

Original Article

Recognition of the game and cooperation by players when scoring goals in football based on the goals scored during the selected matches of the UEFA Champions League and the European League

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Abstract

Introduction. Football as a team sports game requires a high level of technical, tactical and psychophysical skills of players. Due to the specificity of team sports games, individual game competences are the basis for group activities in football. In group actions, the player should understand the relationships existing between her/him and partners, and should also be aware of the possibilities of actions performed by partners and opponents. When each of the members of the group is committed to the highest degree of achieving the game objective, then there is a synergistic effect, i.e. a system of dependent outcomes that facilitate and enable the achievement of the game's goals. **Objective.** The aim of the study is to assess the level of absolutely dependent correlational coefficients (synergy) in a team sports game, which is football, in changing game situations, in achieving the highest offensive objective, i.e. scoring a goal. **Materials and methods.** In the work, a detailed observation is presented regarding the actions of footballers in achieving the highest objective of the game, i.e. scoring a goal. The observation concerned the analysis of 99 goals scored during 55 football matches of the UEFA Champions League and the European League in 2011-2018. In the study, the authors used the recorded observational method, with the possibility of multiple observations of the events under study. The research analysis included the use of video material of recorded matches on DVD, where the observed actions were marked on the special observation sheet. The authors observed situations in which goals were scored, and the research material was the team that achieved sports victory in the analysed match. **Results.** The obtained results indicate that both in certain, uncertain and risky situations that characterise sports games, the greatest number of goals was obtained as a result of pre-coordination (PreC), characterised by the fact that the beginning of the next task occurs in the final phase of the preceding activity, even before its completion. Statistical analysis showed statistically significant differences between pre-coordination (PreC) and simultaneous coordination (SC). **Conclusions.** In the implementation of the highest goal of offensive actions in football, a high level of synergy prevails, which requires anticipation of events during the game. For this reason, in addition to shaping motor features and tactical and technical skills in the area of football, in the process of training a player, special attention should be paid to influencing his/her mental and intellectual sphere.

Keywords: football, offensive actions, synergy, football competitions

Introduction

Football is one of the most popular sports games of present times, both in terms of competitive and recreational sports (Bauer, 2001; Mucha et al., 2013; Sawicki, 2015, 2018; Jaworska, 2020). Based on the definition of a team sports game (Naglak 2005, Panfil 2006; Duda 2008; Hasenpflug, 2020), as a sports competition between two teams with strictly defined rules of the game, it can be concluded that the actions of players are intentional activities that require not only good physical preparation, but most of all, activating thought processes, which, due to the need to make the right decision, constitute the superior link in the process of effective action in the conditions of sports competition.

In many studies on the issues of training football players, the importance of above-average football skills in terms of technique and tactics as well as mental and physical characteristics within the context of achieving a high sports level is emphasized (Huijgen et al., 2014; Figueiredo et al., 2009; Forsman et al., 2016; Höner and Feichtinger, 2016; Murr et al., 2018; Bolotin and Bakayev, 2017; Ceruso et al., 2019; Rocca et al., 2020). According to Bauer (2001) and Kamil (2016), the essence of effective training in a sports game is the use of means and forms of teaching in the organisation of the game, which most faithfully reflect the environment of the player's actual operation in his/her natural conditions. Thus, there is a need to accurately recognise the determinants of competition in a sports game, and the intended as well as systematic perception of the studied

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object, process or phenomenon (Rea and Parker, 2014). Roca et al. (2020) emphasize the importance of a footballer's perceptual and cognitive skills, such as anticipating and making the right decisions in the game, creativity and interpreting the game. These competences can be considered invaluable, especially in terms of organising and conducting offensive actions ending in scoring a goal. Therefore, learning these skills should be a key element in football training for children and adolescents. O'Connor et al. (2017 and 2018) also believe that the training process of football should be holistic, at the same time paying to all the skills of the footballer, with particular emphasis on the combination of her/his perceptual, cognitive and technical skills. Wrobel and Krüger (2013) and Hasenpflug (2020) believe that in the process of football training, the player's knowledge of the game and environment is important, which may positively influence better mastery of perceptual and cognitive skills, in particular, quick decision-making, e.g. in offensive goalkeeping situations. It follows from the-above that the effectiveness of action is the systematic reception, processing and production of information in various sports game situations (Pearson et al., 2008; Roca et al., 2012). It seems that this process is of great significance not only in the actions of an individual player, but above all - in cooperation – i.e. in group action.

