



ELSEVIER

Contents lists available at ScienceDirect

Human Movement Science

journal homepage: www.elsevier.com/locate/humov



The coupling between gaze behavior and opponent kinematics during anticipation of badminton shots



David Alder^{a,*}, Paul R. Ford^{a,1}, Joe Causer^{a,2}, A. Mark Williams^{b,3}

^a Liverpool John Moores University, Tom Reilly Building, Byrom Street, Liverpool L3 3AF, United Kingdom

^b Brunel University, Heinz Wolff Building, HW201, Uxbridge UB8 3PH, United Kingdom

ARTICLE INFO

Article history:

Available online 16 September 2014

PsycINFO classification:

2323

Keywords:

Visual perception
Biomechanics
Expert performance
Decision making
Eye movements

ABSTRACT

Purpose: We examined links between the kinematics of an opponent's actions and the visual search behaviors of badminton players responding to those actions.

Method: A kinematic analysis of international standard badminton players ($n = 4$) was undertaken as they completed a range of serves. Video of these players serving was used to create a life-size temporal occlusion test to measure anticipation responses. Expert ($n = 8$) and novice ($n = 8$) badminton players anticipated serve location while wearing an eye movement registration system.

Results: During the execution phase of the opponent's movement, the kinematic analysis showed between-shot differences in distance traveled and peak acceleration at the shoulder, elbow, wrist and racket. Experts were more accurate at responding to the serves compared to novice players. Expert players fixated on the kinematic locations that were most discriminating between serve types more frequently and for a longer duration compared to novice players. Moreover, players were generally more accurate at responding to serves when they fixated vision upon the discriminating arm and racket kinematics.

Conclusions: Findings extend previous literature by providing empirical evidence that expert athletes' visual search behaviors

* Corresponding author. Tel.: +44 07814843933; fax: +44 0151 904 6284.

E-mail addresses: d.alder@2008.ljmu.ac.uk (D. Alder), p.ford@ljmu.ac.uk (P.R. Ford), j.causer@ljmu.ac.uk (J. Causer), mark.williams@brunel.ac.uk (A.M. Williams).

¹ Tel.: +44 0151 904 6246; fax: +44 0151 904 6284.

² Tel./fax: +44 0151 904 6284.

³ Tel.: +44 01895 267605; fax: +44 0151 904 6284.

and anticipatory responses are inextricably linked to the opponent action being observed.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Expert athletic performance consists of many perceptual, cognitive and motor elements (Causser, Janelle, Vickers, & Williams, 2012). A key element in elite sport is the ability to anticipate opponent actions prior to their completion (Williams, Ford, Eccles, & Ward, 2011). Expert athletes are able to anticipate opponent actions by using vision to extract information from their movements prior to a key event in the action, such as ball-racket or ball-foot contact (Abernethy & Russell, 1987; Abernethy, Zawi, & Jackson, 2008; Savelsbergh, Williams, Van der Kamp, & Ward, 2002; Williams, Ward, Knowles, & Smeeton, 2002). However, contradictory findings have emerged in the literature as to the kinematic information that athletes should allocate visual attention to when making anticipation judgments. These conflicting findings are found between and within researchers examining the visual fixations of athletes during anticipation judgments and those examining where the kinematic differences between actions occur, probably because in both cases neither quantifies the other. In this study, we examine, for the first time in the literature, the coupling between the kinematics of opponent actions and the associated visual search behaviors of athletes who are attempting to anticipate those actions.

Previously, researchers have investigated the kinematic differences between actions (Huys, Smeeton, Hodges, Beek, & Williams, 2008), while others have separately examined the kinematic information that athletes fixate vision upon during anticipation (Williams et al., 2002). Huys et al. (2008) used principal component analysis (PCA) to investigate the kinematic patterns that discriminated between forehand tennis strokes to four locations in the opponent's court. The shots varied in direction and depth by being 'cross court' and 'inside-out' to both short and long areas of the court. The kinematics differed between shots as a function of direction, but not shot depth. The authors found that kinematic differences between shots to the left or right occurred at locations across the whole body. In a similar study, Bourne, Bennett, Hayes, and Williams (2011) used PCA to examine handball shots directed to each of the four corners of the goal. In contrast to Huys et al. (2008), kinematic patterns between shots to the four different locations were not significantly different, suggesting that between-shot differences may be subtle and related to changes in refined hand kinematics, which were not measured. Differences between actions in a sport are clear when they are somewhat exaggerated and/or occur across all of the body, such as the 'cross court' versus 'inside-out' tennis shots examined by Huys et al. (2008). As such, visual search research using tennis shots (Ward, Williams, & Bennett, 2002; Williams et al., 2002) has shown that the locations of fixations tend to be distributed across a number of central regions of the body (e.g., head, trunk), which perhaps act as an 'anchor point' of fixation that enables peripheral vision to pick up the kinematic differences in the multiple locations (Ripoll, Kerlirzin, Stein, & Reine, 1995). However, when the differences between actions are subtler, the discriminating differences between shots occur in fewer and often distal body locations (e.g., hands in Bourne et al., 2011). For example, research examining visual search behaviors during badminton shots shows the fixations are located on specific distal areas of the body (arm, wrist, and racket in Abernethy and Russell (1987), because kinematic differences between badminton shot types are hypothesized to be subtle and occurring in these distal areas. Variation in the amount of kinematic locations or information available that differentiate between and within actions might lead to related variation in the locations of visual search fixations used to extract this information. The evidence suggests that the kinematics of the opponents' action and the visual search behavior of the athlete anticipating those actions are inextricably linked, which implies that they should not be examined in isolation.

Download English Version:

<https://daneshyari.com/en/article/7292418>

Download Persian Version:

<https://daneshyari.com/article/7292418>

[Daneshyari.com](https://daneshyari.com)