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THE EFFECTS OF ATTENTIONAL FOCUS ON THE PERFORMANCE OF VOLLEYBALL JUMP SERVE IN ELITE PLAYERS

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Abstract:
Evidence of the last few years demonstrated that the far external focus of attention would lead to better motor performance (e.g., Mc Nevin., et al, 2003; MacKay and Wulf, 2012). According to the Frequency of Movement Adjustment analysis evidence of "Constrained Action Hypothesis", the aim of this study was to examine the effects of different attentional focuses on the performance of a manipulative-complex motor skill in highly skillful athletes. 12 professional volleyball players completed a 4 blocks of 8 trail (4 trail for accuracy, 4 trail for effectiveness) of jump serve in four experimental conditions (Non-Instruction, Internal focuses on hand movement, Near external focuses on ball, and Far external focuses on target zone or player). The data of accuracy, effectiveness, and self-perception of the performance was acquired by pointed target areas, analyzing volleyball serve effectiveness method, and self-rated manipulative check, respectively. Results of ANOVA with repeated measures showed that accuracy scores, effectiveness, and self-perceived performance of volleyball jump serve in far external condition was better than near external and internal conditions. In addition, the significant differences between non-instructional and far external conditions were observed only in self-perceived performance. In general, these results confirmed recent findings regarding the detrimental effects of internal focus of attention and the facilitative effects of external focus of attention, especially far external on skilled performance.

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1. Introduction

The focus of attention's effects on motor performance and learning has been one of the main interests for sport psychologists, coaches and athletes. The majority of studies have shown that the performer's focus of attention has an important influence on the performance and learning of motor skills. Over the past 15 years, research on focus of attention has consistently demonstrated that an external focus (i.e., on the movement effect) enhances motor performance and learning relative to an internal focus (i.e., on body movements) (Wulf, 2013).

At the highest levels of men's volleyball, the most crucial aspect of the game lies in a team's ability to serve effectively and receive the opposing team's serve successfully (Papageorgiou & Spitzley, 2003). There are many psychological variables such as cognitive strategies that can affect the server's performance in naturalistic volleyball environment. For instance, the attentional focusing such as serving to the target zone, specific player, performing with 50,80 or 100 % of his/her power, or just send the ball on opponent court are strategies mostly used by coaches and athletes. Therefore, it seems to be necessary to study attentional strategies in volleyball jump serve.

There is also evidence that showed the effectiveness of external versus internal focus of attention in performing volleyball serve. For example, Wulf and colleagues (2002), examined how the effectiveness of feedback for the learning of volleyball overhand serve as a complex motor skills is affected by the focus of attention it induces. The results demonstrated that "*the external-focus feedback resulted in more effective performance and learning than internal focus feedback did in terms of the accuracy of the serves for both novice and advanced players*". This study also confirmed that external-focus feedback also has a beneficial effect on movement form, at least when it was provided during practice. Therefore, performers do not need direct references to their body movements in order to acquire the correct technique.

Wulf, McNevin, and Shea (2001), explained the benefits of an external rather than internal focus of attention by postulating the "Constrained action hypothesis". According to this view, adopting an external focus of attention allows unconscious or automatic processes to control the movements. In contrast, when participants adopt an internal focus, they are more likely to consciously intervene in these control processes, thereby inadvertently disrupting automatic control processes. There are several lines of

evidence in support of this view. For example, frequency of movement adjustment analysis in balancing task have consistently showed higher frequency adjustments for external campared to internal focus (Wulf, McNevin, and Shea, 2001; Wulf, Shea, and Park, 2001; Mc Nevin, et al. 2003). Their findings suggest that external focus caused in utilizing more, and faster, reflex loops operating at an automatic level, while internal focus used more conscious, and slower, feedback loops. Additionally, they found that increasing the distance of external focus resulted in even higher frequencies in responding and greater stability. This result suggests that movement effects that occur at a greater distance from the body result in even greater automaticity. According to the frequency of movement adjustments evidence, we examined the effects of different distance of attentional focus on the performance of manipulated and complex motor skill in elite volleyball players.

