The Efficiency Model of Goalkeeper's Actions in Soccer

DOI: 10.2478/v10131-0013-x

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

Andrzej Szwarc (A,D,E,F,G), **Patrycja Lipińska** (B,C,E,F), **Michał Chamera** (B,D,E,F)

Jedrzej Sniadecki Academy of Physical Education and Sport in Gdansk, Poland

Key words: *soccer, European Championship, observation, goalkeeper, efficiency of action.*

Abstract

Background: *The purpose of this paper was to present cognitive models illustrating efficiency of the goalkeeper's actions in soccer based on observation of play in selected matches of the Euro 2008 finals.*

Material/Methods: *The observation method was used in the study. The play of both goalkeepers was analysed in 7 soccer matches in a cup phase of the European Championships which took place in Portugal in 2008. The data was recorded on the authors' observation forms. Activity, effectiveness and reliability during both offensive and defensive actions were subject to this examination.*

Results: *It was revealed that most actions of the goalkeeper are aimed at taking control of the field of play or keeping possession of the ball; creating goal scoring opportunity represents only a small percentage of offensive actions. Defensive actions are generally performed individually and the highest reliability is reported while catching the ball.*

Conclusions: *Efficiency models of goalkeepers' actions should be used to create models of play for players representing a lower level of sports competence in order to improve the effectiveness of their game play.*

One should continue further study to improve a research tool so as to evaluate other, important from the point of view of the game's objectives, actions definitely dependent on team mates' behavior.

Word count: 1960
Tables: 8
Figures: 2
References: 21

Received: July 2010
Accepted: November 2010
Published: December 2010

Address for correspondence:
Prof. nadzw. dr hab. Andrzej Szwarc
Academy of Physical Education and Sport, Chair of Sports Games and Martial Arts , 80-336 Gdańsk, Poland, ul. K. Górskiego 1
Phone: +4858 554-71-88, e-mail: szwrc@awf.gda.pl

Introduction

Objective knowledge of players' actions during a team game and improvement in these actions are the most important issues in the praxeology of sport play. To deal with these issues so-called models of play are created. The praxeological model of sport play includes detailed models (tabular, mathematical and graphic) illustrating and designing actions and players' behaviors in a classified game [1,2].

In the praxeology of sport play basic values of efficiency of action[1], such as rationality, activity, efficiency and reliability are estimated. Evaluation of players' activities from the point of view of the game's objectives contributes to the rationalization of game actions by relating these actions to objective cognitive models and improving effectiveness in play by illustrating performed actions defined as effective, and to economization of players' actions by the limitation of performing ineffective actions to eliminate in this way an expensive "trial and error" method [1,2].

Research on understanding the structure of soccer has several years' tradition which goes back to the 1960s. Determinants of goalkeepers' effective actions were searched, among others, by Szwarc [3], Bergier [4, 5], Kapera [6, 7], Bergier and Soroka [8], Bergier and Syryjczyk [9-10]. However, until now models illustrating a high level of the goalkeepers' play have not been created. Thus the main aim of this study was to prepare models illustrating efficiency of actions in elite goalkeepers.

The following research questions have been posed:

1. What are the most frequently performed actions in offensive and defensive phases by a top goalkeeper?
2. What are the activity, effectiveness and reliability of individual and group offensive and defensive actions of top goalkeepers in the aspect of implemented aims of the game?

Material and method

The observation method was used in the study. The play of both goalkeepers was analysed in 7 soccer matches in a cup phase of the European Championships which took place in Portugal in 2008 (Tab.1).

Tab.1. List of Euro 2008 games in which goalkeepers' play was observed

Competing teams	Stage competitions	Match result
Portugal - Germany	Quarter-final	2-3
Spain - Italy	Quarter-final	0-0
Turkey - Croatia	Quarter-final	3-2
Holland- Russia	Quarter-final	0-3
Spain - Russia	Semi- final	3-0
Germany - Turkey	Semi- final	3-2
Spain - Germany	Final	1-0

The data was recorded on the authors' observation forms [11]. Activity, effectiveness and reliability were subject to this examination. In attack, control of the field of play, keeping possession of the ball, creating a goal scoring opportunity and scoring a goal were assessed. In defence, actions against both scoring a goal and a goal scoring opportunity were determined.

