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System of tactical assessment in Soccer (FUT-SAT): Development and preliminary validation

Sistema de avaliação táctica no Futebol (FUT-SAT): Desenvolvimento e validação preliminar

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ABSTRACT

The purpose of this paper was to report the development and preliminary validation of tactical assessment system in Soccer and highlight its advantages. The validation process followed five perspectives of the concept of validity that consider the value of heuristic methods and the importance of the description of behavior performed in playing situations. Thus, the process of validation was focused on four points: i) acceptability and reasonableness of the test perceived by players; ii) analysis of content of assessment tool through a panel of experts; iii) potential of the assessment tool to discriminate the quality of the performance of players; iv) observation reliability. Values were higher than .63 for correlation between the evaluations of coaches and the system. It shows the potential of this system to distinguish the performances of players based on the evaluations of coaches. The players who performed the field test agreed with its physical demands and spatial and normative configurations. All experts endorsed the categories and variables of this system. The reliabilities showed values higher than .79 for intra and inter-observers. Therefore, it is possible to conclude that the system is valid and reliable for the assessment of the tactical behavior of soccer players.
Keywords: validation, soccer, tactics, evaluation, tactical principles

RESUMO

É objectivo do presente artigo apresentar os procedimentos utilizados no desenvolvimento e estabelecimento da validade de um sistema de avaliação táctica no Futebol, assim como destacar as vantagens deste sistema em relação a outros instrumentos de avaliação do comportamento táctico disponíveis na literatura. Estes procedimentos tomaram em consideração as cinco perspectivas de noção de validade que valorizam os métodos heurísticos e os comportamentos desempenhados em jogo. Desta forma, o processo de validação focou-se em quatro pontos: i) grau de aceitabilidade e razoabilidade do teste de campo entre os jogadores; ii) análise e avaliação de peritos em relação aos conteúdos do instrumento de observação; iii) análise e avaliação dos treinadores em relação ao desempenho dos jogadores no teste de campo; e iv) fiabilidade das observações dos avaliadores. Os resultados mostraram valores superiores a .63 para a correlação entre as avaliações dos treinadores e do sistema. Os jogadores que realizaram o teste de campo concordaram com as suas demandas físicas e configurações espaciais e normativas. Todos os peritos aprovaram as categorias e as variáveis contidas no sistema. As fiabilidades intra e inter-avaliadores apresentaram valores superiores a .79. Como tal, é plausível concluir que as medidas utilizadas no sistema são válidas para o contexto do Futebol e as suas observações são fiáveis para a avaliação do comportamento táctico dos jogadores de Futebol.
Palavras-chave: validação, futebol, táctica, avaliação, princípios tácticos

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The organization inherent to the game of Soccer justifies that the tactical capabilities and cognitive processes that underlie decision-making are considered essential requirements to the performance of players (McPherson, 1994). The essentialities of these requirements become more evident when three aspects of the Soccer game are considered: i) Most of the actions take place when players are not in direct contact with the ball; ii) Players with limited mastery of technical skills are able to play Soccer if they possess a reasonable level of tactical understanding (Oslin, Mitchell, & Griffin, 1998); iii) Poor tactical knowledge may compromise the efficient and/or effective performance of technical skills (Teodorescu, 1984).

Regarding the processes of teaching and training of tactical capabilities, the core tactical principles of the game of Soccer possess high importance for providing the players with the possibility to achieve effective solutions to their movements on the pitch. Collectively, the form and the dynamic of the interactions of these principles and their applications within the context of the game enable the playing pattern of the team to exist. With respect to the organization of the training sessions, teachers and coaches have been trying to develop these principles and the tactical competencies of players by changing the formal and functional structure of the game (Holt, Strean, & Bengoechea, 2002). According to Lee and Ward (2009), these changes are effective because they enable the manipulation of the game complexity, according to the practitioners' tactical knowledge and level of performance.

Such findings seem to display important reasons for player performance; assessments are based on a tactical proposition that highlights movements and respective positioning on the pitch, depending on the match setup. However, the methods and instruments which are available, enable us to clearly define the description of the tactical aspects of the game, such as: i) On the description and quantification of events during games (Ferreira, Paoli, & Costa, 2008); ii) On the description and assessment of specific player behaviors (Memmert, 2002; Suzuki & Nishijima, 2004); iii); On quantification and description of the interaction of players or systems of play (Frencken & Lemmink, 2009; Shestakov, Kosilova, Zasenko, & Averkin, 2007; Tenga, Kanstad, Ronglan, & Bahr, 2009); iv) On the junction of multifactorial indicators of the game to the making of performance indexes (Gréhaigne, Mahut, & Fernandez, 2001; Oslin et al., 1998).

Despite the variety of points of analysis over the tactical aspects and also sports performance, there is a chain of researchers who have stated that the instruments that are available in literature have limitations regarding the description and quantification of tactical indicators that express performance in Soccer (Olsen & Larsen, 1997). Besides that, Gréhaigne e Godbout (1998) highlight the necessity of developing instruments that allow establishing a connection between the content taught in the process of teaching and training, and the behaviors performed by players within the game of Soccer.