In a few studies, the effectiveness of different external focus of attention on performance has been examined (McNevin, et al., 2003; Bell and Hardy, 2009; MacKay & Wulf, 2012; Banks, 2012; Portrer, Anton, & Wu, 2012). McNevin et al (2003), was the first one who demonstrated the advantage of distal external focus by increasing the distance of the external focus from the body to markers on the stabilometer platform. They argued that a more distal focus made the movement effect more easily distinguishable from the body movements that create the facilitate effect more than a proximal focus. The results of follow-up studies confirmed this initial finding. For example, Bell and Hardy (2009) compared the effectiveness of three different focuses (internal, proximal external, and distal external) on pitch shots of skilled performers. Their results demonstrated greater accuracy in hitting balls when the focus was on the ball trajectory and landing point (distal) compared to the club (proximal). The results of Porter et al (2012) also showed that participants jumped farther when they focus on jumping as close as possible to a target (distal) than when they focused on jumping as far past the start lines as possible (proximal). McKay and Wulf (2012) examined the effectiveness of distal (the target) versus proximal (the flight of the dart) external foci of attention as a function of performers' preferences for a certain focus in novice dart throwing performance. Their study demonstrated that dart throwing accuracy was generally enhanced when participants adopted a distal focus, regardless of focus order or preference.

While there is some evidence that support the advantages of increasing distance of the external focus from the body to environment (McNevin, et al., 2003; Bell and Hardy, 2009; MacKay & Wulf, 2012; Banks, 2012; Portrer, Anton, & Wu, 2013), it seems that further studies are needed to generalize the findings by examining the effects of attentional foci in different types of motor skills, using a variety type of measurements.

In addition, the skillfulness of subjects may have different and potential influences. Vallacher and colleagues (Vallacher, 1993; Vallacher and Vanger, 1987) pointed out that having an increase in skill level; actions tend to be monitored at higher hierarchical levels. Therefore, the aim of this study was to examine the effects of different distance of attentional focus on the performance of elite volleyball player's jump serving as measured by accuracy, effectiveness and self-perceived performance.

2. Material and Methods

2.1 Participants

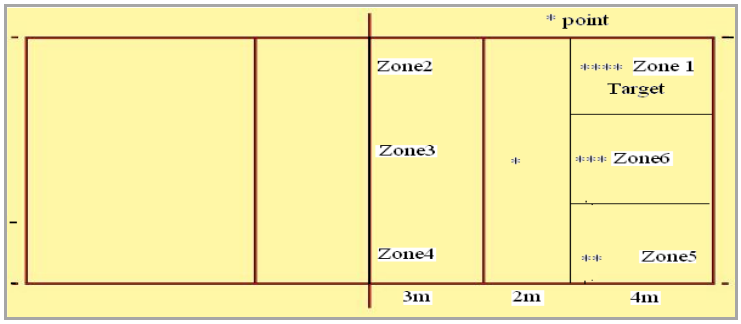
12 elite volleyball players ranging in age from 19 to 32 years (M=25.33, SD=4.34) that had been playing in Iranian super (n=8) or prime (n=4) league participated in the study, voluntarily. Ethics approval and informed consent were obtained before the participants were tested.

2.2 Experimental Design

The task was volleyball jump serve that are used in volleyball games. It is an overhand serve where the ball is first tossed high in the air, then the player makes a timed approach and jumps to make contact with the ball, hitting it with much pace and topspin. This is the most popular serve amongst professional teams. Participants were asked to perform their serve as they perform in competition. The experiment was conducted in indoor volleyball court with standard volleyball court, net, and balls.

A. Accuracy

The end section (9 m end-line *4 m long lines) of the "opponents" back row (or back court) side of the court, were divided into three sections of 3 * 4 m target area that was marked with 5cm wide colored tape, which was clearly visible from the participants' side of the court. Hit balls on the predetermined target area (zone 1 or zone 5), Near section to target area (zone 6), and far section to target area (zone 5 or zone 1) was scored as 3, 2, and 1 point, respectively. For balls that were out of bounds or hit the net, 0 points were recorded. The serves were always performed from the right side of the court.