According to Wilhelm (2006), group activity concerns several players (the number is regulated by the restrictions of a given discipline), jointly performing tasks and cooperating due to a specific goal. This group is an integral whole, where each of its members acts within a certain scope, which means that the players fulfil more or less dependent roles. Their actions concern multi-stakeholders, which means that each player, while performing different functions, must always take the actions of his/her partners into consideration (Wilhelm, 2006; Hasenpflug, 2020). In group actions, the player should understand the relationships that take place between her/him and partners (Stock, 2013). S/he should not only know how to act individually in certain situations, but also be aware of the possibilities of actions performed by partners and opponents; only then, according to Bauer (2001) and Wilhelm (2006), the ability to act tactically appears, consisting in the fact that the player is able not only to implement her/his own intentions, but at the same time, s/he is able to coordinate them with the actions of partners. The player can see her/his own mistakes, the ones made by partners and opponents, and learns to avoid them.

Würth (2006), Strauss (2013), Wrobel and Krüger (2013) and Hansen et al. (2017) assume that the prediction of group game effectiveness is a function of the individual abilities of the players and the merging abilities of the group. It seems that these factors are largely based on the understanding of the game (knowledge about the game, decision-making efficiency), hence, it may be assumed that it is more effective to achieve a goal when the individual actions of players are intentionally and rationally integrated into group activities that depend on the degree of interaction between players (Bauer, 2001; Kamil, 2016; Hasenpflug, 2020).

A competitor in a group is only a part of it as much as s/he actually performs functions on its behalf. When each of the members of the group is committed to the highest degree of achieving the objective of the game, a synergistic effect occurs. According to Panfil (2006), synergy in a team sports game is an equifinal system of dependent effects mitigating (facilitating) and enabling (organising) the achievement of game goals. These synergies are part of so-called external synergy. The level of its manifestation is determined by the interdependent individual dispositions of players, creating equifinal systems of synergistic dispositions (internal synergy).

Moreover, Panfil (2006) lists the different levels of cooperation in team sports games, dividing it into three parts:

1. Pre-coordination - a situation in the game when interdependent actions are performed in advance, i.e. the next task starts in the final phase of the preceding activity, even prior to its completion.
2. Simultaneous coordination - a situation in the game when interdependent actions are performed simultaneously, i.e. the next task starts at the same time, e.g. at the end of the preceding action.
3. Post-coordination - a situation in the game when interdependent actions are performed in a follow-up system, i.e. the beginning of the next task depends on the final result of the previous one.

Assuming that a team game is the sequence of diverse situational actions, both individual and, above all, group actions, hence, the authors of the work attempted to define the structure of this specific activity. Taking the differentiated level of cooperation into account: pre-, simultaneous and post-, in the research, the nature of this activity was determined according to the level of intentionality in achieving the main goal of the game for offensive activities in the analysed football matches. Recognition of this issue in multi-stakeholder activities is extremely important (the specificity of the game), therefore, these activities can significantly facilitate the process of rational management of players in team sports.

The aim of the study is to assess the level of absolutely dependent cooperation (synergy) in a team sports game - which is football, during changing game situations, in achieving the highest offensive aim, i.e. scoring a goal.

The following research questions have been formulated:

- Does the effectiveness of achieving the main objective of the game in offensive actions (i.e. scoring a goal) depend on the level of player synergy?
- Does the degree of conflict of sports objective in the game depend on the involvement of a creative player?

Materials & Methods

Materials

In this study, a detailed observation of the activities of footballers in achieving the highest objective of the game, i.e. scoring a goal, was conducted. The observation concerned the analysis of 99 goals scored during 55 football matches of the UEFA Champions League and the European League in 2011-2018.

Methods

In the authors' research, the method of recorded observation was used, with the possibility of multiple observations of the events being the subject of research. The research analysis included the use of video material of recorded matches on DVD, where the observed activities were applied to the observation sheet.

The authors observed situations in which goals were scored, and the research material was the team that achieved sports victory in a given match. In the research methods, an observation sheet (Table 1) was used, where in the appropriate boxes under a specific issue (observation parameter), all noticed facts, events and circumstances related to the issue under study were recorded (Drissler, 2011).