This paper aims to clarify the procedures used in the development and establishment of the validity of a system of tactical assessment in Soccer. Moreover, it also aims to highlight the advantages of this system in relation to other instruments of assessment of tactical behavior available in literature. To do so, the structure of results in this paper will follow the model embraced in three other studies that also aimed to present the process of validation of their assessment of player behavior (Blomqvist, Luhtanen, Laakso, & Keskinen, 2000; Oslin et al., 1998; Prudente, Garganta, & Anguera, 2004). The adoption of this structure of results is justified by its instructive and didactic character of describing results according to each procedure used to develop and establish the validity of the System of Tactical Assessment in Soccer (FUT-SAT).

Development and Validation of the System of Tactical Assessment in Soccer

The procedures used to develop the System of Tactical Assessment in Soccer (FUT-SAT), as well as to establish its validity, were conceived based on well-known procedures in literature (Cronbach, 1988; Hopkins, 2008). These procedures took into account the five perspectives on the validity argument described by Cronbach (1988), especially the value of the heuristic methods and the importance of behaviors that are to be assessed by the observation instrument that is intended to be built. Regarding the process of system validation, the procedures used focused on: 1) Face Validity: degree of acceptability and reasonability of the field test among those evaluated; 2) Content Validity: analysis and assessment by experts regarding the contents of the observation instrument, aiming to assure that the variables included in the instrument correspond to the fundamental aspects of the game in its totality and that its categories were exhaustive and mutually exclusive; 3) Construct Validity: analysis and evaluation by coaches regarding players' performance within the field test, aiming to verify the potential to discriminate the quality of players' performance through performance indexes used in the system, corresponding to the categorizations presented by the coaches; and 4) Reliability of Observations: temporal consistency/stability of the observers, aiming to verify the understanding they have, regarding the variables used in the observation instrument, their ability to avoid the three typical errors within the process of evaluation of images (operational, observational and comprehension) and the accuracy of reproduction of the measure through time.

The following two points in this paper include the detailed description of the procedures that were used in the development and validation of FUT-SAT. The first one deals with aspects related to the conceptual structure, composition and protocol. The second focuses on the description of the procedures used to establish the system validity and on the presentation of the obtained results.

All procedures were in accordance with the standards of the institutional research ethics committee.

All participants and their parents (only for the 17-year-old participants) signed informed consent forms before participating in this study.

Development of the System of Tactical Assessment in Soccer

Conceptual Structure of the System

FUT-SAT was built with the aim to easily provide coaches, teachers and researchers with a means to access specifically, and objectively the information that reflect tactical behaviors performed by players in game situations. Its conceptual structure is founded on the core tactical principles of Soccer, being for the offensive phase: penetration, offensive coverage, depth mobility, width, length and offensive unity; and for the defensive phase: delay, defensive coverage, balance, concentration and defensive unity (Costa, Garganta, Greco, & Mesquita, 2009c; Worthington, 1974). These principles were chosen for representing the core aspects of the process of teaching and training of the tactical capability. Besides that, this set of principles has objective measures of the players' motion according to the management of game space performed by them.

The presence of these principles in the core structure of FUT-SAT helps to understand the tactical organization of the game, since the dynamic of its interactions and applications is related with the model and the playing level of the teams. Furthermore, the use of modified spaces to the assessment of the tactical behavior matches the needs of teaching and training, since many coaches use changes in structure of their game drills, whether they are to facilitate the flow or to induce the occurrence of actions related to the tactical capabilities (Holt et al., 2002).

The use of the numeric setup GK+3 vs. 3+GK (goalkeeper + 3 players vs. 3 players + goalkeeper) arises from the understanding that this structure ensures the occurrence of all tactical principles inherent to formal play. This configuration enables, in offensive terms, the movement from a binary choice to a multiple choice and the preservation of the play without the ball, since it gathers the ball carriers and two potential receivers. From the defensive point of view, it gathers a direct defender of the ball carrier (1st defender) to perform the delay and two defenders (2nd and 3rd), relatively more distant from the ball carrier, to perform possible distance coverage, such as double marking and compensations, respecting other defensive tactical principles (Garganta & Gréhaigne, 1999).

Due to such characteristics, this system enables the progress in terms of objective measures of players' motion in the game, what has been emphasized by literature as a limitation for the building of reliable instruments for assessment of player performance (Olsen & Larsen, 1997). The consideration of the tactical principles as nuclear aspects of assessment also presents advantages in the contextualized and longitudinal assessment of the players, during the whole process of formation, since they are all considered principles taught during this process (Gréhaigne & Godbout, 1998).

Another advantage of the system concerns the flexibility of use of its categories and variables, since they can be used according to the objectives of the coach or the researcher. This system also meets the need to assess specific tactical aspects of the game of Soccer that up to now had not been covered in the existing instruments in literature (Gréhaigne et al., 2001; Memmert, 2002; Oslin et al., 1998), and enables the assessment of the dynamics established by players with and without the ball during the game, considering the presence and quality of interaction of the opponent (Tenga et al., 2009).

Composition of the System
Variables and Categories

FUT-SAT comprises two macro-categories, seven categories and 76 variables that are organized according to the type of information dealt with by the system (see Figure 1). The Macro-Category Observation comprises three categories and 24 variables. The Macro-Category named Tactical Principles features ten variables. The category Place of Action in the Game Field features four variables and the category Action Outcomes features ten variables.

