Original Article

A systemic overview of football game: The principles behind the game

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ABSTRACT

Clemente, M.F., Lourenço Martins, F.M., Sousa Mendes, R., & Figueiredo, A.J. (2014). A systemic overview of football game: The principles behind the game. *J. Hum. Sport Exerc., 9*(2), pp.656-667. The football game is a specific system constituted by many players' interactions. The specific nature of such sport must be properly analyzed and discussed in sport community in order to understand the principles that rules the system organization. As a team sport with specific properties it is truly important to discuss how players' interactions from the dynamic nature of game. Therefore, the aim of this study is to classify the football game as a team sport and to discuss their specific dynamic that determines the emergence of a tactical behavior and a strategic definition. Such discussion can be important to determine the specific pedagogical and didactical contents to teach at youth football training and even in Physical Education classes. **Key words**: FOOTBALL, SYSTEMS, PRINCIPLES OF PLAY, PEDAGOGY

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TEAM SPORTS: SYSTEMIC NATURE

Animals such as elephants, bison and quail form defensives circles, and predators often adopt complex attacking patterns to cope with these defensive formations (Deneubourg & Goss, 1989). Additionally, many collective activities performed by social insects result in complex spatio-temporal patterns (Bonabeau, Theraulaz, Deneubourg, Aron, & Camazine, 1997). Thus, individual agents in complex systems have a tendency to spontaneously organize themselves into rich coordinated patterns by modifying their movements on the basis of local social interactions (Couzin, Krause, Franks, & Levin, 2005). Jarman and Jarman (1979) propose that the tendency to take the same speed and direction is the major force that allows ungulate herds to be a stable and structured organization. The behaviour of agents – either natural or artificial – was perceived as similar, and it was reported that collective behaviours in both systems emerged from non-linear responses over time supported by local interaction rules (Halloy et al., 2007).

A system is said to be quasi-decomposable if it can be decomposed into isolated subsystems, with some interaction between them and the environment (Gréhaigne, Bouthier, & David, 1997). Therefore, they may be considered either: *i*) microsystems, obtained by retaining only a few subsystems with all of their interactions (e.g. confrontation between two force lines at a given instant); and *ii*) infrasystems, obtained by retaining only a few subsystems with some of their interactions (1 vs. 1 or 2 vs. 2 at a given point in the match).

As with the general characteristics of systems, interactions among subsystems are either energy-based or information-based. These subsystems may organize themselves into various types of networks, which are either superimposed upon or merged inside the system (Gréhaigne et al., 1997). One example of this fact occurs when some players act during an offensive moment, thereby generating specific forms of cooperation, i.e. generating a subsystem.

System analysis has been developed as a result of the interaction between various scientific areas, including biology, information theory, cybernetics and the theory of systems (Gréhaigne et al., 1997). Complex systems manifest a number of fundamental characteristics, including many different levels in the system; a capacity for stable and unstable patterned relationships among parts of the system, and which emerge through system self-organization; and the ability of subsystem components to constrain the behaviour of other subsystems (Kauffmann, 1993; Kelso, 1995). The way in which order emerges in the complex behaviour of dynamical systems is a fundamental problem for scientists studying natural phenomena within this framework of analysis (Handford, Davids, Bennett, & Button, 1997).

In trying to describe dynamical systems' etymological sense, it is possible to report that the system is an agglomeration of related parts that can be perceived as a single entity. "Dynamical" means that the system changes over time. Therefore, a dynamical system is a system where the state changes over time (Araújo, 2006). Dynamical system theory may offer a greater scope and potential for scientific endeavour in performance analysis (Glazier, 2010). Therefore, dynamical systems can be interpreted either via a mathematical and physics-based conception. From the mathematical viewpoint, dynamical systems theory is the branch concerned with studying the evolution of numerical systems in the form of equations of motion (Araújo & Davids, 2009). From the physics-based viewpoint, on the other hand, it is possible to analyse spontaneous patterns formations, phase transitions, symmetry breaks, self-organization, and micro or macro complexity. Summarily, a dynamical system is a set of quantitative variables that change continually, simultaneously and interdependently throughout time, and according to mathematical equations (Araújo, 2006).