B. Effectiveness

All serves were videotaped using DataVolley 2007 software. A six-point assessment scale (0–5) was used to analyze the efficiency of the serves by super league volleyball analyzer. A score of 5 was given to a serve ace/point. 4 was given to a serve with no attack from the opponent team. 3 was given to a serve when opponent can use only high ball attack. 2 was given to a serve when opponent can use first tempo attack with a small risk. 1 was given to a serve when opponent can use all attack options. And the last, 0 was given to an error serve. 3 volleyball receiver and one volleyball setter was used in effectiveness assessing trails.

C. Self-perception of performance

A self-rated manipulation checklist was used to determine the participants' perception of the performance process. After any trail in different type of attentional focus, participants were asked to evaluate their performance and answer the question "*regardless of the results, to what extant you performed your jumps service as well as you could do it*"? They rated it from 0 to 4 by choosing one option of "t*he worst performance*", "*the mildest performance*", and "*the best performance*".

2.3 Procedure

The experiment was conducted 3 months before preseason period. All Urmia volleyball players how were experienced in Iran's volleyball super or prime league were invited to participate in this study. 12 players participated, voluntarily. Each participant was tested individually. At first, they were informed that the purpose of the study was to examine the effectiveness of cognitive strategies on volleyball jump serve performance and they were confident that all data will be used only in this study. Before the beginning of the test, participants were asked to warm up sufficiently. All participants completed the first block of 8 trails (4 for accuracy, 4 for effectiveness) jump serve with 1 minute interval in each of the trails. The first block was performed as non-instructional situation in which they were asked to perform their best jump serve onto predetermined target areas (4 trail) and effectively (4 trail). From the second to forth

block, again experimenter spent a few minutes before any block to describe how to perform the task by using different types of focus of attention. They performed the jump serve by internal focuses on the hand movement, near external focuses on ball, and far external focuses on the target area, in a randomized order that was counterbalanced across participants to avoid potential order effects. There were six sequences of treatment (INF-FEXF-NEXF, INF- NEXF- FEXF, FEXF- INF-NEXF, FEXF-NEXF-INF, NEXF, INF-FEXF, NEXF- FEXF- INF). It should be noted that to be more sure about focusing of attention on instructed types, they verbally repeat the instruction before the start of serve. After performing any jump serve, the participants were asked to evaluate their performance and rate the manipulation check. Volleyball analyzer recorded the serves by video camera to calculate the serve efficiency and accuracy.

2.4 Statistical analysis

One-way repeated measures ANOVA was conducted to compare the effects of attentional focus type on accuracy scores, effectiveness, and self-perceived performance in non-instructional, internal, near external, and far external focus of attention conditions.

3. Results

Table 1: Accuracy scores, effectiveness, and self-perceived performance in different types of attentional foci

	Accuracy Scores		Effectiveness		Self-Percieved Performance	
Attentional Foci	Mean	SD	Mean	SD	Mean	SD
Non-instruction	10	2	11.33	2.53	20	1.90
Internal Focus	6	2	7.66	1.96	14.16	.93
Near External Focus	7.66	2.99	9.83	1.64	18.50	2.67
Far External Focus	10.16	1.40	11.83	1.40	23.50	1.88

A. Accuracy

A One-way repeated measures ANOVA showed that, the mean scores for accuracy between the Non-instruction (M = 10.00, SD= 2.00), internal (M = 6.00, SD= 2.00), Near external (M = 7.66, SD= 2.99), and Far external (M = 10.16, SD= 1.40) conditions, were statistically significantly different, Wilks' Lambda = 0.11, F (3,9) = 22.73, p = .001, partial η^2 = 0.88. Post hoc tests using the LSD revealed that the accuracy scores of non-instructional condition were significantly higher than internal (p=0.001), and near external (p =0.03) conditions. Also, the scores of Far external condition were significantly higher than internal (p=0.001), and near external (p =0.005) conditions.

However, there was no significant difference between non-instruction and far external conditions.

These results suggest that the distance of attentional focus really does have an effect on accuracy performance of volleyball jump service. Specifically, our results suggest that accurate of performance in far external focus of attention is better than near and internal focus of attention. However, there is no real difference in accuracy when comparing non-instruction and far external focus of attention.