The other Macro-Category Outcome features four categories and 52 variables. In this Macro-Category, all four categories Tactical Performance Index (TPI), Tactical Actions, Error Percentage and Place of Action Related to the Principles (PARP) feature the same thirteen variables. The Macro-Category Outcome has this designation due to its variables being dependent on the information coming from the variables that compose the Macro-Category Observation.

Observation Instrument

The observation instrument integrated in this systemic conception of assessment enables the analysis, assessment and classification of the tactical actions performed by the players with and without the ball, according to the variables within the categories Tactical Principles, Place of Action in the Game Field and Action Outcomes.

The variables in these three categories were initially conceived through consultation of the literature (Castelo, 1996; Memmert & Harvey, 2008; Oslin et al., 1998; Teodorescu, 1984; Worthington, 1974). The aim was to identify the tactical principles, the place and action outcomes that should be considered in the assessment of the players' tactical performance. This procedure was preceded by the formulation of the definitions and the categorization of each variable. Chart 1 shows the categories, sub-categories, variables and

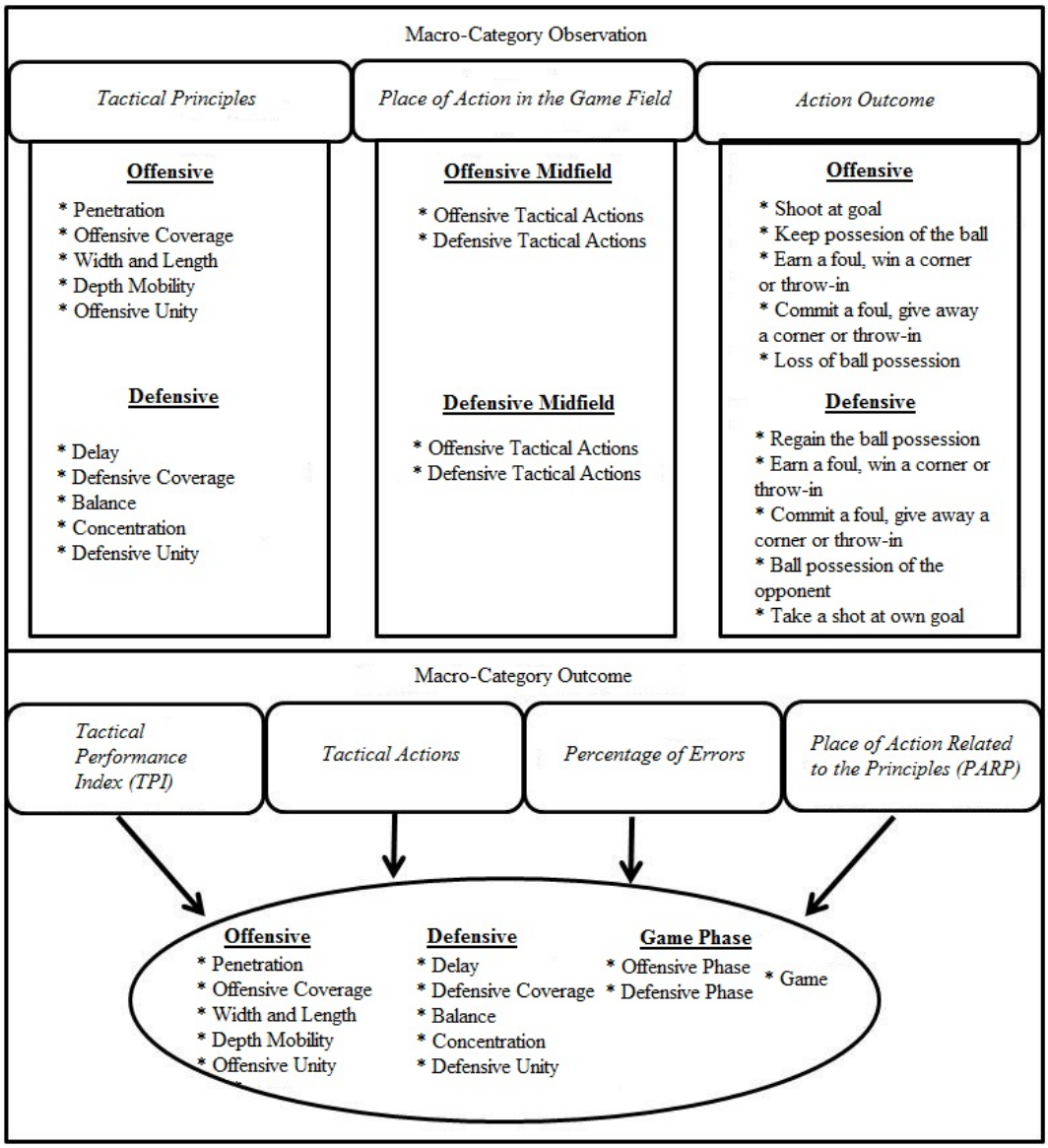

Figure 1. Structural organization of the variables of the System of Observation, Analysis and Assessment of Tactical Performance in Soccer

definitions used in the observation instrument.