Structurally speaking, the elements of the system are represented by the two opposing teams, while the communication network between the two is defined by the rules of the sport (Gréhaigne et al., 1997). A more dynamic aspect of interpersonal coordination involves synchrony or entrainment, in which the movements of interacting individuals become organized in time and space (Richardson, Marsh, & Schmidt, 2005). To this end, collective systems are dependent on information available in specific contexts, particularly the information that is created by each individual's tactical actions (Passos et al., 2008).

A player has to act in order to perceive a teammate's behaviours, as well as those of a defender and the opposition (Passos et al., 2011). Interactions among players originate in coadaptive behaviours, where players adjust their behaviours relative to the perceived actions of neighbouring players in order to achieve performance goals (Fajen, Riley, & Turvey, 2009). Effectively, aggregations often behave as a unit, with properties that are not merely a sum of individual behaviours, but which also sometimes result in new functions (Parrish & Edelstein-Keshet, 1999). Thus, the idea is to characterize the opposition's rapport from a space standpoint. In doing so, we can analyse the relationship and dynamic between the strengths of the attack system, on the one hand, and those of the defensive system on the other, and thereby ascertain how collective behaviours emerge. The notions at stake here include 'in block', 'in pursuit', centre of gravity and ball circulation (Gréhaigne et al., 1997).

TEAM SPORTS: CLASSIFICATION AND ANALYSIS

Logic, tactics and practice each constitute the notions that involve two central and associated ideas: *i*) the reality of the game is intelligible; and *ii*) any intervention in this reality can be the subject of objective, and thus rational, inquiry (Gréhaigne, Richard, & Griffin, 2005). Therefore some authors advocate that the essence of game style is inherent in their players (Deleplace, 1995; Wade, 1970). The statement emphasizes that players have the greatest influence in the evolution of the playing style, as the game actions are performed by them (Gréhaigne et al., 2005). However, coaches, referees and rules constitute the complementary factors that influence the game.

The properties of the sport constitute a fundamental constraint to the potential improvement of players (Almond, 1986). Therefore, match analyses need to consider relevant factors that determine the quality of collective performance in the relationship of strengths between opposite teams, as well as the competency network between teammates (Gréhaigne et al., 2005). Knowledge about relationships within the opposite team and their style of play represents essential information for the efficacy of match analysis.

So does the intrinsic dynamic of the game constrain and determine the quality of a team's performance? This intrinsic dynamic of each sport is related with specific components and their rules, and thus players' type of action and performance depends directly on the sport's characteristics (Gréhaigne et al., 2005). Indeed, the rules determine the sport's essence, as do the type and principles of play, as well as the relations between teammates and opponents. These rules can be defined as: *i*) the modalities of scoring (i.e. the characteristics of the game's target); *ii*) the players' rights (based upon the modalities of scoring); *iii*) the liberty of action (that players have with the ball); and *iv*) the modalities of physical engagement (that ensure the respect of the three previous rules). These characteristics allow us to group sports in the following four categories according to their specificities: *a*) target games; *b*) net/wall games; *c*) striking/fielding games; and *d*) invasion games (Webb, Pearson, & Forrest, 2006).

The aim of target games is to place a projectile in a target in order to achieve the best possible score (Webb et al., 2006). Target games can be classified according to whether they are unopposed or opposed. In the case of unopposed target games (e.g. golf, archery, bowling), the accuracy of the player in relation to the target determines their own success. In opposed target games (e.g. bocce), players have the opportunity to constrain the opponent, interfering with their ball position in order to take advantage for themselves (Webb & Pearson, 2008).

