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Pattern recall skills of talented soccer players: Two new methods applied

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ABSTRACT

In this study we analyzed the pattern recall skills of talented soccer players by means of two innovative methods of analysis and gaze behavior data. Twenty-two young female soccer players watched video clips of 3 vs. 3 small-sided games and, after occlusion, had to reproduce the positions of the players. Recall performance was measured by calculating the spatial error of the recalled player positions at the moment of occlusion and at consecutive 33 ms increments. We analyzed player positions relative to each other, by assessing geometric pattern features in terms of angles between players, and we transformed the data into real-world coordinates to exclude the effects of the 2D perspective in the video clips. The results showed that the participants anticipated the movements of the patterns. In real-world coordinates, the more experienced players anticipated the pattern further in advance than the less experienced players and demonstrated a higher search rate, a shorter fixation duration and a higher fixation order. The differences in recall accuracy between the defensive and offensive elements were not consistent across the methods of analysis and, therefore, we propose that perspective effects of the video clip should be taken into account in further research.

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1. Introduction

It has been well established that skilled athletes possess better perceptual-cognitive skills than their less skilled counterparts (Helsen & Starkes, 1999; Vaeyens, Lenoir, Williams, Mazyn, & Philippaerts, 2007; Vaeyens, Lenoir, Williams, & Philippaerts, 2007; Williams & Grant, 1999; Williams, Ward, Knowles, & Smeeton, 2002). Those skills include the ability to pick up advance information from an opponent's postural orientation prior to a key event such as racquet-ball or foot-ball contact (Savelsbergh, van der Kamp, Williams, & Ward, 2005; Ward, Williams, & Bennett, 2002; Williams & Burwitz, 1993), enhanced knowledge of situational probabilities (Ward & Williams, 2003; Williams, 2000), more effective and efficient visual search strategies (Helsen & Starkes, 1999; Savelsbergh, Haans, Kooijman, & van Kampen, 2010; Williams & Davids, 1998) and better abilities to recognize or recall patterns of play (Gorman, Abernethy, & Farrow, 2011, 2012; Williams, Hodges, North, & Barton, 2006;). The current study focused on recalling patterns of play.

De Groot (1965) and Chase and Simon (1973) conducted the first studies in this area. They showed that expert chess players were better able to recall the positions of chess pieces than less skilled players after briefly viewing a typical chess game configuration. After these initial studies, the pattern recall paradigm was used in numerous other studies of which many involved team sports (Allard, Graham, & Paarsalu, 1980; Borgeaud & Abernethy, 1987; Gorman, Abernethy, & Farrow, 2011, 2012, 2013a, 2013b; Williams, Davids, Burwitz, & Williams, 1993). For example, in the study of Williams et al. (1993) experienced and inexperienced soccer players had to recall the positions of the players after viewing video clips of structured and unstructured soccer game situations by pressing the mouse key on the correct locations in a computer-generated image of a soccer field. The findings showed that the experienced soccer players recalled the positions of the players more accurately than the novices, but only for the structured trials.

A question that is often raised is what the purpose is of recalling patterns after watching video footage, since this task is rarely directly required in the sport domain (Williams & Ericsson, 2005). One answer is that the ability to recall the locations of teammates and opponents in ball games assists players to predict the next likely situation and thereby helps to decide upon the best response. For example, the player in possession of the ball uses the information about the positions of the other players to predict the movements of these players and to decide whether to dribble, pass or shoot (Gorman et al., 2013b). Thus, pattern recall may serve an anticipatory function, it allows expert players to predict future situations based on the current configuration of players. Accordingly, de Groot (1965) reported that when expert chess players viewed structured chess board configurations and made mistakes in recalling the positions of the chess pieces, they incorrectly placed the pieces in positions that were possible subsequent moves. Therefore, De Groot (1965) concluded that pattern perception may involve the encoding of the spatial and functional relationships between the elements.

Direct evidence for the anticipatory function of pattern recall has been found by Gorman et al. (2012, 2013b; see also Didierjean & Marmèche, 2005; Gorman et al., 2011). In their studies, expert and novice basketball players watched static images and moving video clips of structured basketball game situations. Directly afterwards, the video clips were occluded and replaced with an image of a blank basketball court. The participants had to reproduce the last seen positions of the players by dragging Xs and Os (representing defenders and attackers, respectively) onto the image of the court. Gorman et al. (2012, 2013b) compared the pixel coordinates (in percentage of screen size) of the response patterns entered by the participants with the coordinates of the actual player locations both at the final frame presented (i.e., traditional recall score) and at 50 successive 40 ms increments thereafter. The closest match between the entered and actual patterns was identified for each participant and indicated the anticipatory recall score. The moment at which the closest match occurred was named "advance" and measured in ms. The findings revealed that experts were more accurate than novices, but more interesting was that the response patterns of the participants had closer matches with the actual patterns in successive frames of the final frame than with the final frame itself, that is, the anticipatory recall scores were better than the traditional recall scores. The average advance score of expert basketball players on dynamic video clips was 185 ms and was higher than that of the novices. Gorman et al. (2012) concluded that experts use an anticipatory encoding process and