The tactical actions that represent each principle were identified as a criterion, the possibility to observe them during the game through players motion (James, Mellalieu, & Hollely, 2002). The identification procedure was similar to the previous one, i.e. from consultations to literary references about the topic. Through this procedure it was possible to reference tactical actions, establish spatial references and identify the performance indicators during the performance of each of the principles (Hughes & Bartlett, 2002). The spatial references, the tactical actions and the performance indicators can be consulted in a recent published study about the conception and development of the observation instrument (Costa, Garganta, Greco, & Mesquita, 2009a). The spatial references are based on the concepts of a grid, game epicenter, ball line and game center (see Figure 2).

Chart 1

Definitions, categories and sub-categories of variables assessed by FUT-SAT

Categories	Sub-Categories	Variables	Definitions
Tactical Principles	Offensive	Penetration	Movement of player with the ball towards the goal line.
		Offensive Coverage	Offensive supports to the player with the ball.
		Depth Mobility	Movement of players between the last defender and goal line.
		Width and Length	Movement of players to extend and use the effective play-space.
		Offensive Unity	Movement of the last line of defenders towards the offensive midfield, in order to support offensive actions of the teammates.
	Defensive	Delay	Actions to slow down the opponent's attempt to move forward with the ball.
		Defensive Coverage	Positioning of off-ball defenders behind the "delay" player, providing defensive support.
		Balance	Positioning of off-ball defenders in reaction to movements of attackers, trying to achieve the numerical stability or superiority in the opposition relationship.
		Concentration	Positioning of off-ball defenders to occupy vital spaces and protect the scoring area.
		Defensive Unity	Positioning of off-ball defenders to reduce the effective play-space of the opponents.
Place of Action	Offensive Midfield	Offensive Actions	Offensive actions performed in the offensive midfield.
		Defensive Actions	Defensive actions performed in the offensive midfield.
	Defensive Midfield	Offensive Actions	Offensive actions performed in the defensive midfield.
		Defensive Actions	Defensive actions performed in the defensive midfield.
Action Outcomes	Offensive	Shoot at goal	When a player shoots at goal, and (a) scores a goal, (b) the goalkeeper makes a save, (c) the ball touches one of the goalposts or the crossbar.
		Keep possession of the ball	When team players execute passes to each other and keep up with the ball.
		Earn a foul, win a corner or throw-in	When the match is stopped due to a foul, corner or throw-in; the team that was attacking KEEPS possession of the ball.
		Commit a foul, give away a corner or throw in	When the match is stopped due to a foul, corner or throw-in; the possession of the ball CHANGES to the team that was in defence.
		Loss of ball possession	When the attacking team loses the ball possession.
	Defensive	Regain the ball possession	When the defensive players regain the ball possession.
		Earn a foul, win a corner or throw-in	When the match is stopped due to a foul, corner or throw-in and the possession of the ball CHANGES to the team that was in defence.
		Commit a foul, give away a corner or throw in	When the match is stopped due to a foul, corner or throw-in; the team that was attacking KEEPS possession of the ball.
		Ball possession of the opponent	When the defensive players do not regain the ball possession.
		Take a shot at own goal	When the defensive team takes a shot at their own goal, and (a) takes a goal, (b) the goalkeeper makes a save, (c) the ball touches one of the goalposts or the crossbar.

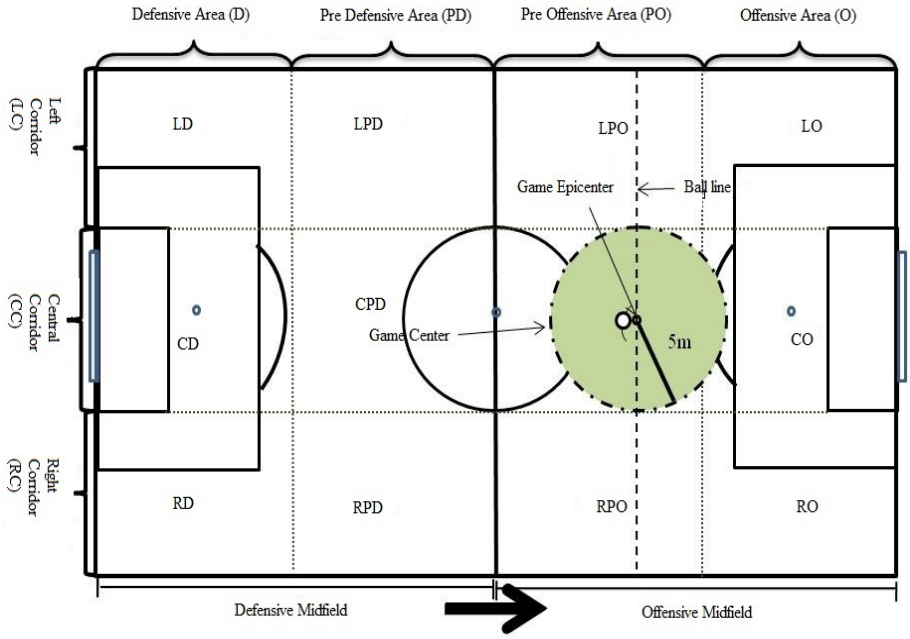

Figure 2. Spatial references used in the "GK+3 vs. 3+GK" Test

Note: 1) The *grid* refers to the imaginary lines considered in relation to the game field enabling it to be divided in 12 zones, three corridors and four sectors; 2) The *game epicenter* is the place where the ball lies at a time "t"; 3) The *ball line* is delimited transversely to the game field from the epicenter; 4) The *game center* is a virtual circle with a five-meter radius from the game epicenter and, depending on the ball line it can be divided in "more offensive" and "less offensive" half.

