THE PENALTY KICKS

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ABSTRACT

This paper is an attempt to study the art of penalty kicks. It involves the use of data analysis to save a penalty kick. If the preferred side of the penalty taker can be predicted through his previous penalty kick record, style of play (left or right footed), power of shooting used in previous kicks then the goal keeper movements towards his preferred side before shooting can distract the shooter and increase the chance of penalty being saved. It also studies how the high pressure conditions and distractions affect the shooting of the shooter.

Keywords: Data Analysis, Penalty Kick, Penalty Saves, Pre Penalty Movements.

I. INTRODUCTION

In soccer, a penalty kick is awarded when a team commits any one of the ten punishable offenses inside its own penalty area as the ball is in play. The governing body of this sport, the Federation of International Football Association (FIFA), describes in detail the rules that govern the nuances of the penalty kick in the Official Laws of the Game (FIFA, 2005):

- "The ball is placed on the penalty mark in the penalty area.
- The player taking the penalty kick is properly identified.
- The defending goalkeeper remains on the goal line, facing the kicker, between the goalposts, until the ball has been kicked.
- The player taking the penalty kicks the ball forward.
- He does not play the ball a second time until it has touched another player.
- A goal may be scored directly from a penalty kick."

Every penalty kick involves two active players: the kicker and the goalkeeper. On an average the ball takes roughly about 0.3 seconds to travel the distance between the penalty mark and the goal line; which is less than the reaction time plus goalkeeper's movement time to intercept any possible path of the ball. Hence, both kicker and goalkeeper have to move simultaneously. The penalty kick could result in only two possible outcomes: goal or save, actions are observed, and the result is decided almost immediately after the players have chosen their strategies. The penalty kicks in soccer is most decisive as well as the simplest sub game arising in football (soccer). The reason for its simplicity (in game theoretical terms) is the fact that only two players are involved as well as a comparatively small and well defined game space. Its decisiveness is also indisputable, bearing in mind

a significant number of decisive penalty-kick shoot-outs in previous World and European championships. The famous David Beckham miss in the EURO 2004 quarter final against Portugal maybe called a good example of its ability and importance to decide the match outcome and career of the player. The relevancy of the penalty kick in context with the economic dynamics may also be questioned. However, the impact of the kick on sports variables from an economic standpoint, like the uncertainty of match outcome, fan/viewer demand and player wages can be deemed limited.

II. THEORETICAL ISSUES SURROUNDING PERFORMANCE FAILURE IN PENALTY KICKS

2.1 Introduction to Penalty Kicks

In soccer, penalty kicks are the deciding factor in the outcome of many matches at both the national and international level. In fact, of the 145 goals scored in the 2010 World Cup finals, 22% came from the penalty spot (Fifa.com). A penalty kick is either awarded if and when either some illegal action occurs within the 18 yard box, or as a penalty shootout, to get an outcome in tied games at the end of the regulation time. In this situation only two entity are involved -shooter and goalkeeper. The shooter is required to score by taking a shot thr from a distance of 11 meters from the center of the goal. While the goalkeeper tries to do the best to prevent this from happening.

2.2 Performance Success in Penalty Kicks

A penalty kick is basically a skill of aiming and requiring the shooter to shoot and get the ball past the goalkeeper. And the goalkeeper has a fundamentally tougher task to somehow anticipate the ball and intercept it to prevent the goal. It is known that a ball placed far from the goalkeeper's reach has a better probability of beating the goalkeeper which would result in a successful goal. It is generally well-known among coaches that the best place to shoot a penalty is on the ground, as close as possible to the edge of the goalpost. This assumption, almost intuitive, is believed to be true because the reaction time that the goalkeeper has is very short, and therefore it should reasonably impossible for him or her to block a well-placed ball directed to that location (Dohmen, 2008). Bar-Eli and Azar (2009) analyzed 286 penalty kicks in an attempt to find out the optimal area of the goal that has the maximum probability of scoring. The analysis revealed that all kick towards the upper third of the goal were scored i.e. no penalty saved , while 12.6% of the kicks to the middle third and 19.8% to the lower third were stopped by the goalkeeper. These results suggest that the common practice of directing penalty kicks to the lower part of the goal (56.6% of the kicks reached this zone) is the least successful kicking strategy in penalty kicks biased on the height of goal. In contrast, the least used strategy of targeting the ball to the upper third of the goal produced more successful shots. They concluded that penalty takers should aim for the top corners of either side of goal.

