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The influence of previous sport experiences in transfer of behaviour patterns among team sports

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THE INFLUENCE OF PREVIOUS SPORT EXPERIENCES IN TRANSFER OF BEHAVIOUR PATTERNS AMONG TEAM SPORTS
KEYWORDS: Transfer; Behaviour patterns; Performance analysis; Team sports.
ABSTRACT. The present study aimed to examine how players' positional data can be used to assess the transfer of behaviour patterns among team sports (basketball, football and rugby) in early specialized and diversified sport careers. Thirty-four college students were divided into early specialization and early diversification groups, according to information provided by a questionnaire designed to obtain detailed information about their sports career. In-game derived variables were calculated based on players' positioning data, collected by GPS and processed with non-linear techniques (approximate entropy). For each positional variable (distance to both team and opponent team centroid and distance to target and opponent target) a top-10 ranking was computed based on approximate entropy values in basketball, football and rugby game performance. The results suggested that students belonging to the early diversification group are over-represented (top-10) in all positional variables regardless of sport. This trend, especially in football and rugby, confirms that it is possible that transfer of behavior patterns occurs more significantly in early diversified approach.

Technological advances have brought more and better information to the study of sports performance. The emergence of global positioning system (GPS) technology in team sport has contributed significantly to these advances (Cummins, Orr, O'Connor and West, 2013). According to Aughey (2011), GPS have been applied to detect fatigue in matches, identify periods of most intense play, different activity profiles by position, competition level and sport. More recent research has integrated GPS data with the tactical information and collective positioning variables (Sampaio, Lago, Gonçalves, Maçãs and Leite, 2014). The player's collective tactical behaviour and intra-team coordination tendencies are assessed through team centroid (i.e. the mean position from all players) (Sampaio and Macas, 2012) and through the distance to target (i.e. players moving synchronously in the direction of the basket) (Leite et al., 2014). The last one, may suggests the basket as a system attractor, acted as a key task constrain (source of information) to shape system interactions (Esteves et al., 2012).

Research on expertise has shown that positioning and decision-making have been identified as the key tactical skills that best predict adult performance level (Kannekens, Elferink-Gemser and Visscher, 2011). Nowadays, it is available interesting information regarding expert profiles in sports domain, but otherwise it's misunderstood evidence about how these athletes developed such characteristics. In this sense, Abernethy, Baker and Côté (2005) refers that experts receive exposure to a wide range of sports in their developing years and also confirms the inverse relationship between previous sport experiences and the amount of sport-specific training needed to become an expert. In fact, an early diversification sport career does not limit access to elite status especially in sports where peak performance is reached after the maturation (Côté, Lidor and Hackfort, 2009). Besides, several authors refer benefits of this type of practice, such as transference of patterns between related sports (Abernethy et al., 2005; Baker, Côté and Abernethy, 2003; Smeeton, Ward and Williams, 2004).

The concept of transfer of learning holds that an individual who acquires successful performance in one task or domain can transfer that successful performance into another task (Duncan, 1953). And then, new insights are coming since recent studies have started to examine perceptual and behaviour transfer and whether pattern recognition and recall skills may be related to decision-making skills (Causer and Ford, 2014). According to all these considerations, there is some evidence that early diversification in many sports can positively impact later success in sport (Abernethy et al., 2005; Baker et al., 2003). However, this evidence is far from clear, as regards the recent research of Collins, Collins, Macnamara and Jones (2014) stated. Thus, the aim of the present study was to examine how players' positional data provided by GPS devices can be used to assess the transfer of behaviour patterns among team sports (basketball, football and rugby) in early specialization and early diversification sports career.

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Method

Participants

Thirty-four college students (age, 22.3 ± 2.6 years; weight, 66.6 ± 9.7 kg; height, 171.3 ± 8.4 cm) from a physical education degree at University of Trás-os-Montes and Alto Douro (Portugal) volunteered to participate in this study. All participants received a clear explanation of the nature and the demands of the study, and wrote an informed consent before testing. The investigation was approved by the local Institutional Research Ethics Committee and conformed to the recommendations of the Declaration of Helsinki.