Characterization of the Field Test

The field test within this system is named "GK+3 vs. 3+GK" Test, being performed during 4 minutes in a field of 36 meters long by 27 meters wide. The dimensions of this test were calculated based on the measures of a Soccer field permitted by the International Football Association Board and on the ratio calculation of the use of game space by outfield players. The amount of time was established through a pilot study, in which it was found that four minutes, comparatively with the time length of up to eight minutes, would suffice for all players to perform the actions related with all of the tactical principles assessed by the observation instrument (Costa, Garganta, Greco, & Mesquita, 2009b).

To conduct the test, the practitioners were randomly divided in two teams of three players each, and numbered from 1 to 3 for one team and 4 to 6 for another, aiming to facilitate the identification of players in the video. During the application the players are asked to play according to the official laws of the game, except by the offside rule. The images are recorded by a video camera placed diagonally in relation to the goal-line and the sideline.

Protocol of the System

FUT-SAT's protocol comprises three procedures, which can be performed in a simple way (by only one individual) or favoring dual-input data. The first consists of analyzing the actions performed by the players during the match, with the ball possession being the analysis unit. This is considered when a player meets at least one of the following assumptions: (a) performs at least three consecutive contacts with the ball; (b) performs a correct pass (enables the team to keep ball possession); or (c) shoots at goal (Garganta, 1997).

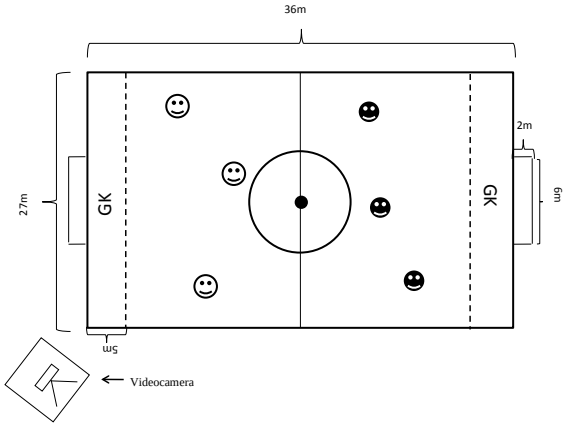

Figure 3. Representation of the physical structure of the "GK+3 vs. 3+GK" Test

The second procedure refers to the assessment, classification and recording of the tactical actions. To accomplish these three actions, the observer relies on the observation instrument and has the support of the *Soccer Analyser*® and *Utilius VS*® software. The first, specially built for FUT-SAT, enables the insertion of the test's spatial references within the video and enables the rigorous assessment of players' positioning and movement within the playing field. The second is intended to register and save the observed actions.

The third procedure refers to the calculation of the variables included in the categories Tactical Performance Index (TPI), Tactical Actions, Percentage of Errors and Place of Action Related to the Principles (PARP). In order to automate this procedure an *ad hoc* Excel for Windows® spreadsheet was built (see Figure 4). This spreadsheet enables, through the insertion of records performed in the second procedure, to automatically carry out the calculation of the variables of these four categories.

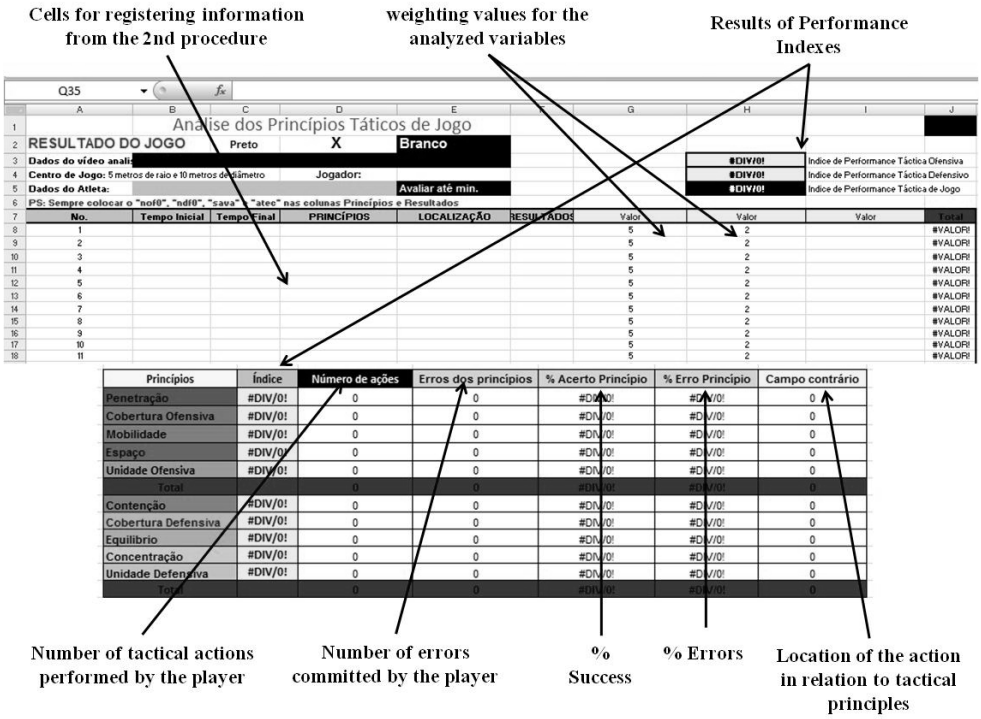

Figure 4. Excel *ad hoc* spreadsheet which enables automatic calculations of the variables in the Outcome Macro-Category