In net/wall games, the player or team aims to send an object into their opponent's field so that it cannot be played our returned. Examples of the net games are tennis, badminton or volleyball. Racquetball or squash are examples of wall games (Webb & Pearson, 2008).

The main goal of striking/fielding games (e.g. baseball, softball, cricket) is to score more runs than the other team using the number of innings and time allowed. This is usually achieved through the efficacy of the strike in relation to a ball when it is projected by the opposing team.

The purpose of invasion games is to invade your opponent's field, aiming to score more points within the time limit than the opposing team (Webb et al., 2006). Invasion games can be grouped into subcategories (Webb & Pearson, 2008) including: *i*) where the ball can be carried or caught across the line (e.g. rugby, American football); *ii*) can be thrown or shot into a target (e.g. basketball, netball); or *iii*) can be struck with a stick or foot into a target area (e.g. hockey, football).

It is important emphasize that the target's positioning, as well as the type and dimension of the field, can define the type of technical and tactical skills inherent to the game (Gréhaigne et al., 2005). The space to run, as well as the format and position of the target, are strong constraints to the technical action and the tactical behaviour of the teams' attempts to achieve their main goals. As such, it is fundamental analyse the systemic model of sports games in order to understand how players act collectively when trying achieve collective goals.

INTERNAL LOGIC OF TEAM SPORTS

The opposition and coordination between two teams is the essence of invasion sports, where each team tries to recover, maintain and move the ball to the score zone in order to score a goal (Gréhaigne & Godbout, 1995). Metzler (1987) describes the essence of the team sports as a possibility to actively solve an unpredictable set of problems with the highest efficacy possible. This problem-solving occurs simultaneously in the offensive and defensive phases, depending on the ball possession state. Therefore, invasion team sports constitute a complex and dynamical system that persist throughout the match, constantly adapting to the contextual constraints (Gréhaigne et al., 1997; McGarry, 2005).

Rapport of Strength

The fundamental notion of opposition leads us to consider two opposing teams interacting as organized systems within a match (Gréhaigne, Godbout, & Zerai, 2011). Usually, the relationship between teams is antagonistic, as each are trying to achieve their own goals while hampering their opponent's actions. These antagonistic links between several groups of players, who are each confronted by virtue of certain game rules, may in fact determine interaction patterns (Gréhaigne et al., 1997). Thus, the opposition concept helps in highlighting the pressure notion at a particular point in the game so as to break the balance of forces during momentary configurations of play (Gréhaigne et al., 2011). Therefore, ball possession may change at any instance, inverting the direction of play, and thus making team sports a dynamic, variable

and at certain points an unpredictable game (Gréhaigne et al., 2005). This proves that their complexity is composed of many interactive components (McGarry, Anderson, Wallace, Hughes, & Franks, 2002).

Despite these complex characteristics, different organizational levels can be identified in many team sports. During the match, the global opposition relationship breaks down into partial oppositional relationships, i.e. sub-phases. These opposition settings momentarily involve a few players, generating specific shapes of play (Gréhaigne et al., 2005). Thus, this strength rapport is a permanent characteristic of the game in terms of ball possession and the organizational quality of the teams in their attempt to achieve their main goals and annul their opponent's strong points.

Network

At the organizational level, the numerous interrelations between players within the team make up what one might call a competency network (Gréhaigne, 1992). The competency network is based on each player's recognized strengths and weaknesses with reference to the practice of the sport, and also in relation to the group's dynamism (Gréhaigne et al., 2005). Therefore, team function performance in sports is assured by a complex network of interpersonal relationships among players (Passos et al., 2011); as such, the competency network is more of a dynamic concept than a static one (Gréhaigne, Godbout, & Bouthier, 1999). Any network analysis needs to consider the regular and variable interactions between players. In the study of competency networks, some works have been undertaken in order to improve knowledge about the teams' collective behaviour (Grunz, Memmert, & Perl, 2012; Memmert & Perl, 2009).

