1) Analysis of fixation time and fixation frequency

In the experimental study, the information on the situation graph is the main source of the information obtained by the participants. With the increase of the difficulty of the situation picture, the fixation time and the fixation frequency of the athletes in the ordinary level are significantly different. The difficulty level of the athletes in the high level group is the same. Of the situation map, the fixation time and the number of fixation differences but not very obvious. However, as the difficulty of situational picture increases, ordinary level athletes also gradually increase consideration of situational situation because every specific information in situational picture should be noticed, so the quality of
processing information of their follow-up information may be improved, meanwhile Consumes energy and resourcefulness of gaze, and makes judgment after the information is processed compared with the "knowledge module" owned by itself [7].

(2) Annotation frequency
According to the concept of fixation frequency and the data analyzed in this experiment, the attention frequency of high-level athletes is obviously lower than that of ordinary level in the scene images with the same difficulty of fixation, which shows that the number of fixation in a short time is small. Make the right judgments, reflect the processing efficiency higher than the average level athletes, obtain effective information and make decisions within a limited time, and the top athletes search more by the overall clue mode. The normal level group fixation frequency is high, indicating that the number of fixation obtained per second, the amount of information will increase, the processing speed is slow, the efficiency will become lower, and more rely on a single clue mode decision [8].

3.2. High-Level and Common Level Basketball Guard Athletes Decision-Making Speed of the Differences and Analysis
Decision making refers to the process of making a choice. Motion decision-making is the whole process that athletes perceive information, process information and take actions in the sports situation. The main characteristics of the decision-making tasks which are different from the general decision-making tasks are less information available for decision-making, time pressure and uncertainty of results. Wang (2002) distinguishes two different kinds of decision-making in sports decisions: cognitive and intuitive. Cognitive decision-making is similar to decision-making in simpler and general situations. It mainly takes the form of logical thinking and conducts decision-making activities through the strategies of probability theory or decision-making [9]. Intuitionistic decision-making is a quick, direct, and contingent decision made by athletes in complex sports situations characterized by rapid movements, time pressures and uncertain outcomes. Both decisions have good accuracy [10].

4. Conclusions
(1) Through the comparative analysis of the eye movement characteristics of basketball players at high and average levels, it can be found that athletes of different levels have differences in fixation time, fixation frequency, fixation frequency and gaze trajectory when looking at the situation pictures. High-level athletes use a relatively practical, attention, the more attention, the fixation time is longer, the frequency of fixation is relatively wasteful more attention resources.

(2) With the increase of complexity of the situation map, the accuracy and speed of decision-making of ordinary level athletes decrease, but the accuracy and speed change of decision-making of high-level athletes is not obvious.

(3) The differences between high-level and average-level athletes in decision-making are as follows: the high-level athletes are integrated in the process of sports decision-making while the average level athletes are analytic.

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