From these categories, TPI is characterized by its compound variables. Variables' TPIs are calculated based on the tactical principle performance criterion, by the player, and in the three variables categories which compose the Macro-Category Observation. From here, match's, offensive phase's, defensive phase's and principle's TPIs are calculated. Variables'

weighting values used in the TPIs calculations are shown in Chart 2 and their combinations provide values which vary from zero to one hundred points. These values were obtained through consultations with experts and through the importance of tactical variables analyzed, taking into account the logic of the game of Soccer and the suggestions presented by Memmert and Harvey (2008). The equation utilized for the calculation of TPI is:

$$\textit{Tactical Performance Index (TPI)} = \Sigma \text{ tactical actions} (PP \times QP \times PA \times AO) / \text{number of tactical actions}$$

Establishment of the Validity of the System of Tactical Assessment in Soccer

Player Assessment

Aiming to analyze the interest of players to take part in the "GK+3 vs. 3+GK" Test, four questions were asked of the applicants. This procedure has been considered crucial to investigate the test acceptability and adequacy regarding its physical demands and spatial and normative settings (Anastasi, 1988). According to this author, the perception of test relevance facilitates the practitioners' effective participation and influences the quality of the data collected, as the evaluated players will be committed to demonstrating their full repertoire of skills.

There were 440 players who performed the test, 144 from the U-11 youth level, 224 from the U-13 youth level, 36 from the U-15 youth level and 36 from the U-17 youth level, taking into account the level of comprehension of all participants. All players who performed the test were competing in regional championships in their respective youth levels. It is observed in the results shown in Table 1 that players demonstrated to be interested in performing the "GK+3 vs. 3+GK" Test (Q1+Q4) and that fatigue was not a factor that affected their playing well (Q3); though some (21.36%) have experienced it during the test (Q2).

Expert Analysis

FUT-SAT's content was assessed by a panel of seven experts. Its selection was based upon four criteria linked to practical and academic backgrounds in Soccer. In order to meet these requirements, experts had to have worked with technical staff at youth and professional levels. In addition, they had to possess coaching

Chart 2

Components and values considered for the calculation of the Tactical Performance Index

Components	Values		Values
1) Performance of the Principle (PP)			
Yes	1		
No	0		
2) Quality of Principle Performance (QP)			
Successful	10		
Unsuccessful	5		
3) Place of Action in the Game Field (PA)			
- Offensive Midfield		- Defensive Midfield	
Offensive Tactical Actions	2	Defensive Tactical Actions	2
Defensive Tactical Actions	1	Offensive Tactical Actions	1
4) Action Outcome (AO)			
- Offensive		- Defensive	
Shoot at goal	5	Regain ball possession	5
Keep possession of the ball	4	Earn a foul, win a corner or throw-in	4
Earn a foul, win a corner or throw-in	3	Commit foul, give away a corner or throw-in	3
Commit a foul, give away a corner or throw-in	2	Ball possession of the opponent	2
Loss of ball possession	1	Take a shot at own goal	1

Table 1
Players' acceptability values for taking the "GK+3 vs. 3+GK" Test

Categories	Questions*							
	Q1		Q2		Q3		Q4	
	Yes	No	Yes	No	Yes	No	Yes	No
U-11	144	0	16	128	0	144	144	0
U-13	224	0	54	170	0	224	224	0
U-15	36	0	12	24	0	36	36	0
U-17	36	0	12	24	0	36	36	0
Total	**440**	**0**	**94**	**346**	**0**	**440**	**440**	**0**

* The questions asked were the following: Q1. Did you enjoy taking the test? Q2. Have you felt tired during the test? Q3. Has fatigue prevented you from playing well? Q4. If asked, would you like to take the test again?

badges, level II at the least, and possess an academic Sports degree with emphasis on Soccer. By fulfilling these requirements, the panel comprised of five MScs. and two PhDs. in Sport Sciences, all of which have already been part of technical staffs who coached professional teams in national tournaments, UEFA Cup, UEFA Champions League or FIFA World Cup Qualifiers. The expert panel was asked of their position over the relevance of the variables and indicators which compose the system observation instrument, considering its representativeness regarding the key aspects of the game.

The experts individually analyzed the content of the categories: Tactical Principles, Place of Action in the Game Field and Action Outcome, according to the following aspects: (a) Importance and definition of variables; (b) Variable and categories weighting for tactical performance; (c) Spatial references used for defining the tactical principles; and (d) Tactical actions and their performance indicators.

All content that raised doubts of semantic nature were reformulated and presented to the experts for a second time (personally or by e-mail) until an agreement was reached. Only after analysis of the aspects mentioned in the previous paragraph and the unanimous approval was the variable incorporated to the system.

Coaches Assessment

Aiming to verify the potentiality of distinction of players performance by FUT-SAT, three coaches from the Soccer teams were asked to rate the tactical performance of their players with a score range of zero to one hundred. In order to do so, the coaches were provided with videos of the "GK+3 vs. 3+GK" Test performed by their players.