Different computer-based approaches have attempted to extract and analyse tactical patterns in team sports (Grunz et al., 2012). Considering Memmert and Perl (2009), there are three ways of using a dynamically controlled network: i) as a static tool (if the application context does not change); ii) as an adaptive tool (if the application context is changing); and iii) as an object of analysis (if the learning dynamics of the network is of interest).

Recently, a water polo team was seen to apply the networking method to analyse intra-team behaviour. Through a networking method – among other analyses – it may be possible to identify the player who most frequently interacts with their neighbour (i.e. teammates), as well as their own contribution to successful and unsuccessful collective performance (Bourbousson, Poizat, Saury, & Seve, 2010). In their study, Passos et al. (2011) built an adjacency matrix for each unit attack, and found that two linkage levels were established: i) identification when a player passed the ball to a teammate; or ii) identification when players changed their position in the performance area due to a teammate's displacement. In terms of the usefulness of this method, the results suggest that the networking method provides an interesting tool to qualitatively describe the interactions that occur between team players in water polo games (Passos et al., 2011). Furthermore, it is possible identify the preferential attachments between players and their efficiency.

Strategy and Tactics

Tactics and strategy are two different terms that need to be understood individually when considering the sport context. Strategy relates to the principles of play or action orientations which enable a team's organization and preparation for a given match (Bouthier, 1988). On the other hand, tactics relate to the players' orientation during the game in order to adapt their initial requirements to the dynamical constraints performed by the opposite team. Thus, strategy constitutes the elements previously discussed by the organization (i.e. a team) to prepare for a match (Gréhaigne & Godbout, 1995). Indeed, strategy relates to the general order, i.e. the players' positioning and their distribution in the field, as well as the specific missions of each player (Gréhaigne et al., 1999). Tactics, however, relate to the punctual adaptation to new

play configurations, to the state of ball possession and to an opponent's position (Gréhaigne & Godbout, 1995). The tactic concept relates to the behavioural adaptation in response to the opponent and the play status (Gréhaigne et al., 2005).

Therefore, there are substantial differences between strategy and tactic at the time and space levels. Strategy relates to the more elaborate cognitive processes due to the larger amount of time needed to prepare and lower constraints (Gréhaigne et al., 1999). In comparison, the tactic concept requires higher levels of decision-making and behaviour adaptations in functions related to contextual constraints, i.e. action decisions. Thus, tactical behaviour prevails during the game (Gréhaigne et al., 1999).

Considering the above-mentioned points, some principles underlying the team's strategies and tactical behaviour provide a higher organization and structure to collective behaviour. Without principles of play, teammates' relationships may lose some organization, decreasing the opportunity to play as a team or unit. Thus, the team sports theory has developed some principles over the years that potentiate collective behaviour and the quality of play.

Principles Underlying Strategy and Tactics

The principles behind strategy and tactics are predominantly related to players' actions. All of these principles are linked to the main goal of the game, i.e. surpass the opponent's actions and achieve victory. The general principles are fundamentally related to a relationship with strength or the establishment of a competency network. As such, these principles could be related with the majority of collective invasion sports games. The following section will present nine principles underlying strategy and tactics, as suggested by Gréhaigne et al. (2005).

Deception Principle

This principle is related to the ability to force the opponent to make mistakes. Through the deception principle, players (collectively or individually) use fakes to outwit their opponents. Deception has an essentially collective basis, requiring higher levels of the involvement among teammates. One example of the deception principle is collective organization against the opposing team in order to force it into making mistakes in the final phases. Another example is to force the opponent team to play on their weak side by covering their strong side with more players.

Surprise Principle

This principle is closely related to the offensive phase. The objective is to show more unpredictability levels in collective actions in order to destabilize the opponent team in the defensive phase. It is possible to surprise them so as to increase the opportunities to complete offensive actions with success. Thus, this principle relates with the mobility and opportunity principles mentioned below.