[1] *In praxeological terms, efficiency of action is a total of practical qualities of play i.e. positively assessed characteristics of this action including rationality, effectiveness, reliability and activity of a player; more effective is a player who gained the highest number of positive values of assessment relativized to the objectives (scored goals, control of the field of play, retained possession of the ball) or, in case the number of positive values of assessment equals, the one who has the highest values of assessment [1].*

Results

Attack

Data from Tab.2 show that in Euro 2008 matches taking control of the field of play (75%) and keeping possession of the ball (22%) were the dominant actions performed by goalkeepers. Creating a goal scoring opportunity amounted to 3% of play actions. In the analysed matches the subjects did not perform scoring a goal action.

Tab.2 The efficiency model of goalkeepers' actions in defense

Indices / Type of actions	Number of actions	Number of effective actions	Reliability	Percentage of total actions	Average number of actions in a match
Interception of the ball	64	61	96	22	9.1
Taking control of the field of play	218	142	65	75	31.2
Creating a goal scoring opportunity	8	8	100	3	1.2
Scoring a goal	0	0	0	0	0

Top goalkeepers were most effective in keeping possession of the ball (9 actions on average in one match with 96% reliability) and creating a goal scoring opportunity (1 action on average with 100% reliability). The observed players were the most effective in taking control of the field of play (218 actions including 142 effective – 65% reliability).

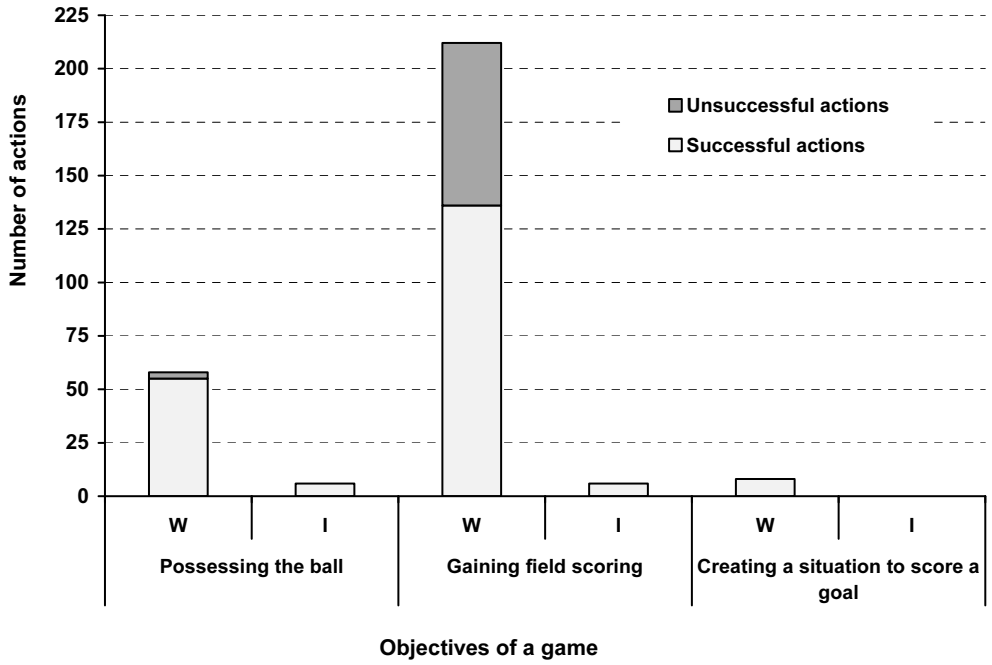

Fig.1. Reliability of goalkeepers' actions in attack considering the game's objectives and ways of actions (I – individual, W – cooperation)

Tabular and graphic models illustrating the effectiveness of actions in keeping possession of the ball (Tab. 3 and Fig. 1) show that cooperation significantly predominated individual actions (85 and 6 actions respectively); however, 100% of reliability was gained in individual actions only. Most frequently catching the ball (42 times) was performed, rarelier catching the ball in a pass from the team mate (8 times), then followed catching the ball after tackling and dribbling (5 times) and other actions (3 times).

The data from Table 4 and Figure 1 show that the goalkeepers under study cooperated 218 times and 142 times effectively in controlling the field of play. Only in 5 situations were individual actions performed but with 100% reliability (tackling and/or interception). The top goalkeepers most often took control of the field of play by a pass kick (out of 114 actions, 52 were effective – 45% reliability). The highest reliability (98%) was achieved when the ball was thrown with a hand.

