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Angular relationships regulate coordination tendencies of performers in attacker–defender dyads in team sports ☆

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ABSTRACT

This study examined the continuous interpersonal interactions of performers in dyadic systems in team sports, as a function of changing information constraints. As a task vehicle, we investigated how attackers attained success in 1v1 sub-phases of basketball by exploring angular relations with immediate opponents and the basket. We hypothesized that angular relations would convey information for the attackers to dribble past defenders. Four basketball players performed as an attacker and defender in 1v1 sub-phases of basketball, in which the co-positioning and orientation of participants relative to the basket was manipulated. After video recording performance behaviors, we digitized participant movement displacement trajectories and categorized trials as successful or unsuccessful (from the attackers' viewpoint). Results revealed that, to successfully dribble past a defender, attackers tended to explore the left hand side of the space by defenders by increasing their angular velocity and decreasing their angular variability, especially in the center of the court. Interpersonal interactions and goal-achievement in attacker–defender dyads appear to

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have been constrained by the angular relations sustained between participants relative to the scoring target. Results revealed the functionality of exploratory behaviors of participants attempting re-align spatial relations with an opponent in 1v1 sub-phases of team games.

1. Introduction

Research on collective social systems has shown that patterns of behaviors of individual members remain continuously co-dependent over space and time (Araújo, Davids, Bennett, Button, & Chapman, 2004; Davids, Button, Araújo, Renshaw, & Hristovski, 2006; Schmidt & Richardson, 2008). For example, Schmidt and O'Brien (1997) used a visual wrist-pendulum task to investigate unintended interpersonal coordination in dyads. They found that, when visual information from one participant was available, particular coordination modes were more frequently observed than others, suggesting how the interpersonal interactions between individuals in a social collective were informationally coupled.

In team sport collectives, competing individuals continuously interact to achieve specific performance goals such as when a ball carrier strives to pass a ball to a teammate before a defender moves into position to intercept the ball (Travassos,Araújo, Davids, et al., 2012). An ecological dynamics approach is a viable theoretical framework which seeks to understand and explain how evolving constraints influence transitions in coordination tendencies between individuals in collective systems like team sports (underpinning actions and decision-making behaviors) (Araújo & Davids, 2009). According to this rationale, an individual's performance behaviors are continuously dependent on use of specifying information within particular performance environments (Araújo, Davids, & Hristovski, 2006).

A major task for movement scientists is to seek to develop understanding of the effects of key information constraints on the continuous interpersonal interactions of individuals in such social systems (Vilar, Araújo, Davids, & Button, 2012). For example, research has begun to identify relevant informational constraints that support performance behaviors of attackers and defenders in 1v1 dyadic subphases of team games. In empirical work on 1v1 sub-phases, values of interpersonal distance in basketball (i.e., distance between an attacker and immediate defender) (Cordovil et al., 2009) and relative velocity in association football (i.e., velocity differential between attacker and defender movement displacements) (Duarte et al., 2010), have been shown to influence performance behaviors of attackers dribble past defenders and approach the scoring target. In fact, the relative positioning of performers to a scoring target has been identified in previous research as a critical feature for studying collective and dyadic system dynamics in team sports (Araújo et al., 2004; Travassos, Araújo, Duarte, & McGarry, 2012). To exemplify, a recent study in basketball showed that interpersonal coordination tendencies (i.e., dynamics of the relationship between an attacker and defender) were shaped by manipulation of the relative position of attacker–defender dyads to the basket, suggesting that attackers preferred to move past the defender on the left (Esteves et al., 2012). In futsal (a five-versus-five indoor football game), it was reported that the angular relations between an attacker, defender and the goal constrained success in shooting at goal by the attacker (Vilar et al., 2012). Another investigation of 1v1 sub-phases of rugby union examined running angles of an attacker and a defender in relation to the try line (Passos et al., 2009). However, the method of computing the dependent variable in that study did not enable investigators to differentiate between a leftward or rightward move by the attacker to pass the defender (i.e., an attacker positioned to the left or right of the defender returned a value of 0°, meaning that the attacker–defender vector was parallel to the try line).

These studies highlighted the importance of team games players engaging in exploratory actions to create information for action (Whitagen, de Poel, Araújo, & Pepping, 2012). In ecological psychology, Gibson (1966) conceived a perceiver as an active individual seeking to detect invariant patterns in the