Procedures

Each participant completed a questionnaire designed to obtain detailed information about their sports path (Leite, Baker and Sampaio, 2009) (see Table 1). As the questionnaire task relied extensively on the retrospective recall of the participants, they were required to repeat measures were taken to cross-validate the data (Baker et al., 2003; Leite et al., 2009). Thus, 10 % of the sample was asked to refill the questionnaire one month after the first data collection. To examine the correspondence of information reported at both time points the percent agreement was computed (Bahrick, Hall and Berger, 1996). There was a complete agreement (100 %) between the information given by the participants in both moments. Following this procedure and after a detailed examination of the longitudinal sport career of each participant, the researchers grouped the subjects in two categories: early specialization and early diversification sport career. The definition of these categories follows the guidelines of the *Long-Term Athlete Development* model extensively reviewed by Ford et al. (2011).

Participants performed an initial standardized warm-up period of 15 min. Following this period, 3 games were played interspersed with a 20 min. interruption: 1st: 4-a-side basketball game in a 28x15m outdoor court; 2nd: 6-a-side football game (Gr + 6 x 6 + Gr) in a 60 x 40m outdoor natural turf pitch; 3rd: 7-a-side rugby game in a 60 x 40m outdoor natural turf pitch. All games had the same duration: 4 bouts of four min. duration interspersed with 3 min. of rest, and reproducing as much as possible the official game. The players' positioning data were gathered using GPS units (15 Hz) (SPI Pro, GPSports, Canberra, Australia). To decrease measurement error and increase the validity and reliability of the system, the players used the same unit across all the game situations (Johnston, Watsford, Kelly, Pine and Spurrs, 2014).

Data Processing and Analysis

The players' positioning data were exported from the GPS units and computed using dedicated routines in Matlab R2013b software (version 6.5; Math-Works, Inc., Massachusetts, USA) according to the guidelines suggested by Folgado, Duarte, Fernandes and Sampaio (2014). The data were used to obtain the centroid of each team (i.e. the mean position from all players). Then the follow variables were calculated: distance from each player to both team and opponent team centroid, and distance from each player to both target and opponent target. These variables were processed with nonlinear techniques (approximate entropy, ApEn) to identify the regularity in players' movement patterns (see Sampaio and Maçãs, 2012). The values range between 0 (more regularity) and 2 (less regularity) of unitless real numbers. According to the obtained values in ApEn players were allocated in a top-10 ranking for each variable: for the distance to centroid and distance to target we select the most regular players, on the other hand for the distance to opponents' centroid and distance to opponents' target we select the less regular players for each team sport (basketball, football and rugby). Players who specialized in any of the team sports under examination were automatically excluded from the top-10 ranking.

Variables	Early Specialization	Early Diversification
Main sport starting age	10.8 ± 2.6	11.7 ± 3.5
Milestones (hours)		
Unstructured practice	336.5 ± 254.9	676.9 ± 505.8
Deliberate practice (specific sport)	1756 ± 878.3	2772.9 ± 1287.5
Total hours Free practice + Deliberate practice	2092.2 ± 1520.1	3361.9 ± 1764.4
Competition (hours)		
Main sport	741.8 ± 445.1	800.6 ± 449.0
Other sports	44.1 ± 110.1	159.9 ± 145.4

Table 1. Sport career milestones (mean, SD in years of age and hours) for the early specialization and early diversification groups.

Variables	Basketball (top-10)		Football (top-10)		Rugby (top-10)	
	Early Specialization	Early Diversification	Early Specialization	Early Diversification	Early Specialization	Early Diversification
Distance to centroid	3	7	2	8	2	8
Distance to opponents' centroid	4	6	3	7	3	7
Distance to target	5	5	3	7	3	7
Distance to opponents' target	5	5	4	6	3	7
Total	17 (42.5 %)	23 (57.5 %)	12 (30 %)	28 (70 %)	11 (27.5 %)	29 (72.5 %)

Table 2. Results from top-10 ranking players according to positional variables (absolute values) for the early specialization and early diversification cohorts in different teams' sports.

Results

Table 2 presents the results of the positional variables for early specialization and early diversification cohorts in each of three team sport played – basketball, football and rugby. The results confirm the higher frequency of students included in early diversification group in all positional variables regardless of team sports (approximately 67 %). This trend is especially noted in football (28 in 40) and rugby (29 in 40). Results confirmed that subjects belonging to early diversification cohort presented greater intra-team regularity in distance to centroid variable in all sports.