The data from Table 5 show that in creating a goal scoring opportunity the goalkeepers under study displayed 100% reliability.

To create a goal scoring opportunity, goalkeepers passed the ball to team mates after a previous drop of the ball (6 times) or after kicking the ball from the field (twice).

The above actions constituted a small percentage of all actions performed by top goalkeepers while competing. The players under study did not participate in any actions aimed at scoring goals.

Tab. 3. Efficiency of play in keeping possession of the ball

Action \ Types of effectiveness		Activity	Effectiveness	Reliability
Individual	Tackling and/or interception	6	6	100
Cooperation	Catching the ball after tackling and/or interception	5	5	100
	Catching the ball	42	40	95
	Catching the ball from a team mate	8	8	100
	other (e.g. pass kick)	3	2	66

Tab.4 Efficiency of play in taking control of the field of play

Action \ Types of effectiveness		Activity	Effectiveness	Reliability
Cooperation	Throwing the ball	56	55	98
	Passing the ball after previous drop	42	29	70
	Pass kick	114	52	45
Individual	Tackling and/or interception	6	6	100

Tab.5. Efficiency of play in creating a goal scoring opportunity

Action \ Types of effectiveness		Activity	Effectiveness	Reliability
Cooperation	Kicking the ball after previous drop	6	6	1
	Kicking the ball from the field	2	2	1

Defense

The top goalkeepers in the examined matches showed a similar reliability in defense both in counteracting to score a goal and creating a goal scoring opportunity: 82% and 90% reliability, respectively (Tab. 6). A slight difference in the activity of these actions was also noted (120 and 97 actions respectively).

Tab.6. Efficiency of goalkeepers' play in defense

Type of actions \ Indices	Number of actions	Number of effective actions	Reliability	Percentage of total actions	Average number of actions in a match
Against scoring a goal	120	98	82	56	17
Against creating a goal scoring opportunity	97	88	90	44	14

The tabular and graphic models of efficiency of play in defense show (Tab. 7 and Fig. 2) that the goalkeepers under study performed all the actions individually, reasonably depending on the team mates' behavior. Out of 120 total actions, 98 were effective (86% reliability). Catching the ball was the most frequent and reliable action (45 actions with 98% reliability).

The players undertook other actions with a very high reliability in defense such as fisting (75%), pushing (78%), situational defense (80%), interventions without the ball (70%) and defense of direct and indirect free kick (80%). The goalkeepers under study did not defend when taking a penalty kick.

The data in Table 8 and Figure 2 show that individual actions of goalkeepers to counteract scoring a goal amounted to 89% reliability. Catching the ball was the most frequent and effective action (92 actions with 91% reliability). 100% reliability was achieved during interventions without a ball and 90% when interception-kicking out were performed outside the penalty area. The reliability of other actions i.e. fisting, pushing, interception-kicking out within the penalty area fluctuated between 77% and 89%.

Tab.7. Efficiency of play to counteract scoring a goal

Action \ Types of effectiveness		Activity	Effectiveness	Reliability
Individual	Catching the ball	45	44	98
	Fisting	8	6	75
	Pushing	19	15	78
	One-to-one defense	5	3	70
	Situational defense	7	6	80
	Penalty kick defense	0	0	0
	Defense-intervention without the ball	24	16	70
	Defense of indirect and/or direct free kick	9	7	80
	other	3	1	30
Total number of actions		97	120	98

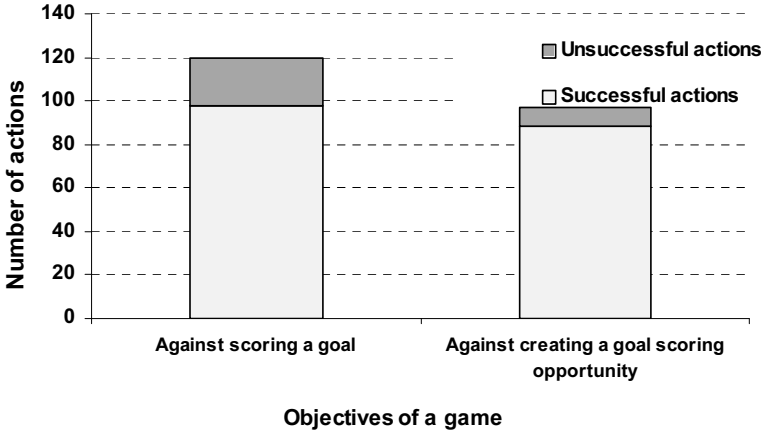

Fig. 2. Reliability of goalkeepers' actions in defense considering the game's objectives and ways of actions