Mobility Principle

Unbalancing a defensive organization is one of the chief objectives in an offensive phase. Through fast shifting and good ball circulation, attackers may intrude into a given area of the score zone, disrupting the equilibrium of the defensive organization. Disrupting the opponent's defensive organization is the easiest way to explore the score zone and finalize an offensive action. Therefore, in the offensive phase, the permanent oscillation of the ball around the field is fundamental to moving defenders within the central zone.

Opportunity Principle
This principle relates to the opportunity to take advantage of an opponent's mistakes. Thus, any mistakes committed by the opponents need to be duly taken advantage of in order to increase the opportunity to win. This is a fundamental principle, applicable to all sports that involve competition with others.

Cohesion Principle
All individual actions need to correspond to collective principles so as to ensure that all players are tuned into the specific objective. In other words, all players must play in harmony. The ability to maintain collective structure and act according to the state of the team can help to achieve the key goals, particularly in defensive and offensive phases. By maintaining cohesion, players will have more support to act both in the defensive and offensive phase.
Competency Principle

Cohesion is obtained through the competency network, which involves different roles and functions among teammates. Thus, the whole system acquires a certain homogeneity that makes it possible to lower maintenance energy costs (Gréhaigne et al., 2005). In other words, the competency principle relates to the efficiency of collective action when trying to reduce individual energy costs and act more closely and more organized, i.e. not depending directly on individuals or isolated actions within the collective action.

Reserve Principle
A support player acts as an alternative to immediately restarting a sequence of play, such as when certain manoeuvres have failed. In football, for example, having the forwards take possession of the ball makes it possible to distribute other players and deploy a reserve along the longitudinal axis of play (Gréhaigne et al., 2005).

Economy Principle
This principle is closely related to players' cognitive processes when deciding their actions during functions of efficiency, i.e. achieving better results at the lowest possible cost. Thus, this process depends on to the capacity to organize the team to achieve their goals while maintaining personal principles. The economy principle relates to the competency to understand the whole game and solve problems efficiently.

Improvement Principle
A team's preparation for a match is made by considering their own characteristics and principles, as well as those of their opponents. These knowledge and competences are an initial stage of the team, and thus enable an individual approach to a specific match. Nevertheless, the complex and dynamic processes that occur in a match may require adjustments in order to outperform the opposing team. As such, this ability to understand the dynamic reality of the game, as well as solutions to these problems, may improve collective efficacy, increasing the opportunity to win the match and develop as a team.

Football's Tactical Principles
Tactical principles are defined as a set of play shapes that allows players to quickly achieve tactical solutions to solve any problems originated by the opponent team (Garganta & Pinto, 1994). Collectively, the tactical principles' application helps a team to control the match, maintaining efficacy in offensive and defensive phases. Over the years, many tactical principles have been developed and characterized (Castelo, 1996; Duprat, 2007; Garganta & Pinto, 1994; Zerhouni, 1980). From such authors it is possible organize three theoretical constructs: i) general principles; ii) operational principles; and iii) fundamental principles.

General principles are common to all phases of the game, and are characterized by their spatial and numerical relations to team players and opponents. There are three general principles of the game: i) to not allow a numerical disadvantage; ii) to avoid numerical equality; and iii) to attempt numerical superiority (Costa, Garganta, Greco, & Mesquita, 2009).

The operational principles are the procedures required to solve a set of problems in the game by considering defensive and offensive phases. In the defensive phase, the operational principles are: i) to avoid opponent finalization; ii) to recover the ball; iii) to prevent the opponent's progression; iv) to protect the goal; and v) to reduce the opponent's playspace. Considering the offensive phase, the operational principles are: i) to maintain ball possession; ii) to create offensive actions; iii) to advance on the opponent's field; iv) to create finalization situations; and v) to try to score.