B. Effectiveness

A One-way repeated measures ANOVA showed that, the mean scores for serve effectiveness between the Non-instruction (M = 11.33, SD= 2.53), internal (M = 7.66, SD= 1.96), Near external (M = 9.83, SD= 1.64), and Far external (M = 11.83, SD= 1.40) conditions, were statistically significantly different, Wilks' Lambda = 0.18, F (3,9) = 12.89, p = .001, partial η^2 = 0.81. Post hoc tests using the LSD revealed that the actual performance scores of internal focus condition were significantly lower than non-instruction (p=0.002), near external (p =0.048) and Far external (p = 0.001) conditions. Also, the scores of near external condition were significantly lower than Far external (p =0.03) conditions. However, there was no significant difference between non-instruction and far external focus conditions.

These results suggest that the distance of attentional focus also affects actual performance of volleyball jump service. Just like the accuracy result, this results showed that the effectiveness of performance in far external focus of attention is better than near and internal focus of attention. However, there is no real difference between non-instruction and far external focus of attention conditions.

C. Self-Perception of performance

A One-way repeated measures ANOVA showed that, the mean scores for self-perception of performance between the Non-instruction (M = 20.00, SD= 1.90), internal (M = 14.16, SD= .93), Near external (M = 18.50, SD= 2.67), and Far external (M = 23.50, SD= 1.88) conditions, were statistically significantly different, Wilks' Lambda = 0.03, F (3,9) = 77.70, p = .001, partial η^2 = 0.96. Post hoc tests using the LSD revealed that the scores of far external focus condition were significantly higher than non-instruction (p=0.001), near external (p =0.001) and internal (p = 0.001) conditions. Also, the scores of non-instruction (p = 001) and near external (p = 001) were significantly higher than internal (p =0.03) conditions. However, there was no significant difference between non-instruction and far external focus conditions.

These results suggest that the distance of attentional focus affects the self-perception of performance, too. Interestingly, these results showed that precieption of the performance in far external condition is better than all other types of attentional focus. In addition, there is no difference between non-instruction and near external focus of attention conditions.

4. Discussion

The aim of this study was to examine the effects of different attentional focus on the performance of volleyball jump serve in the highly skillful players. The main finding was that in all used measures, far external focus of attention has important and more facilitative effects on performance. There has been extensive discussion into the issues of being both a researcher with knowledge of the participants and a participant in the research process (Atkinson and Hammersley, 1998). Additionally, there were some advantages of far external focus rather than non-instructional condition in terms of self-perception of the performance. The important thing to give a player is a level of success and confidence in order to keep the player motivated (Lewthwaite and Wulf, 2010).

According to the nature of the volleyball jump serve, the accurate and effective serve requires more eye-hand coordination, efficient intra and intermuscle coordination, and greater force production. Jumping performance is supporting by finding showing increase EMG activity under internal focus and control condition (Marchmant, et al, 2006). An external focus has been shown to result in the increased accuracy and reduced EMG activity in basketball free-throw shooting (Zachry, et al, 2005), increased force production in a force production task (Marchant, et al, 2009), and eye-hand coordination in a speeded aiming task (Carpenter, et al, 2013) compared to internal focus. Some have questioned the value of an internal focus and suggest it may actually hinder performance (McNevin et al., 2003).

The present study has a number of limitations. An important one is related to the number of trails in each block. Because of difficulty in the accessibility of elite athletes, we have to do the study in one session for each player. In pilot study by 2 players, we found that 4 trials for each 8 blocks could be appropriate as the performance of jump serve is so hard. Therefore, may be this data couldn't be able to show the power of the differences between the focus conditions. The other one is concerned with counterbalancing of blocks. Because of the nature of utilized instructions that potentially affect non-instructional condition, we established counterbalance to the three attentional foci conditions. Therefore, the differences between non-instructional condition and other instructional focus conditions must be concluded cautiously.

From an applied perspective, the findings of the present study provide several implications for volleyball elite players, coaches, and sport psychologists. In particular, they need to be aware of the appropriate attentional focus strategies in performing volleyball skills. According to the results of this study, elite players performed better when they focused on the target area or target players rather than focusing on ball and hand movements. Therefore, this finding suggests that directing the player's focus of attention on target area or target player may result in beneficial performance outcomes.

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