Table 1. Observation sheet showing game characteristics in offensive cooperation

Classification of match according to result: Win, draw, loss			Sports class of competition: Champions League (2016)		
			Playing teams and match result: Olympique Lyon : Dinamo Zagreb 3:0		
Type of coordination / Order of goals	Pre-coordination	Simultaneous coordination	Post-coordination	Type of situation	
1	X			uncertain	
2		X		uncertain	
3		X		uncertain	
Total	3	1	2	0	

The research observation included the assessment of absolutely dependent cooperation, which, according to the concept by Panfil (2006) and Duda (2008), concerned different levels of player cooperation:

- Pre-coordination (PreC) - a situation in which interdependent actions are performed in advance, i.e. the beginning of the next task takes place in the final phase of the preceding activity, even before its completion.

In observational analysis, a positive activity in this action was the state in which the player scoring a goal made a "freeing" move, stepping into a convenient shooting position in the final phase of the partner's action (just before its end), which created a positive situation for passing the ball.

- Simultaneous coordination (SC) - a situation in which interdependent actions are performed simultaneously, i.e. the next task is started at the same time, e.g. at the end of the preceding action.

In observational analysis, a positive activity in this action was the state in which the player scoring a goal made a "freeing" move, moving into a convenient shooting position, simultaneously with the end of the partner's action, which created a positive situation for passing the ball.

- Post-coordination (PostC) - a situation in which interdependent actions are performed in a follow-up system, i.e. the beginning of the next task depends on the final result of the previous one.

In observational analysis, a positive activity in this action was the state where the player scoring a goal made a "freeing" move, moving into a convenient shooting position when the partner had gained full freedom (possibility) of passing the ball.

In the research process, the activities described above concerned the analysis of goals scored in three specific situations:

- Certain situations - situations in which the number of attackers exceeds the number of defenders.
- Uncertain situations - situations in which the number of attackers was equal to the number of defenders.
- Risky situations - situations in which the number of attackers was smaller than the number of defenders.

The characteristics of goals scored at this level of research concerned the observation of matches that, in the evaluation of the measurable sports result, ended with the predominance of at least two goals.

Statistical analysis

In order to answer the formulated research questions, the following calculations and statistical methods were applied: basic statistical calculations were used in the assessment of the research results: arithmetic mean, standard deviation, coefficient of variation, and the significance level of differences was determined via the Student's *t*-test (Sheskin, 1997; Rea and Parker, 2014). Differences at the level of $p < 0.05$ were considered statistically significant.

Results

In the chosen research procedure, the methods of player cooperation in achieving the highest objective of the game, i.e. scoring a goal, were analysed. Attempts were made to characterise the mode of action in terms of the level of intentionality and purpose of the task. The aspects of these assumptions required not only high motor skills but, above all, high mental involvement (reading the game, understanding partner's intentions). The evaluation of the method for achieving the highest offensive objective of the game - scoring a goal - was also dictated by the highest difficulty of action. It was assumed that the very effect of scoring a goal emphasizes the aspect of the research objective. Presenting the results of the research, first, the analysis of actions taken while scoring goals in certain situations – when the offensive action of players was dominant. For the observed matches in these activities, 24 goals were scored (Table 2), of which 6 goals (25%) were scored as a result of post-coordination, 7 goals (29.2%) in the course of simultaneous coordination operations, while 11 (45.8%) goals were scored through pre-coordination activities.

Table 2. Quantitative characteristics of scored goals taking coordination of action in certain situations into account

Goals No.	Type of coordination in performing action		
	Pre-coordination	Simultaneous coordination	Post-coordination
1	1	0	0
2	1	0	0
3	0	1	0
4	1	0	0
5	0	0	1
6	1	0	0
7	0	1	0
8	0	1	0
9	0	1	0
10	1	0	0
11	1	0	0
12	1	0	0
13	0	0	1
14	1	0	0
15	1	0	0
16	0	1	0
17	0	0	1
18	0	1	0
19	1	0	0
20	0	1	0
21	1	0	1
22	0	1	0
23	0	0	0
24	0	0	1
Total / Value %	11 / 45.8%	7 / 29.2%	6 / 25 %

From the analysis of the presented data for actions in certain situations, it can be noted that actions performed in the course of follow-up coordination, which according to Panfil (2006) are only slightly characterised by anticipation processes, were the lowest in terms of percentage values (Figure 1).

