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Different Stages of Rally Score Distinguish Performance Level in Badminton: A preliminary study

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Abstract
The study aimed to investigate the use of visual display badminton game rallies to determine the level of sports intelligence. Methods of this study reveal the study participants with video display real game of badminton where some strokes rally divided into several shots. The result showed expert level players led the perceptual-cognitive task among another tested group. This preliminary study could suggest that the 'software' approach in skilled performance has been heading the search for systematic differences in information processing strategies between expert and novice athletes.

Keywords: perceptual-visual; prediction; decision making; video task

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1.0 Introduction

The rapid development of current sports technology has certainly brought progress in various fields. As mentioned earlier, how the industrial and technological revolution overshadowed human cognitive and motor abilities through artificial intelligence (AI), the sports industry also had an impact on the revolution (Bezobrazov et al., 2019). The development of sports science, medicine, and sports technology today has pioneered the development of grassroots athletes, identifying talent, improving long-term performance, and focusing on the high-performance capabilities of the athletes.

Performance improvement is a priority for every athlete, especially in motor skills and physical fitness. If seen, the anthropometric index is more underlying the component of talent identification effectiveness, followed by motor ability, psychological ability and ending skill acquisition (Werkiani et al., 2012). Meanwhile, traditional research methods are more focused on the basic study of physiological and metabolic factors that underlie the performance of athletes (Cabello Manrique & González-Badillo 2003; Faude et al. 2007) as well as vital capacity and VO^2max (Singh, 2012).

However, the next focus is on the acquisition of perceptual-cognitive skills, which emphasises aspects of expectations, anticipation and decision making based on individual perceptions. These skills are pertinent in assessing specific sports intelligence as innovative approaches to improving and enhancing perceptual skills on and off the field (Broadbent et al., 2014; Put et al., 2016).

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2.0 Background of the study

The training plan is designed to achieve the long -term and short -term goals that have been set for the athlete. In order to achieve performance goals, all information regarding performance achievement during training session on and off the court is collected as an indicator of performance. If the physical training session underlies the training performance, the off-court training will complement the athlete, including strategic and tactical aspects.

This video -based study and training covers both individual and team sports. The emphasis on strategy and tactics is a contributor to decision-making skills by using video -based training in a wide variety of major sports (Loffing & Hagemann 2014a; Pizzera & Raab 2012; Put et al. 2013). Racquet sports such as squash, tennis and badminton are individual sports that have used this video approach (Loffing et al. 2015; Loffing & Hagemann 2014b; Tenenbaum et al. 2000; Triolet et al. 2013). Furthermore, decision-making tasks are based on visual displays through speed of response that have been performed in major sports such as volleyball, tennis, and football. (Lorains et al. 2013; Piras et al. 2014; Roca et al. 2011).

However, this visual display approach has not yet used the rally prediction method to assess motor intelligence for the sport of badminton. Exposure to the rally display includes aspects of observation of body kinematics, decision-making speed, perceptual and cognitive skills such as studies conducted in other sports. (Alves et al. 2013; Cañal-Bruland et al. 2011; Macquet & Fleurance 2007). All these aspects are considered critical in this study to assess the level of perceptual-cognitive skills for the sport of badminton. Thus, this study focus on the measurement of perception-visual skills among different groups of badminton skills through rally prediction test.

3.0 Methodology

This experimental procedure study method exposed to the study participants with a visual display of badminton game based on the number of rallies. Each video display of the shot stroke will be stopped to allow participants to choose answers to each of the available questions. It is important to understand things that can be taught and can be done with various play situations. In this study, it could be best described the interactions and changes that take place make us try to accept and understand; (perceptual-cognitive skills), as well as the ability to receive and act with movement (motor-perception skills) (Starkes et al. 2004).

Visual perception tasks (involving rally prediction as a cognitive parameter) for the sport of badminton racket will be displayed dynamically from the perspective of the opponent on the court. The video taken is based on game recorded at the highest level of badminton matches and involved skillful players. The visuals of this racquet sport were edited into a number of rallies namely 8, 12, 16 16, 20, 24, and 28. Next, for temporal occlusion each rally displayed shot situations where the visuals of the game will be stopped to determine winner of the match. The instrument's application structure is specifically designed for experimental conditions to determine winner of the rally.