Discussion

The aim of this study was to examine how players' positional data provided by GPS devices can be used to assess the transfer of behaviour patterns among team sports in specialized and diversified sport careers. Globally, the results suggests an over representation of subjects whose career was defined as early diversification in all positional variables regardless of the team sports analyzed – basketball, football or rugby. The results reinforce the idea that players who had a diversified sport background were not in disadvantage compared to players who specialized early (Baker, 2003). In fact, the aforementioned sport career milestones showed that students who had an early diversification sport career accumulated a larger number of hours of free practice and deliberate practice, as well as competition hours in main sport but also in others sports, compared to the early specialization cohort. Thus, exposure to practice these skills in other sport environments could explain some results of this study. There is some evidence that deliberate play activities (i.e. low-structured game) resulted in better tactical game intelligence in comparison to structured practice (Greco, Memmert and Morales, 2010). Furthermore, Baker and colleagues (2003) indicated that participation in other relevant activities (e.g. other sports where dynamic decision-making is necessary) could improve physical and cognitive skills.

To explain these results, some researchers have proposed that early sampling provides motor, perceptual and pattern recognition skills transferability (Abernethy et. al., 2005; Collins et. al., 2014), mainly due to the different environments and stimuli experienced through different sports. It is well-known that particularly in team sports, athletes are required to simultaneously perceive the positions and movements of teammates, opponents, and the ball, then consciously decide on the best possible action (Memmert and Furley, 2007). In this sense, the GPS technology brings new insights as demonstrated in Sampaio and Maçãs (2012) study, pointing that game pattern regularity as a game performance indicator. The top-10 rankings were obtained in accordance with this principle, and thereby we can conclude that previous experiences may develop in a more fruitful way intra-team adaptation regardless of sport practiced. But how do they get this organization during the game? In fact, in team sports the players deal with a multitude of attention processes (Huttermann and Memmert, 2014), and one possible explanation is that involvement in several sports during early stages improve their focus of attention to relevant stimulus and consequently, provides a better decision-making. In a study of Memmert and Furley (2007) the results revealed that team's players need a wide breadth of attention in order to generate tactical response patterns and seek original solutions in their game plans. Also, Memmert and Harvey (2010) refers a tactical transfer between games from the same category (i.e. invasion games) can be easily evidenced by players with a diversified path. Additionally, interesting findings were observed in the target variables obtained in basketball, with an identical representation between both sport careers. Perhaps, the distinctive characteristics of basketball game may justify these results, however future researcher in this domain is required to confirm the obtained results in our study.

The variability of sport careers reinforces the need for additional work to establish precisely what benefit is accrued from participation in several sports and activities outside of main area of specialization. The results support the idea that involvement in several sports during the early stages of development is an alternative to early specialization. This study showed new benefits of an early diversification, which seems to benefit the transferability of behaviour patterns between similar sports, or at least among those sports that share functional characteristics.

LA INFLUENCIA DE EXPERIENCIAS DEPORTIVAS ANTERIORES EN LA TRANSFERENCIA DE PATRONES DE COMPORTAMIENTO ENTRE DEPORTES DE EQUIPO

PALABRAS CLAVE: Transferencia, Patrones de comportamiento, Análisis de rendimiento, Deportes de equipo.

RESUMEN: El presente estudio tuvo como objetivo examinar cómo se pueden utilizar los datos posicionales de los jugadores para evaluar la transferencia de patrones de comportamiento entre los deportes de equipo (baloncesto, fútbol y rugby) en las carreras deportivas de especialización ó diversificación temprana. Treinta y cuatro estudiantes universitarios fueron divididos en grupos de especialización temprana ó de diversificación temprana, de acuerdo a la información proporcionada por un cuestionario diseñado para obtener información detallada acerca de su carrera deportiva. Las variables de la situación de juego, fueron calculadas en función de los datos de posicionamiento de los jugadores, obtenidos por GPS y procesados con técnicas no lineales (entropía aproximada). Para cada variable posicional (distancia de la propia equipo a su centro, y la distancia al centro del equipo contrario y la meta oponente) se calculó un ranking top-10 con en base a los valores de entropía aproximadas en el juego del baloncesto, fútbol y rugby. Los resultados sugieren que los estudiantes pertenecientes al grupo de la diversificación temprana son más representado (top-10) en todas las variables posicionales, independientemente del deporte. Esta tendencia, sobre todo en el fútbol y el rugby, confirma que es posible que la transferencia de patrones de comportamiento se produce más significativamente cuando la iniciación deportiva es direccionada a una diversificación temprana.

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