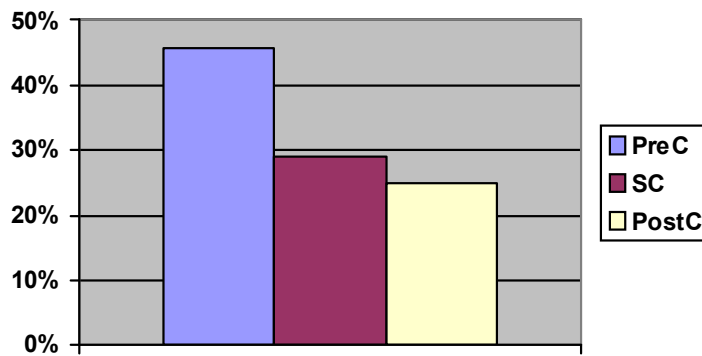


Fig. 1. Percentage characteristics of goals scored by players according to coordination of action in certain situations

In statistical analysis (Table 3), it may be noted that the obtained values indicate significant differences ($p < 0.01$) already in the comparison of activities: the level of pre- and post-coordination, as well as simultaneous and post-coordination. This fact points to the clear dominance of pre- and simultaneous coordination activities while scoring goals in uncertain situations. Analysis of the coefficient of variation also shows that the goals scored in the actions during uncertain situations were dominated by cooperation at the level of pre- and simultaneous coordination. Therefore, it may be concluded that the majority of goals (79.4%) in uncertain situations, as stated by Naglak (2005) and Panfil (2006), were scored with a high degree of anticipation of the partners' actions.

Table 3. Value of action differentiation in scoring goals taking type of coordination during certain situations into account

Statistical characteristics		Type of coordination in action		
		Pre-coordination	Simultaneous coordination	Post-coordination
Arithmetic mean		0.50	0.29	0.21
Standard deviation		0.51	0.46	0.41
Coefficient of variation		102.15	159.19	199.13
Degree of statistical significance of differences	PreC - SC	1.81		
	PreC - PostC	2.45**		
	SC - PostC		1.14	

** $p < 0.01$

Further analysis in the research process concerned the characteristics of players' cooperation while scoring goals in uncertain situations (Table 4). In the assessment of the situation, these were goals that were scored in the balanced actions of: forwards - defenders.

For the observed matches in these activities, 29 goals were scored, of which 6 goals (20.6%) were scored as a result of post-coordination actions, 10 goals (34.5%) were scored in the course of simultaneous coordination operations, while 13 (44.9%) were scored while performing pre-coordination activities.

Table 4. Quantitative characteristics of scored goals taking coordination of actions in uncertain situations into account

Goals No.	Type of coordination in action		
	Pre-coordination	Simultaneous coordination	Post-coordination
1	0	1	0
2	0	0	1
3	1	0	0
4	1	0	0
5	0	0	1
6	0	1	0
7	0	1	0
8	1	0	0
9	1	0	0
10	1	0	0
11	0	0	1
12	0	1	0
13	1	0	0
14	1	0	0
15	0	1	0
16	0	0	1
17	1	0	0
18	1	0	0
19	1	0	0
20	1	0	0
21	0	1	0
22	0	1	0
23	0	0	1
24	0	1	0
25	0	0	1
26	0	1	0
27	1	0	0
28	0	1	0
29	1	0	0
Total / Value %	13 = 44.9%	10 = 34.5%	6 = 20.6%

From the analysis of the presented data for actions in uncertain situations, it can be noted that actions performed in the course of follow-up coordination, which according to Panfil (2006) are only slightly characterised by anticipation processes, were the lowest in terms of percentage values (Figure 2).

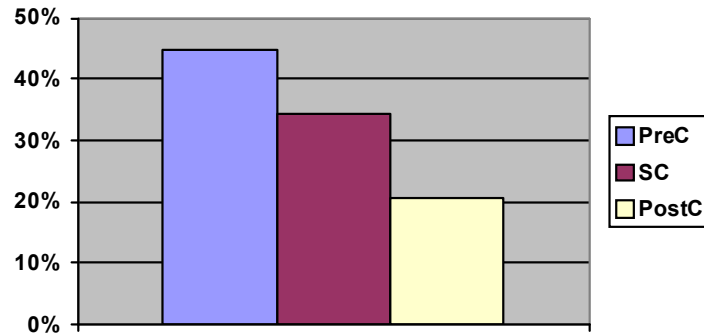


Fig. 2. Percentage characteristics of goals scored by players according to coordination of action in uncertain situations

In statistical analysis (Table 5), it may be noted that the obtained values indicate significant differences ($p < 0.01$) already in the comparison of activities: the level of pre- and post-coordination, as well as simultaneous and post-coordination. This fact points to the clear dominance of pre- and simultaneous coordination activities while scoring goals in uncertain situations. Analysis of the coefficient of variation also shows that the goals scored in the actions during uncertain situations were dominated by cooperation at the level of pre- and simultaneous coordination. Therefore, it may be concluded that the majority of goals (79.4%) in uncertain situations, as stated by Naglak (2005) and Panfil (2006), were scored with a high degree of anticipation of the partners' actions.