These fundamental principles represent a set of basic rules that guide the action of players and teams in the two phases of the game (i.e. defensive and offensive). These maintain balance in one's own team and unbalance the opponent by trying to take advantage of their weaknesses. These principles are grouped into offensive and defensive categories, wherein each opposes the other. Its importance is essential to improve the tactical quality of the teams, as it organizes collective behaviour in the game status.

Fundamental Defensive Tactical Principles

The defensive principles of play enable better coordination between team players, improving their collective intervention. All defensive principles aim for quick and effective action in order to protect the goal and recover ball possession (Worthington, 1974). The accomplishment of these principles guides the players' positioning on the field in relation to the ball, teammates, opponents, as well as to the main objectives of the team. Thus, the defensive tactical principles aim to constrain the space and time of the opponents so as to achieve their goal, avoiding the effectiveness of the opponent's offensive phase (Bangsbo & Peitersen, 2002).The five fundamental defensive tactical principles are: i) delay; ii) defensive coverage; iii) balance; iv) concentration; and v) defensive unity (Costa et al., 2009).

Delay Principle

The delay principle is characterized by the action of the opposition defender over the attacker, with ball possession aimed at reducing the offensive space, and constraining the opportunities to pass or conclude an offensive action successfully. The guidelines of this principle is the individual and rigorous marking of the attacker with ball possession so as to delay offensive progression, as well as the constraint of passing lines or shooting attempts. During this process, defenders should maintain their position between their own goal and the ball's position.

Defensive Coverage Principle

Defensive coverage refers to the protective action of the first defender, i.e. the second defender protects the defender that makes the delay principle over the attacker with ball possession. Thus, if the attacker with ball possession overtakes the first defender, the second will try to slow the offensive progress. Furthermore, the protective action of the second player can allow an improvement of their defensive action, because they feel safer in cases of failure to attack the ball (Worthington, 1974).

Balance Principle

The first theoretical assumption to accomplish the balance principle is ensuring numerical superiority (or at least numerical equality) in the defensive phase over the opponent. The second theoretical assumption is

the frequent adjustments in reaction to the opponent's positioning. The guidelines of the balance principle are to cover the space and mark the attackers without ball possession, avoiding passing lines, and thus reducing success opportunities.

Concentration Principle

The concentration principle aims to reduce the effective play area of the opposing team; as such, the higher proximity between teammates in the defensive phase increases the effectiveness of the defensive coverage, as well as the protection of the score zone. Therefore, for an effective defensive pressing process, the highest priority is to ensure the concentration principle, as this will make it easier to recover ball possession (Bangsbo & Peitersen, 2002). The guidelines of this principle are to orientate the opponent to play in less dangerous areas, and decrease the length and width of the players' distribution so as to reduce the free spaces between teammates. The concentration principle can be accomplished in any field zone, but depends on the strategies and orientation of the team, as well as the match status.

Defensive Unit Principle

The defensive unit principle is the positioning of off-ball defenders so to decrease the effective playspace of the opponents (Costa, Garganta, Greco, Mesquita, & Seabra, 2010). To accomplish this principle, a deeper knowledge and understanding of the game is indispensable, as is knowledge of the strategic orientations of one's own team. A defensive unit conception depends on the ability to position oneself in the right place according to one's teammates, the ball's position, opponents' position and the status of one's own team. This unit should be ensured throughout the game and in any field zone. By reducing the dispersion of teammates within the ball possession zone, it will make it more difficult for opponents to penetrate between defensive lines. Theoretically, the dispersion level of the team is smaller during an offensive phase and triangulations, and within the area between team defenders.

Attacking Fundamental Tactical Principles

Offensive tactical principles aim to give players fundamental information that allows them to improve collective behaviour. Through tactical principles, it is possible for all players to act in an organized manner, attuning their behaviour with the main goal of the team, i.e. to create successful finalization opportunities and score. Thus, tactical principles are essential guidelines, allowing an improvement of the collective behaviour in order to overtake the defensive organization of the opposing team. The five offensive fundamental principles of play in football are: i) penetration; ii) offensive coverage; iii) depth mobility; iv) width and length; and v) the offensive unit (Costa et al., 2009).

