International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Research on Athletes Visual Search: A Case Study

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Abstract: ***This paper aimed at comparing expert and novice volleyball players in a visual-motor task using realistic stimuli. A Volleyball Setter attack action video to the participants, while their eye movements were recorded on the head video based on eye movement. Participants were asked to predict the direction (forward or backward) the press of a key, toss setter. The key response time, response speed, and gaze behavior is from the first frame display setter ball contact to the measurement of the button pressed. Experts predict faster and more accurate than the direction of novice, show accurate predictions, continues for a long time they use fixed less search strategy and cost less time watching all the display area, key information is extracted from the judgment in the. These results are consistent with the view that superior performance in experts is due to their ability to efficiently encode domain-specific information that is relevant to the task.***

Keywords: Athletes Visual Search; Case Study; Response Accuracy; Correlation Analysis

1. Introduction

Sport expertise has been defined as the ability to consistently demonstrate superior athletic performance. It is widely believed that professional athletes perform but it is unclear whether superior performance than novices stem from more refined sense organs to coordinate. Athletes must be able to identify the most information in the field of vision, proper attention directly, efficiently and effectively extract meaning from these areas [1]. Performance in a successful campaign, know when and where there may be important, especially when the scene is wide and task related information can be in different form and position. Athlete's advantage in primary visual motion beginner tasks, such as vision, saccadic eye movement, depth perception, eye movement, reaction time, has been widely studied, but the results cannot be extended to all sports [2]. In the difference of visual search strategy, therefore, that is, able to quickly locate task related information between expert and novice players, a movement may not be consistent with other [3]. Anticipation is an important part in sports expertise; it refers to the ability to predict what is likely to happen prior to the event itself. This ability to “read the play” is essential in sport where the speed of the game means that decisions must typically be made in advance of an opponent’s action. Expected movement of the key factors includes visual ability, consciousness and cognitive ability. The ability to recall and recognize an evolution model of the game is the most powerful predicting skills in team sports. For example, we can't compare expected volleyball serve, where the main goal is to get the ball in the net against the court's volleyball environmental action expected, its purpose is in the proper position setting ball attack. Task in the first case, may need different information processing strategies, such as the position detection of clues or identify the developing mode of the game. Therefore, in certain situations it is conceivable that players may rely exclusively on the ability to process information from an opponent’s postural orientation, whereas in others they have to make an anticipatory judgment based on perceived event probabilities. The ability to extract important information from a sport action, even in the same sport, may be related to the type of action being examined.

In this research we addressed the question whether gaze behavior can affect performance in volleyball. In this regard, volleyball has a wide range of investigation, but we still haven't detailed results, let us know in the novice players better visual search strategy experts. Some writers use simple experiment tasks that have a specific visual skills and better results compared to the advanced volleyball players and beginners [4]. Others showed faster simple reaction times (RTs) in expert than novice players. In volleyball, experts perform better in tasks concerning perceptual speed, extent of the focus of attention, prediction and estimation of speed, and direction of moving objects. Relevant information would include, among others, the ball distance, its angle, velocity, and acceleration of descent, setter’s body movements, as well as the appropriate procedures for using these variables to correctly evaluate the ball trajectory. Piras et al. [5] compared gaze strategy of expert and novice volleyball players while observing a filmed action in which the coach tosses the ball to the setter. They found that the expert players do less number of fixation duration longer the setter's hand and body, from body movements, may try to get the most information can be used to predict the trajectory of the ball. This simple decision strategy, also known as a simple heuristic, can rely on the concept of reduce, reduce the number of fixation) can more (the ability to predict) connected to think athletes use less information or less cognitive steps are needed to achieve goals. Experts explain fixed time is short, long – term memory hypothesis is put forward. According to this hypothesis, the expert can be encoded and retrieve information more quickly than novice, so the average fixed time shorter than novices. Long-term working memory is a memory skill, personal get to meet specific memory requirements of a complex cognitive activity in a particular area. In order to meet the technical performance, the individual for specific domain knowledge, process, and all kinds of perceptual motor skills.

In order to study the relationship between the fixation strategies and the process of the expected in this article, we

report the results of the record button response time and look at behavior from the expert and novice, in a task of the participants were asked to predict throwing the target position of the setter. According to previous studies [6], if we want to test this hypothesis experts volleyball players show superior expectations, defined as high response buttons and the accuracy of response time is short, for starters, if so, this advantage can explain whether or not to use a more efficient effective visual search strategies, assessment, fewer number of gaze longer duration of the interests of the related areas.

