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TAU INFLUENCE ON DECISION MAKING IN BASKETBALL

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ABSTRACT: Decision making in sport emerges from the players' interaction with the game context (Araújo, Davids, & Hristovski, 2006). Results from studies on the one-on-one in basketball identified interpersonal distance and relative velocity as relevant variables (i.e., control parameters). These results are reinterpreted in the perspective of the General Tau Theory (Lee, 1998), in which movement is regarded as guided by controlling tau motion-gaps (time to fulfil a gap) and tau-couplings. Further empirical evidence for this argument, came from a recent study in a team ball sport, where the tau variable was considered and verified as significantly related to decisional behaviour. Following this, it is assumed that the focus in candidate control parameters that detach the spatial component from the temporal one, presented in previous studies, may not be sufficient to explain the decisional behaviour in basketball. In this way, the variable tau is proposed as more informative given that enfolds inextricably spatial-temporal information.

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Introduction

Human action results from a cyclic process of perception of contextual information to guide action, and action to detect the contextual information (Gibson, 1979). According to the ecological dynamics approach (Araújo et al., 2006), there are behaviour patterns that emerge from the interactions of the individual and the environment, such as the dyad comprised by an attacker and a defender. The behavioural patterns are expressed by symmetry and symmetry breakings in the attacker-defender system. Thus, environmental information is regarded as a constraint in the emergence of decision-making (Davids, Button, Araújo, Renshaw, & Hristovski, 2006). The players interact in the playing field in order to attain a particular goal, in a continuous process of decision-making. For example, the attacking players displace themselves in the pitch, dribble the opposite players, make passes to teammates, whereas the defending players disarm an opposite player with ball, or intercept an adversary opponent's pass. As follows, the core purpose of the present paper is to show how the tau variable (i.e., time to fulfil a spatial gap) originated from General Tau Theory (Lee, 1998) might promote the study and understanding of basketball players' decisional behaviour.

In order to support our line of reasoning, we revised studies conducted in basketball (Araújo, Davids, Bennett, Button, & Chapman, 2004; Araújo et al., 2006) and reinterpreted the obtained results from a general tau theory point of view (Lee, 1998). Besides, we revised data from recent studies performed in the domain of other team ball sport (Correia, Araújo, Craig, & Passos, submitted) that show how information conveyed by tau variable ($\tau(x) = x/\dot{x}$, Lee, 1980) might influence players' decisional behaviour in the course of a match.

Method

Control Parameters identified in basketball

In the basketball domain, studies by Araújo and colleagues (Araújo et al., 2004, 2006) investigated the interaction between an attacking player with a ball and a defender in a one-versus-one situation. The distance between the dyad and the basket was considered as revealing the global dynamics of this dyadic system. Also the interpersonal distance was empirically showed as a relevant parameter (i.e., control parameter), leading to qualitative changes (i.e., symmetry breakings) in the attacker-defender-basket system (Figure 1). Additionally, Araújo (2006) proposed the relative velocity between the attacker and the defender, as a candidate control parameter. This parameter was already demonstrated as relevant in another team ball sport (Passos, Araújo, Davids, Gouveia, Milho, & Serpa, 2008).

Tau as a Control Parameter

General Tau Theory, developed by Lee (1998) and followers (e.g., Craig, Delay, Grealy, & Lee, 2000), is a theory of prospective movement control that argues that movement is guided by means of controlling the dynamic loading of any space or measurable dimension. This theory is regarded as in accordance with Gibson (1979) ecological approach given that it complies with the mutuality and reciprocity between perception and action, besides the fact of operacionalizing the assumption that information that constrains individuals' actions is directly available and can be used to movement control. According to this perspective, movement is guided by the direct perception of a variable that provides spatial and temporal information, the variable tau (Lee, 1980). This variable specifies the time to fill the space between a current location/value

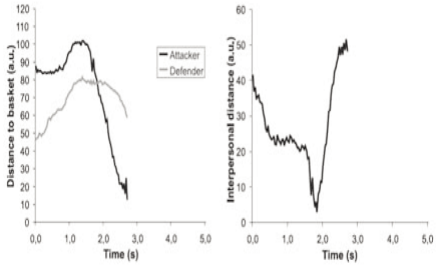

Figure 1. Illustrative 1x1 situation where the transition to a new state occurs at a critical value of the control parameter (figure adapted from Davids et al., 2006).

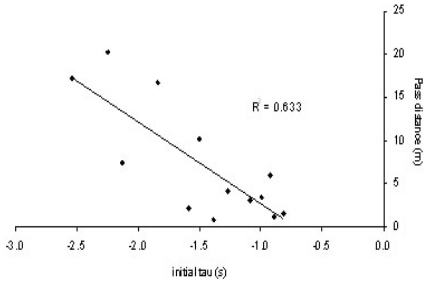

Figure. 2. Linear relationship between initial tau (independent or predictive variable) and pass distance (dependent variable) (data from Correia, et al, submitted).

and a final location/value (i.e., a closing motion-gap of any measurable dimension, such as the distance between two opposing players) considering that its rate of loading is kept constant (Lee, 1998). It has therefore the advantage of discharging behaviour emergence from the need of information processing or enrichment (likewise endorsed by other theoretical approaches of behaviour, see Williams & Ward, 2007). This happens because of the way the space or the dimension described by this variable closes and the correspondent information it provides about future system states of affair are directly perceived by the individual. Therefore, General Tau Theory does not concern only with space perception, but instead stands towards this process as a spatial-temporal coordination problem (Warren, 2007).

Likewise Araújo (Araújo et al., 2004; Araújo et al., 2006), a recent study analysed the way the variable tau would be involved in the detection and use of pass action possibility for a teammate in rugby union (Correia et al., submitted). In this study, performed with data taken from actual match situations, a significant correlation was verified between the initial tau value of the distance motion-gap between attacker with ball and the defender, and subsequent pass characteristics (namely, duration and distance). A linear relation between both variables was found (see Figure 2). These results show evidence of a prospective control of action, in this particular case, of pass action. In this study the detection and use of the affordance relative to pass type results from the exploration of time-to-closure of the distance between players that approach each other, specified by the tau of the closing distance between attacker with the ball and defender.

Why include tau in the study of decision-making in basketball?

The presentation of parameters that influence players' behaviour, as operacionalised in the studies of Araújo and colleagues (Araújo et al., 2004, 2006), can be considered in agreement with the ecological premise that action is guided by information (Gibson, 1979). Nevertheless, the parameters analysed in these studies – interpersonal distance and relative velocity– are perhaps less informative than the tau variable (i.e., variable that specifies

the time to closure of any measurable gap). The tau of the closing distance gap between attacker-defender seems more informative by comprising in an indivisible way both dimensions, space and time, providing then spacio-temporal information emergent from the approach between players. In the studies of Araújo and associates (2004, 2006) the decisional behavior of the basketball players in the one-on-one task could be explained by the detection and use of the information about the time to close the gap between the players. The results of Correia et al. (submitted) showed evidence that the variable tau can be considered as an informational variable that drives or constrains the decisional behaviour of players. In this way, it is argued that the empirically found relation between informative variables (that supply only spatial or temporal information, i.e., respectively, the interpersonal distance and the relative velocity) and the emergency of decision making, could be enriched by the analysis of an informational control parameter that enfolds both types of information, that is, the variable tau. A better understanding about the interaction between players during the competition and what information is potentially constraining their behaviour might represent an assistance for the promotion of a practice better adjusted to the constraints (information) that are in fact present in the competition context.

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