Each coach evaluated 48 performances of players from their teams in three moments. In the first moment the coaches were asked to watch and register the scores of the tactical behavior of their players in the game. In the second moment the coaches were asked to rate the performance of their players, according to the core tactical principles of the game of Soccer. In order to facilitate the understanding of the concepts of the principles a detailed explanation was given, with presentation of match scenes which corresponded to each one of the principles and also the provision of reference material which contained the respective descriptions. In the third moment, the coaches were asked to observe and evaluate one player at a time. Such recommendations were made in order to approximate the forms of analysis of the coaches to the second procedure of the FUT-SAT's protocol, so as to reduce the interference due to the use of different analysis methodologies over the scores given by the coaches and calculated by the system. Between each period of testing, the coaches' had an interval of three weeks, which aimed to minimize task familiarity problems (Robinson & O'Donoghue, 2007).

The scores were registered by the coaches and the ones obtained through the calculation of the tactical performance index in FUT-SAT were classified in three levels through percentiles: high, medium and low. This procedure was performed aiming to ponder and locate within each group (group of evaluations made by the coach and the group of evaluations made by the system) the performance assessed according to the criteria used in the assessment. After such categorization it was verified the association between the values provided by the coaches and the ones obtained in FUT-SAT (see Table 2).

The Chi-square test (χ^2) was used with a significance level of $p < .05$, to examine the association between total frequencies obtained in the evaluations made by the system and by the coaches (see Table 3). Gamma statistic was used to verify the correlation between these two evaluations.

Through the number and percentage of association presented in Table 2, it can be seen a higher congruence between the coaches' scores and the values of the tactical performance index in FUT-SAT due to the progression of the evaluations, meaning that the more specific and judicious are the coaches' evaluations, according to the tactical principles of the game, the better were the results obtained in the associations.

Data from Table 3 corroborates those from Table 2, indicating progressive increases of the correlation values between the classification of the evaluations of the coaches and those from FUT-SAT. Through these results, it is plausible to assume that FUT-SAT enabled the distinction of players' performances in three levels, taking into account the evaluations of professionals who experience the process of teaching and training.

Table 2

Association between coaches' assessments and the values of the tactical performance index obtained by the System of Tactical Assessment in Soccer in the three categories assessed

Assessments	Categories	Coach 1		Coach 2		Coach 3	
		n	%	*n*	%	*n*	%
1st Assessment	High	11	68.8	8	50.0	11	68.8
	Medium	8	50.0	8	50.0	11	68.8
	Low	13	81.3	11	68.8	11	68.8
	Total	32	66.7	27	56.3	33	68.8
2nd Assessment	High	11	68.8	11	68.8	10	62.5
	Medium	11	68.8	8	50.0	13	81.3
	Low	13	81.3	13	81.3	13	81.3
	Total	35	72.9	32	66.7	36	75.0
3rd Assessment	High	14	87.5	13	81.3	12	75.0
	Medium	11	68.8	10	62.5	13	81.3
	Low	13	81.3	13	81.3	13	81.3
	Total	38	79.2	36	75.0	38	79.2

Table 3

Number and percentage of total associations, significance, correlation index and standard error between coaches' assessments and values of the tactical performance index obtained by the System of Tactical Assessment in Soccer

Assessments	Coach 1					Coach 2					Coach 3				
	n	%	*p*	Gamma	SE	*n*	%	*p*	Gamma	SE	*n*	%	*p*	Gamma	SE
1st	32	66.7	<. 001	.89	.05	27	56.3	.001	.55	.15	33	68.8	< .001	.66	.14
2nd	35	72.9	< .001	.79	.11	32	66.7	< .001	.89	.05	36	75.0	< .001	.63	.15
3rd	38	79.2	< .001	.96	.03	36	75.0	< .001	.94	.03	38	79.2	< .001	.77	.11

Nota: SE - Standard Error

Observer Reliability

Aiming to verify the intra and inter-observer reliability, 5074 tactical actions were reevaluated from a total of 37065, representing 13.69% of the sample, a percentage which is above the reference value (10%) indicated by literature (Tabachnick & Fidell, 2001).

The accuracy of measurements of FUT-SAT was verified in all categories which compose the Macro-Category Observation and also in the Performance Indicators, due to the composition of the tactical performance index.

Six observers with no previous experience in match analysis and randomly chosen, were trained by a period of 120 days. The aim of this training was to verify these observers' understanding and comprehension about the variables that compose the observation instrument (for further information about the training process and the reliability values regarding the observers' observations obtained during such process, refer the study of Costa et al. 2009a). The constitution of the group in six observers came from the interest in investigating whether the increase in the number of observers with limited experience/involvement in Soccer would, by chance, compromise the evaluation and reproduction of the analysis through time. The sessions to determine reliability were conducted with an interval of three weeks to minimize task familiarity (Robinson & O'Donoghue, 2007).

Intra and inter-observers reliability results presented in Table 4 showed that the training performed by the observers was able to provide the necessary conditions so that everyone obtained values over .79, reflecting substantial understanding and comprehension of the variables that compose the observation instrument (Landis & Koch, 1977).