Table 5. Value of action differentiation in scoring goals taking type of coordination during uncertain situations into account

Statistical characteristics	Type of coordination in action		
	Pre-coordination	Simultaneous coordination	Post-coordination
Arithmetic mean	0.45	0.41	0.14
Standard deviation	0.51	0.50	0.35
Coefficient of variation	112.90	121.13	254.43
Degree of statistical significance of differences	PreC - SC	1.25	
	PreC - PostC	2.91**	
	SC - PostC	2.66**	

** $p < 0.01$

Final analysis in the research process concerned the characteristics of players' cooperation in scoring goals during risky situations. In the assessment, these were goals that were obtained in situations of discomfort regarding offensive actions, i.e. with the advantage of the defenders.

As shown in Table 6, for the observed matches in these activities 46 goals were scored, of which 5 (10.8%) were scored in the course of post-cooperative operations, 16 goals (34.8%) in simultaneous coordination actions, while 25 (54.4%) goals were scored during pre-coordination actions.

Table 6. Quantitative characteristics of scored goals taking coordination of actions in risky situations into account

Goals No.	Type of coordination in action		
	Pre-coordination	Simultaneous coordination	Post-coordination
1	1	0	0
2	0	1	0
3	1	0	0
4	0	1	0
5	0	0	1
6	1	0	0
7	0	1	0
8	0	0	1
9	1	0	0
10	1	0	0

11	1	0	0
12	1	0	0
13	0	1	0
14	0	1	0
15	1	0	0
16	0	0	1
17	1	0	0
18	0	1	0
19	1	0	0
20	0	1	0
21	0	0	1
22	0	1	0
23	1	0	0
24	0	1	0
25	0	1	0
26	1	0	0
27	1	0	0
28	1	0	0
29	1	0	0
30	0	1	0
31	1	0	0
32	0	1	0
33	1	0	0
34	0	1	0
35	1	0	0
36	1	0	0
37	0	1	0
38	1	0	0
39	0	0	1
40	1	0	0
41	0	1	0
42	1	0	0
43	1	0	0
44	1	0	0
45	0	1	0
46	1	0	0
Total / Value %	25 / 54.4%	16 / 34.8%	5 / 10.8%

From the analysis of the presented data for actions performed in risky situations, it can be seen that the operations performed in the course of post-coordination actions, which in the opinion of Panfil (2006) are characterised by little anticipation processes, were the lowest value in percentage terms (Figure 3).

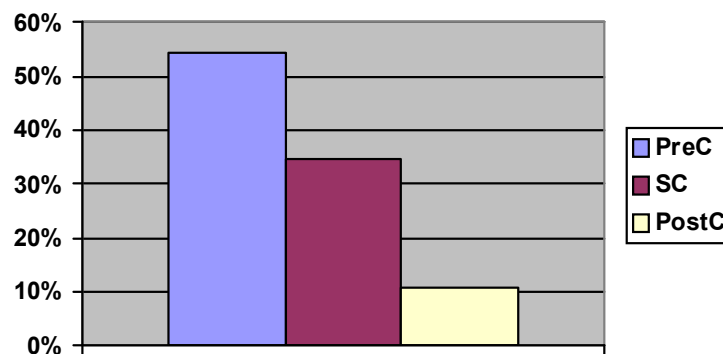


Fig. 3. Percentage characteristics of goals scored by players according to coordination of action in risky situations

These observations are also confirmed by statistical calculations (Table 7), which indicate a clear dominance of activities in pre- and simultaneous coordination.

This fact indicates the clear predominance of pre- and simultaneous coordination in scoring goals during risky situations. Furthermore, the analysis of coefficient of variation may also confirm that the goals scored in the actions of risky situations were dominated by interactions at the level of pre- and simultaneous

coordination. Thus, it may be concluded that the majority of goals (89.2%) in risky situations, as stated by Naglak (2005) and Panfil (2006), were scored with a high degree of anticipation of the partners' actions.