Tab.8. Efficiency of play to counteract scoring a goal

Action \ Types of effectiveness		Activity	Effectiveness	Reliability
Individual	Catching the ball	60	55	92
	Fisting	7	6	82
	Pushing	4	3	81
	Interception-kicking out the ball in the penalty area	6	6	100
	Intervention without a ball	9	8	88
	Interception-kicking out the ball outside the penalty area	11	10	90
Total number of actions		97	88	90

Discussion

Indicators of effective actions of goalkeepers have been sought in Poland by only few researchers so far [3–13]. In the world research centres these issues are not discussed too often, either [among others 14–18]. The detailed preliminary research leads to the following conclusion: the diversity of the subject matter and the methodological eclecticism of the applied research procedures make comparative detailed analyses impossible; apart from a quantitative analysis of actions aiming at getting goals, a comparison of the remaining elements of the game is not justified because the majority of their descriptions and classifications do not take into consideration purposes of the game and situational conditioning of competing [2].

Praxeology of the sports game is seen as a tool for solving many issues because the praxeological methodology permits solving many problems of the sports practice in a scientific way thanks to a systematic approach, rendered relative to the determined situations of the game. The authors' study is supposed to initiate the research activity in this area. As of now an innovative character of the described examinations and their praxeological approach make an honest discussion impossible. Reflection and conclusions can concern only the presented report.

We can conclude that goalkeepers' actions aimed at controlling the field of play dominate in attack. They create ¾ of the total actions performed in the match. The majority of actions are team actions and cooperation definitely dependent on team mates' behavior during the match. 21% of actions performed by top goalkeepers are focused on keeping possession of the ball. Creating a goal scoring opportunity is a small percentage of goalkeepers' activity (3% of total actions being the effect of cooperation). Goalkeepers perform over half of their actions leading to taking control of the field of play passing the ball; however, 100% reliability is gained by throwing the ball.

In defense, top goalkeepers perform mainly individual actions, reasonably dependent on other team mates' actions. The actions are to counteract both scoring a goal and creating a goal scoring opportunity. The highest, 95% reliability is achieved when catching the ball.

Some of the actions, mainly those resulting from cooperation, have not been classified. They are as follows: being in a position to retain the ball to outnumber opponents temporarily while attacking, letting through the ball to outnumber opponents temporarily while performing regular elements of play at the opponents' goal, directing actions of players from a field of play – correction of positioning of 'active zone', narrowing and shortening field of play and off-side. A quantitative approach and the analysis of these actions would certainly expand the created models of actions performed by goalkeepers.

Conclusion

Efficiency models of goalkeepers' actions should be used to create models of play for players representing a lower level of sports competence in order to improve the effectiveness of their game play.

One should continue further study to improve a research tool so as to evaluate other, important from the point of view of the game's objectives, actions definitely dependent on team mates' behavior.

