

Eye Movement on Predicting Serve Return of College Female Tennis Players of Different Levels in Henan Province

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Abstract: Objective: To quantitatively evaluate the influence of sports level on the behavioral indexes and eye movement indexes of female tennis players by independent sample T test analysis, and to provide strategic basis for visual search of athletes. Methods: In this study, 20 female tennis players from colleges and universities in Henan Province were randomly selected as professional group, and 20 female tennis students from colleges and universities in Henan Province were randomly selected as amateur group. All the tested players had normal vision (5.0 after correction), healthy body, and were right-handed racket holding players. The experiment was conducted to compare the two groups of subjects' prediction accuracy rate, reaction time, total number of effective gaze, gaze track and interest area and other eye movement characteristics when watching videos. Results: The professional group had shorter reaction time, and the correct rate was obviously higher than the amateur group. The total effective fixation point of the professional group was more than that of the amateur group, and the professional group could focus more information. The professional group had a mature grasp of cognitive processing strategies, and their visual search times were targeted; Athletes in the professional group can allocate more attention to the key areas of interest that affect the serve landing point, and highly focus on the interest areas directly related to the direction of the serve, so that they can search information more accurately and improve the accuracy of the prediction.

Keywords: Different Sports Level; College Women Tennis Players; Serve Anticipation; Eye Movement Studies.

1. Introduction

Prediction refers to predicting in advance the events that have not yet happened or are happening and are not yet clear enough, and speculate on the future development trend of things to help them grasp the law of the development of things and other conditions, to make the most reasonable judgment and decision [1]. Excellent athletes will predict the events that will happen and when they will happen according to the changes in the environment. In tennis matches, the receiver needs to make a quick judgment on the landing point and rotation of the server in a very short period of time and formulate and make the corresponding receiving strategy, which has a particularly high requirement on the player's visual information search ability and the ability to anticipate the match. Excellent players can often catch the opportunity early, actively collect selective information, have more time to judge, and make effective prediction to achieve the goal of scoring to winning [2]. By distinguishing the key characteristics of athletes at two different sports levels, this study discusses and analyzes the relationship between prediction results and eye movement characteristics, so as to understand the difference of eye movement of college female tennis players at different sports levels, and provide effective decision-making basis for the training of college female tennis players' serve receiving prediction.

2. Object and Method of Study

2.1. Research Objects

A total of 20 female tennis players were selected as the professional group, among which 4 were first-class tennis players and the other 16 were second-class tennis players. In Henan Province, 20 female tennis players were randomly

selected as the amateur group. The test subjects were all players with normal vision (5.0 after correction), healthy body, right-handed racking and average age of 21.25. The test eye movement features included: correct rate, reaction time, total effective fixation number, attention track, etc.

Table 1. Statistical table of subjects' basic information

Group of subjects	Average age	Average years of training	Level of exercise	Number of people
Professional Groups	20.5	7.3	First and Second levels	20
Amateur group	22	2.5	no	20

2.2. Research Methods

2.2.1. Literature Data Method

According to the research content and purpose of the paper, relevant literature was collected from CNKI, China doctoral and Master's thesis database, VIP-CHINESE journal database and Wanfang database, and the relevant literature was classified, sorted, recorded, and summarized, with female players, tennis serves receiving prediction and tennis eye movement research as key words. To lay a solid theoretical foundation for this research.

2.2.2. Mathematical Statistics Method

SPSS software was used to analyze the mean and variance, and independent sample T test was used to analyze the accuracy of two groups of subjects at different levels, the difference in reaction time and eye movement indicators, and the analysis results of the data were statistically described.

3. Results and Analysis

3.1. Comparison of Response Time between Professional Group and Amateur Group

Table 2. statistical results of response time

		Standard	deviation	Minimum	Maximum
Reaction time	Professional Groups	3238.37	619.212	1032.0	6641.0
	Amateur group	3429.87	878.538	1845.0	7932.0

* Time unit: ms (milliseconds), *P < 0.05

Table 3. Results of independent sample t test during reaction

		F	P	t	P
Reaction time		28.757	0.000	1.906	0.054
				0.533	0.586

* Time unit: ms (milliseconds), *P < 0.05

The results of Table 2 show that the professional group has shorter response time and smaller standard deviation, the amateur group has longer response time and larger standard deviation, and the minimum and maximum response time of the professional group are smaller than the maximum and minimum response time of the low level. This indicates that the professional group predicted the reaction time faster and the fluctuation within the group was smaller in the professional group. The difference of reaction time in

professional group was smaller than that in amateur group, and the reaction time was more concentrated. The results in Table 3 show that $P=0.054 > 0.05$ in the independent sample T-test of the reaction time of the two groups, indicating that there is no significant difference in the reaction time between the professional group and the amateur group.

3.2. Comparison of Accuracy Rate between Professional Group and Amateur Group

Table 4. Statistical results of prediction accuracy rate of service receiving landing point between the two groups

		Average	Standard deviation	Minimum	Maximum
Accuracy	Professional Group	69.69	8.84	50.00	85.00
	Inactive group	51.88	9.81	30.00	70.00

Table 5. The independent sample T-test results of the prediction accuracy of the receiving point of the two groups of subjects

		F	P	t	P
Accuracy		0.175	0.679	-5.394	0.000
				-5.384	0.000

*P<0.05

As can be seen from Table 4, the average prediction accuracy of professional group is higher, and the difference between groups is smaller; The average prediction accuracy of amateur group was lower, and the difference between groups was greater. As can be seen from Table 5, $P=0.000 < 0.05$, there is a difference between the two groups of data, that is, there is a significant difference between the professional group and the amateur group of prediction accuracy.