Table 7. Values of statistical significance of differences in actions related to scoring goals taking type of coordination during unproblematic matches in risky situations into account

Statistical characteristics	Type of coordination in action		
	Pre-coordination	Simultaneous coordination	Post-coordination
Arithmetic mean	0.53	0.36	0.11
Standard deviation	0.50	0.48	0.32
Coefficient of variation	94.60	136.15	286.04
Degree of statistical significance of differences	PreC - SC	2.21*	
	PreC - PostC	5.08***	
	SC - PostC	3.05**	

* $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$

Discussion

By characterising the cooperation of players in achieving the highest objective, which occurs in offensive action (scoring a goal), an attempt was made to answer specific research questions:

Does the effectiveness of achieving the highest objective of the game in offensive actions (i.e. scoring a goal) depend on the level of player synergy?

Does the degree of the sports objective in the game depend on the involvement of a creative player?

Taking the process of training a football player into account, these questions seem important and justified, as they facilitate recognising the problem of effective action in terms of internal and external synergy occurring in a team sports game. These activities are characterised by a high level of efficiency of mental processes (Panfil 2006), hence, it seems that in the face of common training in sports games, in which accents of mechanical and habitual behaviour dominate (Duda 2008), these activities allow to pave the path for an effective sports game. Based on the synergy process of players, an attempt was made to determine levels of cooperation, which, according to Panfil's classification (2006), are based not only on the difficulty of completing tasks, but above all, on an attempt to characterise the cooperation of players based on the level of anticipation in action. This aspect was additionally assessed in certain, uncertain and risky situations, in which thought processes may, to a varying degree, dominate the action (Duda 2012).

The obtained research values clearly indicate that in certain, uncertain as well as risky situations that characterise sports games (Naglak 2005), the effectiveness of cooperation requires a high level of synergy. In the authors' research, the confirmation of this thesis was illustrated by the percentage index for the effectiveness of goals scored in selected game situations. These activities require not only high efficiency of external action but, above all, internal action based on anticipation and effective perception (Baudry and Lynch 2001, Naglak 2005, Panfil 2006). The importance of a high level of synergy in group cooperation for sports games is also emphasized by Würth (2006), Wilhelm (2006), Stock (2013), Strauss (2013), Hansen et al. (2017) and Hasenpflug (2020). Therefore, it may be concluded that in order to achieve better cooperation, players must not only understand each other, but above all, they must understand the game - have knowledge on the game, be able to read it, which greatly facilitates decision-making in a competitive sports environment. The great significance of individual competences related to playing football, which are the basis for effective team cooperation, is also indicated by (Bauer, 2001; Mandigo et al., 2007; Broadbent et al., 2015; Bolotin and Bakayev, 2017; Murr et al., 2018; Rocca et al., 2020). It may be concluded that this dependence sets the directions for organised training, as it illustrates the importance of training intellectualisation for the creative action of a player.

Conclusions

In the implementation of the highest objective of offensive actions in football, a high level of synergy prevails, which requires anticipation of events.

The high level of synergistic actions while playing football increases with the difficulty of situational tasks. Due to the multi-stakeholder nature of the team game, which is football, the factors determining the achievement of a high level of sportsmanship of a player should be understood as her/his dispositions to play, which, revealed in various situations, enables her/him to act individually and cooperate. For this reason, apart from shaping motor and tactical as well as technical skills in the area of football, in the process of training a player, special attention should be paid to mental and intellectual spheres. The proper preparation of a footballer at an elite level in terms of perceptual and cognitive skills, such as anticipating events, making the right decisions in the game, creativity and interpreting the game, may significantly increase the effectiveness of her/his actions during the game, especially in terms of organising offensive actions aimed at scoring goals (Stock, 2013; Kamil, 2016; Roca et al. 2020; Hasenpflug, 2020). The results of this study on the circumstances of scoring goals in selected matches of the Champions League and European League confirmed the great significance of group action in the game of football. This was primarily manifested in the domination of scoring

goals as a result of synergistic activities, pre-coordinative in nature, thus related to a high level of anticipation of events during the game. However, it should be emphasized that the effectiveness of a group action is directly influenced by the skills and actions of individual players. They should be an essential part of the training process of players from all age groups, and should be rationally and intentionally integrated into the team's game to enable high effectiveness.

In this paper, the authors deal with issues regarding determinants of achieving the highest sports objective in football, which is scoring goals, but taking into account other sports intentions in this game, such as, for example, preventing the loss of a goal, it would make sense to conduct further research on sports cooperation in the field of defensive actions, not only in a professional football environment but also in the area of recreational sports.

Conflict of Interests: The authors have no conflict of interest to declare.

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