DISCUSSION

The aim of this study was to clarify the procedures used in the development and establishment of the validity of a system of tactical assessment in Soccer, as well as to highlight the advantages of this system over other instruments of assessment of the tactical behavior which are available in literature. The purpose of this system is to provide a valid tool for the context of Soccer, which researchers and coaches can use to identify players' performance during the process of teaching and training (Rowe & Mahar, 2006).

The procedures used to develop FUT-SAT, as well as to establish its validity were supported by recommendations in literature (Cronbach, 1988; Hopkins, 2008), as well as the steps used in other studies that revealed robustness in validation and precision in the measurement of their instruments (Gilbert, Trudel, Gaumond, & Larocque, 1999; Gréhaigne, Godbout, & Bouthier, 1997; Oslin et al., 1998).

Considered by some researchers as being one of the key points of the validation process, the procedures of identification, building and definition of the observable behaviors were performed taking into account the importance of the player behavior over the team's collective organization (Oslin et al., 1998). Besides that, it was sought to meet the suggestions presented in some studies (French & Thomas, 1987; Oslin et al., 1998) which

Table 4
Consistency values of assessment objectivity – Kappa (standard error)

	Intra-Observer		Inter-Observers	
	Lowest Value	Highest Value	Lowest Value	Highest Value
Tactical Principles	.85 (.02)	.97 (.01)	.82 (.04)	.99 (.01)
Performance Indicators	.79 (.03)	.96 (.01)	.79 (.03)	.98 (.01)
Place of Action in the Game Field	.92 (.01)	.98 (.01)	.87 (.04)	.99 (.01)
Action Outcome	.86 (.02)	.99 (.01)	.86 (.04)	.99 (.01)

indicate the need to assess different levels of the game (Memmert & Harvey, 2008), as well as the importance of assessing the actions performed by the players without possession of the ball (Oslin et al., 1998).

The objective description of the behaviors and variables in FUT-SAT enabled high levels of correlation indexes between the observations performed by the evaluators. Coupled with this evidence, the amount of training received by the observers, the fixation of the image and the precision of the assessment of the players' position and distances, facilitated by the use of the software *Soccer Analyser®*, also contributed for the correlation results to be substantial (James et al., 2002; Tenga et al., 2009).

In addition to the result of the evaluators' observations, the ability to distinguish players' performances obtained high levels of correlation between the evaluations performed by coaches and the results obtained by FUT-SAT. These two steps, related to the content assessment and reliability of evaluators' observations, have been generally used in studies that aim to determine the validity of an instrument of assessment of tactical behaviors in modified or in-game situations (Gilbert et al., 1999; Gréhaigne et al., 2001; Memmert, 2002; Oslin et al., 1998).

The possibility to assess player performance with and without ball possession in the context of teaching and training in Soccer, supported by a reliable and robust tool, gives FUT-SAT an additional pedagogical value, since it enables and facilitates the assessment of performance according to pre-established goals, without the obligation to appeal to weariness, regarding the use of all categories, to compute the tactical performance index.

In addition to these potentialities, the ease of application of the field test and its acceptance among the players, since its application does not require the use of numerous or sophisticated equipment and its application protocol gives it the possibility to be ministered as an activity integrated into the training session, which confirms its ecological bias.

Another favorable aspect regards the quantity and quality of the information provided about the assessment of player behaviors. Mainly, coaches and researchers might be aware of the player's performance through quantitative and specific information provided by the Tactical Performance Indexes; or, if they wish so, they may have the opportunity to access more detailed and qualitative information about player behaviors, through the categories Tactical Actions, Percentage of Errors, Place of Action Related to the Principles, Tactical Principles, Place of Action in the Game Field and Action Outcome.

The assessment of players' interaction which had already been covered in other instruments of assessment of the tactical capability (Gréhaigne et al., 2001; Memmert, 2002; Oslin et al., 1998) is another quality of FUT-SAT. However, the possibility to assess the quality of opponent's interaction in situations similar to game conditions provides a more accurate representation of player's capability within the context of the game, providing reliable performance indicators of the player (Oslin et al., 1998).

CONCLUSIONS

FUT-SAT presents progressions on the design of instruments of analysis of tactical behavior in Soccer regarding the content, range and functionality.

Regarding its content, the aspects that emerge are those related to: (1) players' behavior in the field of play, (2) players' interaction, (3) assessment focused on players' movements in the game field, and (4) assessment of movements' efficiency and effectiveness.

With respect to its range, one can highlight: (1) the broadening of the focus of analysis beyond the zone where the ball is, (2) the grouping of variables to be transversal to several game models, (3) the incorporation of variables that can be used to asses players from

different age groups and practice levels, (4) the link with content taught in training, (5) the description and assessment of behaviors presented in the game, and (6) the acceptance of variables that reflect the performance in the game or in similar situations.

Concerning the instrument functionality the following possibilities are emphasized: (1) conceive category systems which enable their use in training or game situations (*in vivo*) and also in laboratory (*in vitro*) for performance analysis and assessment, and (2) reduce the amount of data to be provided to the technical staffs, without loss of quality on information.

The results regarding players', experts' and coaches' assessments, as well as reliability of evaluators' observations suggest that the measures used in FUT-SAT are valid in the context of Soccer and that its observations for assessment of Soccer players' tactical behavior taught within the process of teaching and training in Soccer through their formation is reliable.

For future studies, it is suggested that researchers expand the process of validation of FUT-SAT to other contexts/conditions.

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