A systemic program that consist a badminton rally game application system to assess perceptual-cognitive skills. This application is in the form of a computerized test that displays a visual of badminton rallies. In this study, participants will be placed in an enclosed space and sit on chairs provided and facing 15' inch screen laptops. The total scores for each rally and the overall scores will be compared between the three groups involved. Therefore, the study aims to determine the perceptual-cognitive skills of the sport of badminton through a rally prediction test in different skill performance groups.

3.1 Research Participants

Forty-two (n = 42) male badminton players with two different skills and equally divided for skilled and novice players. One observer group was created to assess the perceptual-visual task created from the video. All participants in this study were selected from the adolescent age group. Skilled players are meet the criteria as registered with a badminton association or club in Malaysia. The mean overall age of the subjects was 17.8 (SD±1.0). While for physical characteristics, the average mean (±SD) for height (cm) was 169.8 (±5.5) and 59.5 (±5.5) for weight (kg). The ages ranged for Observer was 17.7 (±0.83), Novice 18.2 (±0.6) and Expert 17.4 (±1.3). It showed small differences between all groups. The highest average height was among the Novice group 171.4 (±4.5), while the lowest was the Expert group (167.0 (±6.7). The last factor was the average weight of the subjects, which was 59.1 (± 6.5) for the Observer group, Novice 61.3 (± 5.9) and 58.1 (± 8.4) for the Expert group.

3.2 Statistical Analysis

In this article, descriptive statistics provide an overview of the findings regarding participants' scores. All scores will be analyzed descriptively for the total score, mean and standard deviation.

4.0 Results

Firstly, the 8-strokes rally showed the mean score (± SD) for the Observer group was 30.6 (± 20.90), followed by the Novice group at 40.7 (± 12.6), while for the Expert group, it was 53.4 (± 20.5). The Expert group owned the highest average (mean) score. In the 12 -strokes rally, the mean score (± SD) for the Observer group was 41.8 (± 12.6), followed by the Novice group at 44.25 (± 12.55), while for the Expert group, it was 46.54 (± 14.73). The Expert group retained the highest average (mean) score. The third rally consisted of 16-strokes, and the mean score (± SD) for the Observer group was 39.09 (± 9.39), followed by the Novice group at 44.17 (± 10.44), while for the Expert group, it was 47.77 (± 14.44). The highest average (mean) belongs to the Expert group based on these three overall scores. Next, Based on the mean average. In each skill group in rally 20, the mean score (± SD) for the Observer group was 39.8(± 7.1), followed by the Novice group at 42.7 (± 7.9), while for the Expert group, it was 43.5 (± 6.8). The highest average (mean) belongs to the Expert group based on these overall scores. For the 24 -shot rally, the mean score (± SD) for the Observer group was 37.8 (± 6.0), followed by the Novice group at 41.0 (± 4.8), while for the Expert group, it was 46.2 (± 5.8). The highest average (mean) belongs to the Expert group based on these overall scores. Lastly, the mean score (± SD) for the Observer group was 39.4 (± 7.1), followed by the Novice group at 42.8 (± 6.0), while for the Expert group, it was 46.7 (± 7.2). The highest average (mean) belongs to the Expert group based on these overall scores.

Table 1. Descriptive Statistics of Rally Strokes for Observers' Group

Group	Rally	N	Mean	Std. Deviation	Minimum - Maximum Score
Observer	8	14	30.6	20.9	0 - 63.43
	12		41.8	12.6	19.47 - 54.73
	16		39.1	9.4	23.09 - 61.29
	20		39.8	7.1	29.02 - 53.55
	24		37.8	6.0	29.21 - 46.36
	28		39.4	7.1	29.21 - 55.55

Table 2. Descriptive Statistics of Rally Strokes for Novices' Group

Group	Rally	N	Mean	Std. Deviation	Minimum - Maximum Score
Recreation	8	14	40.7	12.6	26.57 - 63.43
	12		44.3	12.1	28.12 - 70.52
	16		44.2	10.4	28.71 - 66.91
	20		42.7	7.9	24.84 - 53.55
	24		41.0	4.8	35.26 - 49.1
	28		42.8	6.0	34.45 - 50.77