References

1. Panfil R. Prakseologia gier sportowych [Praxeology of sport games]. Wrocław: AWF; 2006 [in Polish].
2. Szwarc A. Modele poznawcze odwzorowujące sprawność działania w grach w piłkę nożną [Cognitive models mapping the efficiency in football games]. Gdańsk: AWFiS; 2008 [in Polish].
3. Szwarc A. Analiza czynności motorycznych i specjalistycznych bramkarza w piłce nożnej [An analysis of goalkeeper's motor and specialist activities in football]. *Trener* 1991;3:13-21 [in Polish].
4. Bergier J. Czynności specjalistyczne czołowych bramkarzy Europy [Specialist activities of Europe's leading goalkeepers]. *Trening* 1994;2:92-95 [in Polish].
5. Bergier J. Struktura gry bramkarzy w spotkaniach najwyższej rangi [The structure of goalkeepers' game in matches at the highest level]. *Rocznik Naukowy* IWF AWF w Warszawie, Biała Podlaska; 1995:111-124 [in Polish].
6. Kapera R. Struktura gry ofensywnej bramkarza w piłce nożnej – aplikacje praktyczne [The structure of goalkeeper's offensive play in soccer - practical applications]. *Trening* 1996;2:132-137 [in Polish].
7. Kapera R. Czynności ruchowe bramkarza podczas gry ofensywnej [Goalkeeper's motor activities during offensive play]. *Sport Wyczynowy* 1997;5/6:22-26 [in Polish].
8. Syryjczyk J. Charakterystyka czynności specjalistycznych bramkarza M. Szczęsnego na tle innych bramkarzy w rozgrywkach Ligi Mistrzów w edycji 1995/96 [Goalkeeper M. Szczesny's characteristics of specialist activities compared to other goalkeepers in the Champions League in the 1995-1996 edition]. *Trener* 1998;1:25-28 [in Polish].
9. Bergier J, Syryjczyk J. Czynności ruchowe bramkarzy w piłce nożnej podczas turnieju olimpijskiego Barcelona'92 [Goalkeepers' motor activities in soccer during the Olympic tournament Barcelona`92]. *Trener* 1994;5:24-25 [in Polish].
10. Bergier J, Soroka A. Czynności specjalistyczne bramkarek w II mistrzostwach świata kobiet do lat 19 Tajlandia – 2004 [Goalkeepers' specialist activities in II Women World Championships under 19 years Thailand – 2004]. *Rocznik Naukowy* AWF w Warszawie, Biała Podlaska 2005:229-244 [in Polish].
11. Bergier J, Syryjczyk J. Indywidualna charakterystyka działań z piłką i bez piłki bramkarki w piłce nożnej [Individual characteristics of action with the ball and without the ball of a female goalkeeper in football]. *Trener* 2006;1:20-25 [in Polish].
12. Szwarc A, Chamera M. Protokol nablyudenij i ochenkizffektivnosti dejstvij vratarya v futbole [The sheet of the efficiency of goalkeeper in soccer]. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports* 2010;4:140-146 [in Russian].
13. Soroka A, Bergier J. Charakterystyka działań juniorek i seniorek grających na pozycji bramkarza – na przykładzie gry w piłkę nożną kobiet [Characteristics of actions of juniors and seniors playing as a goalkeeper – the example of women soccer]. In: Bergier J, editor. *Piłka nożna kobiet [Female soccer*]. Biała Podlaska: PWSZ; 2006: 42-56 [in Polish].
14. Sochor J. Obserwacja gry bramkarzy na MŚ'82 w piłce nożnej [Goalkeepers' games observation in football World Championships '82]. *Trener* 1983;9:12-18 [in Polish].
15. Nestor J. Igrata na vodeszitie vratari w svieta i naszitie vratari. *Trenorska Misal* 1987;11:36-41 [in Bulgarian].
16. Suzuki S, Togari H, Isokawa M, Ohashi J, Ohgushi T. Analysis of the goalkeeper's diving motion In: Reilly T, Lees A, Davis K, Murphy WJ, editors. *Science and Football II*, London: E & FN Spon; 1988: 468-475.
17. Graham-Smith P, Lees A, Richardson J. Analysis of the goalkeeper during the penalty kick. *J Sport Sci* 1999;19:916.
18. Moraya E, Bigatão H, Lees A, RanvaudR. Evolving penalty kick strategies: World Cup and club matches 2000-2002. In: Reilly T, Cabui J, Araujo D, editors. *Science and Football V*, Abingdon: Routledge, 2005; 236-242.
19. Sainz de Baranda P, Ortega E, Palao JM. Analysis of goalkeepers` defense in the World Cup in Korea and Japan in 2002. *Eur J Sport Sci* 2008 May;8(3):127-134.
20. Palao JM, Lopez-Montero M, Lopez-Botella M. Relacion entre eficacia, lateralidad y zona de lanzamiento del penalty en function del nivel de competicion en futbol [Relationship between efficacy and laterality of foot strike and shot zone of the penalty in relation to the competition level in soccer]. Int J Sport Sci 2010 April;6;154-165 [in Spanish].
21. Wood G, Wilson M. A moving goalkeeper distracts penalty takers and impairs shooting accuracy. *Eur J Sport Sci* 2010 July;28(9):937-944.