Furthermore, given that the majority of researchers interested in visual search behavior in sports, and particularly in volleyball, have attempted to identify differences in point of gaze as a function of expertise, it is important to examine whether successful performers employ different visual search patterns than unsuccessful performers within a group where the participants are presumed to have a similar level of expertise. This methodology would increase measurement sensitivity and highlight the potential relationship between visual search behavior and decision making skill in simulated dynamic volleyball setting action.

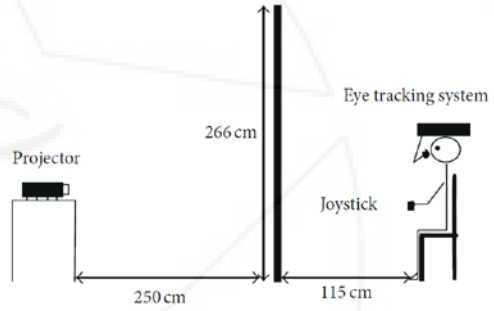
2. Our Proposed Methodology

2.1 Participants

Fifteen expert volleyball players (Italian professionals league B1) and fifteen novices were recruited for the study. Novices had not participated in any sport at a professional level, and although they all knew the rules and the practice of volleyball, they had never participated regularly in volleyball. Mean age of participants was 24.47 ± 1.52 years (experts = 24.87 ± 1.92; novices = 24.07 ± 0.88, $F = 2.14$, $P = 0.15$, Cohen's $d = -0.15$, $r = -0.26$). They all voluntarily underwent the test, which did not include any invasive or harmful procedures. All participants received a verbal explanation before the experiment process and give their written informed consent to participate in the study. They report any unpaid visual defects or some difficulties and used in this study.

2.2 Test Film

Setter block and defense team shooting Angle. Film-clips recorded with a digital camera (Hitachi Dz - Mv270 e) in the 30 frames/s, a resolution of 1280 x 1280 pixels, the 154 cm and 550 cm from the ground net in the middle of the court. Action by coach (placed in the area of the volleyball) throwing the ball setter (positioning in front of the volleyball of area), he had to put it (4) field position forward or reverse (field position 2) when submitted to the participants to complete the film when the ball setter hand (see figure 1). Specifically, we stop the film sequence in the setter ball to prevent the participants received any decision feedback and the actual filming the meeting. The filming perspective we used provided a wide viewing angle and some perspective, which enable us to facilitate the perception of depth. That viewing angle provided the closest correspondence to the field of view that a central defensive player typically observes. We therefore asked the participants to image themselves as a defensive blocker playing in a central position that was just in front of the camera. The setter had to play as if he was in a real game, doing the perfect pass for the hitter. The role of the blocker is to read opponent's setter and determine where the ball will be sent, and once the ball is hit, he/she has to try to block it.



2.3 The Apparatus and Procedure

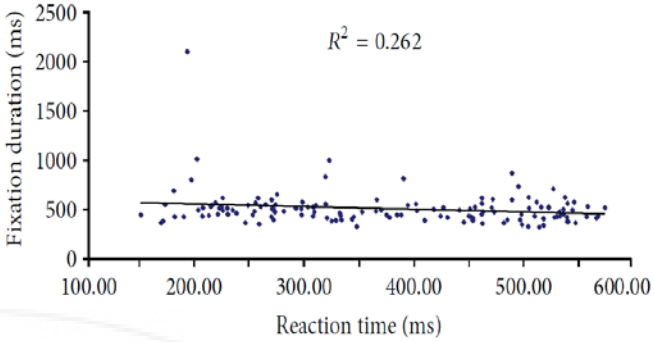
			Experts	Novices
Choice reaction time (ms)		Total	351.02 ± 14.47	406.21 ± 12.19
		Correct response	385.31 ± 21.23	397.48 ± 17.72
		Incorrect response	316.73 ± 17.91	414.94 ± 16.91
Response accuracy (number of trials)	Total	Incorrect	92.00	154.00
		Correct	888.00	515.00
		Total count	980.00	669.00
	Correct	% of total forward	88.00%	72.00%
		% of total backward	93.00%	81.00%
		% of total	91.00%	77.00%
	Incorrect	% of total forward	12.00%	28.00%
		% of total backward	7.00%	19.00%
		% of total	9.00%	23.00%