3.3. Comparison of the Number of Effective Fixation Points (Except in Vitro) between Professional Group and Amateur Group

Table 6. Statistical results of the number of effective fixation points in the two groups

		Average	Standard deviation	Minimum	Maximum
Effective gaze points	Professional Group	6.85	1.74	1.00	16.00
	Inactive group	3.93	0.658	1.00	6.00

Table 7. Results of independent sample T-test for the total number of fixation points of the two groups

		F	P	t	P
Effective Gaze points		85.892	0.000	-7.51	0.000
				-7.95	0.000

*P<0.05

Table 6 shows that the average number of effective fixation points of the professional group is higher than that of the amateur group, and the standard deviation between the two groups is not much different. The minimum value of effective fixation points of the two groups is the same as 1, and the maximum value of the professional group is higher than that of the amateur group. It shows that compared with the amateur group, the professional group knows better to focus the gaze points on the effective parts of gaze, and pays more attention to the effective areas of interest; The professional group knew how to predict the landing point of the serve by

collecting the information transmitted by the serving players.

The effective fixation points of the two groups were compared through the independent sample t test, and Table 7 was obtained. The effective fixation points of the two groups were different ($P=0.000 < 0.05$), that is, there were significant differences in the number of effective fixation points between the professional group and the amateur group.

3.4. Comparison of the Percentage of Focus Points in Interest Areas between Professional Group and Amateur Group

According to data analysis, the percentage of fixation points in the interest area of the professional group is 61.04%, much higher than the 38.96% of the amateur group, indicating that the professional group has a higher level of attention to the interest area; Pay more attention to the physical movements of athletes and have an advantage in receiving and serving. After calculation, $P=0.002 < 0.05$ indicates a significant difference in the percentage of fixation points in the area of interest between the professional group and the amateur group.

3.5. Comparison of Fixation Tracks between Professional Group and Amateur Group

The fixation trajectory is the line of the movement trajectory of the fixation point when the tested athletes look at the experimental material in the experiment [3]. After the analysis of the two groups of subjects when watching the same video, the professional group in the racquet and arm of the athlete's fixation point is the most; The amateur group had more scattered fixations, and the amateur group had more fixations in the invalid fixations area and less fixations in the body parts of the main shots. Therefore, the professional group had more advantages than the amateur group in extracting effective information.

4. Research Conclusion

1. The correct rate of the professional group is significantly higher than that of the amateur group, indicating that the professional group can better obtain the value of the opposing team's serve information when the players predict the serve point, interpret the serve information more accurately and have higher prediction accuracy; Amateurs in the case of insufficient ability to predict serve landing, interpret serve information and low prediction accuracy, the value of information obtained was lower. The amateurs obtained lower value of information when predicting the serve landing point, and their ability to interpret the serve information was insufficient, and the accuracy of prediction was lower. There was no significant difference between the two groups in the pre-judging reaction time, indicating that the professional group analyzed the collected information more carefully during the pre-judging, thus improving the accuracy of the pre-judging of the serve point, which was consistent with the actual research results of this paper. The professional group would weigh the relationship between the reaction speed and the accuracy of the video which was difficult to judge. And they would choose to obtain higher accuracy at the cost of sacrificing reaction time. Gao Jue Shu also came to a similar conclusion in the study, which is as follows: there are obvious differences in the prediction accuracy of the return point of badminton among the subjects with different sports levels,

and the prediction accuracy of the professional group is higher than that of the novice group, but there is no significant difference in the judgment reaction time between the two groups [4]. In addition, when the average reaction time of the professional group is lower than that of the amateur group, it can still be proved that the professional group has shorter reaction time and higher prediction accuracy than the amateur group.

2. In terms of total effective fixation points, the professional group had more fixation points than the amateur group, indicating that the athletes in the professional group had stronger cognitive ability and visual search ability under the stimulation of the same presentation materials, and could focus on more information and obtain more effective fixation points. The amateur group lacked effective search for information when looking at information, and the number of fixation points in the limited time was smaller than that of the professional group, so the effective information obtained was less than that of the professional group.

3. In terms of the number of fixation points in each area of interest of the two groups, the professional group had a higher average number of fixation points in each area of interest (head, ball, leg, arm, chest and abdomen) than the amateur group. The professional group had the largest number of fixation points in the area of interest of the ball. Athletes in the professional group allocated the most attention to the ball part when watching the presented materials.

4. In terms of the gazing time assigned to each area of interest, the average gazing time in the head, ball, arm, chest and abdomen of the professional group was higher than that of the amateur group. The professional group was the most focused on the arm and ball, and the least focused on the leg; Amateurs spent the most staring time on the legs and the least on the arms. It is proved that professional players can allocate more attention to the key parts that affect the landing point of the serve, and highly focus their attention on the areas directly related to the direction of the serve.

5. The professional group focused more attention on the athletes when watching the presented materials, so they could search the information more accurately and improve the prediction accuracy; The amateur group's fixation points are more scattered, the distribution is irregular, the focus of the fixation track is not strong, there is no focus on the target, the scope of the fixation track is larger than the professional group, the information of the fixation track is also more chaotic, so when watching the presented materials, the amateur group cannot quickly and effectively process the effective information.

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