Penetration Principle

The penetration principle is characterized by the progress of the attacker with ball possession in the direction of the score zone. Their main objective is to reach the zone closest to the goal by aiming to finalize the offensive attempt. The guidelines of this tactical principle are to overtake the direct opponent and unbalance the defensive organization in order take advantage of this situation, thereby bringing the ball to a favourable position in the score zone. Actions that identify the penetration principle include progress with ball when trying to approximate the attacker's position to the goal, or when the direct opponent tries to take advantage by overtaking in order to create space to play or finalize.

Offensive Coverage Principle

The coverage principle is characterized by the backing action provided by a teammate to the player with possession. The support provided by the teammates is fundamental to the offensive phase, providing him with many options to conclude the process with efficacy. To benefit from this principle, the attacker with ball

possession needs to simplify their actions, usually by opting for safe passes or actions. Furthermore, it is fundamental that teammates take actions towards or away from the player with ball possession, depending on the position of opponents and the ball.

Depth Mobility Principle

Depth mobility is characterized by teammates' optimal movements to receive the ball from the player with ball possession. These movements can be completed away from the player with ball possession (i.e. break movements) or close to them (i.e. support movements). The guidelines for this principle are the variability of the actions of the ball and opponents' positions, as well as the velocity of the movements when trying to unbalance the defensive organization. All of the mobility processes should be made with intent, i.e. giving valid solutions to successfully conclude the offensive phase (Worthington, 1974). Thus, it is fundamental that teammates understand the dynamic processes that allow them to improve their quality during the offensive phase.

Width and Length Principle

The movements of players should extend and utilise the effective playspace. Increasing the dispersion of players during an offensive phase will make it easier to attract defensive players to non-vital zones (e.g. lateral lines), thereby removing them from the vital ones (i.e. the middle side). Thus, the width and length principle is in opposition to the defensive concentration principle of the opposite team described previously. Resituating some opponent defenders to non-vital areas will make it possible to explore the central area of the score zone. Furthermore, it will be possible for the player with ball possession in the central area to try and overtake the direct opponent, allowing them to benefit from the additional space and successfully conclude the offensive process.

Offensive Unit Principle

The positioning of off-ball defenders decreases the effective playspace of their opponents. Maintaining collective cohesion and the balance between team sectors is as important as an effective and functional distribution of players in relation to ball position, the phase and match status of the game, as well as the opponents' positioning. Thus, a team needs to function as a whole, positioning itself functionally on the field. The fundamental guideline of this principle is their efficient positioning on the field, considering not only their individual missions, but also the collective objective and functionality of the team (Castelo, 1996). This unit principle assumes a balance between the team's sectors (i.e. defenders, midfielders and forwards) as a determinant factor to success when a team loses ball possession. Keeping proximity between team sectors and their balanced organization is easier during defensive organization (Teodorescu, 1984), and increases the opportunities to improve high-quality defensive action. The ultimate goal is to avoid imbalance in the team at any stage of the game.

CONCLUSION

All principles of play are regulated by the inter-players' relationships in a given space and time. This spatio-temporal relationship is truly important and one of the most important variables to be optimized by sports training, i.e. the synchronization of multiple players to achieve a common goal. Therefore, coaches and sports analysts have a specific mission: to observe and collect relevant information about the collective behaviour of players. Using such information can improve football training and the tactical behaviour of football teams. Thus, specific metrics that inspect the collective synchronization of football players has emerged in the most recent literature on match analysis. Despite this important opportunity in literature, few studies have inspected inter-player relationships using specific technological metrics, even though this

would provide coaches and analysts with an easy and quick method to help them obtain information and provide support to plan football training sessions.

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