The participants sat on a chair, in front of a vertical translucent screen (266 × 269 cm), 115 cm from subject's eyes (see Figure 2). The sequences were back projected by a digital projector with a resolution of 1024 × 768 pixels, distant 250 cm from the screen and forming an image 87 cm high and 120 cm wide. Eye movements were recorded binocularly by a video-based eye tracking system (EyeLink II, SR Research Ltd, Mississauga, Canada). Each participant was test before, eye tracking for calibration, in the eyes of the participant links to a specific location on the screen. To do this, the position of the eyes is recorded in a random target interval regularly nine points of the grid size, then each

validation was twelve pieces of video data. Finally, the drift correction after each trial was executed. In the video stimulus, each video clip started with a 500ms acoustic tone to prepare participants for the video onset. The duration of each clip was equal across all trials. The participants were required to follow the action as if they were on volleyball field. The locations of the volleyball sets were completely randomized but kept in the same order for each participant. The filmed action consisted of the coach tossing the ball to the setter, who had to set either forward (to court position 4) or backward (to court position 2). When the ball reaches the setter of hand, the participants must be identified as quickly as possible and accurately whether offensive stimulus will forward or backward setter. The response is to press the two buttons (left or right), one of the game pad. Clear the response on the screen (at the end of the leading to video) in the following video. There is no feedback to the participants, their performance in each test. Practice, calibration, validation, rest time and average data collected 30 to 40 minutes of the participants. Practice (5 test similar, but different video clips) is necessary, in order to avoid wrong reaction due to lack of the ability to use the system. Participants were encouraged to rest for 5 minutes midway experiment, after 60 experiments.

3. Experimental Analysis

A repeated measure ANOVA was conducted on the proportion of correct responses in which setting directions (backward, forward) were the within-subjects factors and expertise (experts, novices) the between-subjects factor. ANOVA showed a significant main effect for expertise ($F1,28= 5.50$, $P = .026$, and $\eta p2 = .16$), suggesting that participants showed more correct responses in comparison to novices (see Table 1). A 2 × 2 repeated measures ANOVA was also done to analyze the key-press response time in which setting direction (backward, forward) and response accuracy (correct, incorrect) were the within-subjects factors, expertise (experts, novices) the between-subjects factor. ANOVA showed a significant main effect for expertise ($F1,28= 5.20$, $P = .038$, and $\eta p2 = .13$) and a response accuracy × expertise interaction effect ($F1,28= 5.22$, $P = .030$, and $\eta p2 = .15$). The main effect of expertise was due to the fact that experts showed a shorter key-press response time with respect to novices. The interaction effect was due to the fact that experts took longer to provide correct than incorrect responses, whereas novices showed the opposite results pattern, of longer response times on incorrect trials (see Table 1). Results showed a clear influence of professional knowledge, with a short RT and higher accuracy of experts (91% and 77%) than novices.



4. Discussion and Conclusion

The aims of this study were (1) to examine the relationships between visual search behavior and anticipatory responses in order to discover differences between expert and novice volleyball players and (2) to compare gaze strategies and action effectiveness in an expert group. As predicted, experts have better performance than their novice, the expected test, they are more accurately predict the direction of the setting and faster response than novice group. They show that the correct response to 91% to 77% of the novice and keys shorter response time. Experts in the field of gaze behavior, has been shown in a previous study [7], the use of a search strategy involves fewer number of fixation duration longer than their rookie. Have already mentioned in the report before [8], experts can reduce the information to be processed or require less looking to create a consistent perceptual said. Our results seem to be [9] and long-term working memory theory, the specialist when encoding and retrieval of information more quickly than novice need short rather than fixed time longer. On the other hand, our results in fixed time protocol information hypothesis, in fixed time is longer than the experts should show the tasks related to regional [10]. Our expert proof is no longer a fixed time in the field of task related, especially when the task time is limited and response is a precision performance metrics. In addition, we found that the important fixation time and look at the number of the correlation between expert and novice in the fixed time and response time between the right and experts correct reaction, when fixed number is a control variable. The results show that with reduction in the number of watching each fixed time linear increase only when the response is correct. This is in line with the simple heuristic method to explain and previous research reports, experts showed less gaze of longer duration task [11].

In conclusion, the present study discerned two strategies among expert players in their attempts to block two different types of volleyball attack. With respect to setting directions, experts appear to use a different strategy in backward than forward settings. In fact, in the first case, they watched for too long all interest areas, especially legs, hands, and trunk, while, in forward setting, they watched equally, for short times, coach, ball, hands, and trunk areas and, more, although not significant, setter's legs. With respect to response accuracy, experts employ a distinct anticipation strategy in correct responses, where they watched equally, for short times, all areas, while in incorrect responses they watched more the setter's legs, hands, and trunk. The critical

difference for success seems not to fix for long time any of the interest areas to decide the ball destination but to use a visual search strategy aimed at the most efficient extraction of information per fixation. The best parameters for successful performance, on expert group, were few number of fixations, of 500ms each, during the phase before hands-ball contact, an anticipatory response time between 346 and 367 ms after the hands-ball contact, and a low number of interest areas fixated per trial. In the future, we plan to conduct more related experiments.

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