Table 3. Descriptive Statistics of Rally Strokes for Experts' Group

Group	Rally	N	Mean	Std. Deviation	Minimum - Maximum Score
Expert	8	14	53.4	20.5	39.23 - 90
	12		46.5	14.7	28.12 - 90
	16		47.8	14.4	33.69 - 90
	20		43.5	6.8	32.86 - 57.16
	24		46.2	5.8	35.26 - 54.74
	28		46.7	7.2	34.45 - 58.05

5.0 Discussion

Findings from the descriptive analysis showed that the Expert group dominated the overall average score for each rally. In the production of motor reactions through movement and current decisions, it is crucial to assess relevant visual information as quickly as possible (Hüttermann et al., 2018). This advantage is certainly possessed by a group of experts who can think and act in a short time based on the demands of the structure of the sport itself. Elite athletes have the advantage of recalling game structure information. Even skilled athletes can use the advantage of visual cues to predict where the position of the ball will be sent.

Although the speed of tactical decisions is not done, elite athletes are more likely to make accurate decisions on every opponent's movement. There is accumulated evidence that expert athletes differ consistently in relation to the diversity of perceptions and cognitive and strategic behaviours used intensively and effectively to identify, remember and manipulate relevant information in their sport. (Swann et al. 2015). The differences in the perception-cognitive aspect show that the 'hardware' factor does not give a high advantage for each level of performance, but the primary key to the advantage between the two lies in the 'software' factor, which is the diversity of processing strategies in forming strategic knowledge.

Visual perception theory can describe how visual expectations help the performance of motor skills. It is common knowledge that high-performing expert athletes are superior in anticipating the movements of opponents. The accuracy of this expectation is based on the efficiency of observation of visual information at the beginning of the action sequence, thus helping to improve motor skills, so that skill performance becomes more successful. (Abernethy & Russell 1987; Mann et al. 2010; Urgesi et al. 2010; Yarrow et al. 2009). Empirical studies on visual perception lead to the following characteristics, namely perception (describing the current environmental conditions), perceptual expectation (expectation of the next action without motor response) and perception-motor expectation (expectation of the next action with motor response).

Regarding sports skills, the simulation of the diversity of the opponent's movement patterns was done using the video basis of temporal occlusion, spatial occlusion or the concept of light signs to differentiate between expert and novice groups. The perception-visual task is by way of showing sports-specific information to the subject, and they are required to observe the results of the response that the opponent will do). This concept demonstrates the high ability of expert athletes in terms of accurate expectations of the direction of the shot in badminton (Abernethy et al., 2008; Abernethy & Zawi, 2007), the type of shot and the direction of the service shot in tennis (Farrow et al., 2005; Shim et al., 2005) and the expected direction of the location of the handball penalty throw (Mann et al., 2014).

The task of temporal occlusion is seen as a key element to the importance of racquet sports perception skills. It is used to control the duration of viewing time and provide insight into the phase diversity of selected movement patterns and the production of balls in the air to determine the moment of acquisition of visual information. (Müller & Abernethy 2012). The consistent main findings for each study involving racquet sports show the prowess and ability of expert athletes who can produce initial cues (cues) of perception from the moment of kinematic preparation that is when racquet-object contact occurs. Novice athletes are more reliant on late kinematic information and are only found when racket-object contact occurs. Thus, knowing the primary sources of this visual information can contribute to anticipation skills in helping to unravel the secrets of expert athlete success.

6.0 Conclusion

The results of the study produced an innovation that is appropriate for improving sports performance. Emphasis on the aspect of motor intelligence can contribute to the development of athletes in addition to the importance of the aspect of physical fitness. The visual-perception system framework is effectively developed based on badminton performance indicators. The duration and duration of the rally game can provide information available to players to formulate a point collection strategy. Thus, exposure to the visual display of the actual game can help and facilitate more efficient training planning towards improving athlete performance. All the study findings are the main indicators for all parties involved, especially in the sport of badminton, to accept the perception-visual training approach towards improving the performance of motor intelligence. Therefore, several parties can benefit from this study.

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