2.3 Performance Failure in Penalty Kicks

According to Bar-Eli, and Friedman, 1988, a study that examined the penalty kicks in the 1986 FIFA World Cup observed that about 70% of the total 42 kicks taken landed 2 metre either side of the goalkeeper standing in center of goal. That is, the majority of the penalty kicks did not land in the predestined optimal place. Despite the relatively large target area, and the fact that players frequently hit smaller targets over much longer distances and

large number of penalty kicks are missed. Many studies have tried to count the success rate of penalty takers in major football match worldwide and there is a general agreement that this is between 75% and 86% in case of top male professionals . Therefore despite the relative simplicity of this seemingly basic aiming task, a large proportion of penalty kicks are missed. There are a few notable examples of performance failure from the world of football that may further cover this point. For example, three recent European Champions League finals were decided by penalty shootouts (i.e., FC Bayern München-Valencia CF in 2001, AC Milan–Juventus FC in 2003, and Liverpool FC–AC Milan in 2005), with a relatively high percentage of kicks being missed: 4 out of 11 (36.36%) in 2001, 5 out of 10 (50%) in 2003, and 5 out of 10 (50%) in 2005, which means that a total of 14 out of 31 shots (45.16%) were not scored from in those high pressure games, including penalties shot during the games themselves. Such a failure has grabbed the attention of sport psychologists, who have examined many factors which can affect performance in this task. Jordet, Hartman, Visscher, and Lemmink (2007) explored whether such performance failure was because of stress, skill level, physical fatigue or chance. Data were collected on 41 penalty shootouts comprising of 409 penalty kicks from major international. Jordet and colleagues have also examined how anxiety affects the behaviors of penalty takers and what effect these behaviors have on the shooting performance. Jordet and Hartman (2008) analyzed all the penalty shootouts from the UEFA European Championships, the UEFA Champions League and the FIFA World Cups in an effort to examine the relationships between shot valence, avoidance behavior and performance. Shots which are goals instantly lead to victory is classified as affirmative valence shots and shots where a miss instantly lead to loss were classified as negative valence shots. Avoidance behavior was described as not looking towards the goalkeeper or shoot too quickly. The results shows that avoidance behaviors occurred more when players were shooting to avoid defeat compared to when they were shooting to win and players with negative valence shots performed worse than those with positive shots. The authors concluded that avoidance behaviors and disruptions to temporal aspects of penalty shooting may help explain why soccer players choke under the pressure of penalty shootouts.

III. USE OF DATA ANALYSIS FOR PREDECTING THE PREDERED SIDE OF SHOOTING OF PENELTY SHOOTER

The data analysis is essential because the human memory is capable of making mistakes. The fact is several teams ranked at the top teams use information which is obtained from interactive computers with video technology to make effective and informed decisions that are biased on the study about tactics, technique and strategy. The process of development of fast, efficient recording and display systems would probably involve head coach, researcher and manager answering such questions as: how to collect information during the game; what information is needed to be collected; how can the information can be arranged and displayed; what types of data base can be developed and who will be able to access the information Once a mutual agreement has been reached on these and other issues (eg reliability of the data collection process) informative feedback can be provided to players. This information can be used to augment and correct preliminary impressions gained from game performance are only a small part of the potential benefits notation can provide. Through this we can obtain the records of the shooter's previous penalty kicks. This can help us either obtains his preferred side or the amount of power used in his previous takes. So the Goal keeper could use that information for saving the penalty kick. According to Minimax Theorem by Palocious-Huerta (2003) the shooters are divided into two kinds:-left

footed and right footed. The shooter has his natural side as the preferred side and other non-natural side. The left footed player shoots on the left side of the goal keeper as its preferred side and right footed player shoots right hand side of the of goal keeper as his preferred side. A goalkeeper may also rely on knowledge of the shooter's past behavior to inform his decision. An example of that would be by former Dutch national team goalkeeper Hans van Breukelen, who always had a box with cards with all the information about the opponent's penalty specialist. Ecuador national goalkeeper Marcelo Elizaga, saved a penalty from Carlos Tevez in a match between their national teams and then revealed that he had studied some penalty kicks from Tevez and suspected he was going to shoot to the his left side. Two other examples occurred during the 2006 FIFA World Cup:

1. Portuguese number 1 Ricardo in a quarter-final match against England, where he saved three penalties.
2. The quarter-final match between Argentina and Germany also came down to penalties, and German goalkeeper Jens Lehmann was seen looking at a piece of paper kept in his sock before each Argentinian player would come forward for a penalty kick. It is presumed that information on each kicker's "habits" were written on this paper. Lehmann saved 2 of the 4 penalties taken.

So data analysis of penalty shootout is being used effectively by some of the goalkeepers. The other strategies such as distraction through movement before person shoots could be used to gain an edge.

VI. MOVEMENT OF GOALKEEPER DISTRACTS PENALTY SHOOTERS AND REDUCE SHOOTING ACCURACY

Goalkeepers frequently absorb tactics that are made to disrupt, delay or distract shooter during the time of preparation and execution of the penalty kick. In one recent study, Jordet et al., (2009) found that players that were delayed from taking their penalty kick, often by the goalkeeper, were more likely to miss. However, there is no empirical evidence to prove the effect of distractions have on the visual attention and performance of shooters shooting under pressure. Through data analysis if the goal keeper knows which side or which the shooter his going to shoot or which is his preferred side then he can distract the penalty shooter through his actions before penalty kicks such as moving towards his preferred side and letting him/her change preferred side to non-natural or not favored side .This causes a drastically increase in the probability of saving the penalty kick. The goal keeper can stand 10-20 cm towards the preferred side and subconsciously make them shoot in the direction which he is going to dive. According to Land, 2009; Neggers and Bekkering, 2000, Neuroscience researchers have suggested that the neural mechanisms regulating goal-directed movements gain from the timely and accurate space information of the foveated target. For example, in the 2008 UEFA Champions League Final between Manchester United and Chelsea, United goalkeeper Edwin van der Sar pointed to his left side when Nicolas Anelka stepped up to take a shot in the penalty shootout. This was because all of Chelsea's penalties went to the left. Anelka's shot instead went to Van der Sar's right, which was saved. Liverpool goalkeeper Bruce Grobbelaar used a famous method of distracting the players called the "spaghetti legs" trick to help his club defeat Roma to win the 1984 European Cup.

V. SOME DATA OF PRESENT GOAL KEEPERS WITH HIGH NUMBER OF PENALTY SAVES.

PKs Missed Against % – the percentage of penalties that have either been saved, hit the woodwork or missed the target against that keeper

Bsports football

It is clearly evident from the data that penalty missed by hitting the woodwork or missed the target is quite significant in number. This is due to significant factors such as goalkeeper distractions and psychological pressure.

As we know how management information system helps us in building a effective decision making systems we can develop a system where the goalkeepers are told prior to penalty the information required by him/her to make the save.

Player	Nation	PKs Faced	PKs Saved	PK Save %	PKs Missed Against %	% PK Conceded
Tim Howard	**USA**	**15**	**6**	**40.0%**	**53.3%**	**46.7%**
Keylor Navas	**Costa Rica**	**10**	**2**	**20.0%**	**50.0%**	**50.0%**
Nick Rimando	**USA**	**18**	**5**	**27.8%**	**44.4%**	**55.6%**
Roman Weidenfeller	**Germany**	**9**	**4**	**44.4%**	**44.4%**	**56.6%**
Guillermo Ochoa	**Mexico**	**18**	**4**	**22.2%**	**38.9%**	**61.1%**
Sergio Romero	**Argentina**	**6**	**1**	**16.7%**	**33.3%**	**66.7%**
Manuel Neuer	**Germany**	**12**	**4**	**33.3%**	**33.3%**	**66.7%**
Vincent Enyeama	**Nigeria**	**3**	**1**	**33.3%**	**33.3%**	**66.7%**
Julio Cesar	**Brazil**	**20**	**6**	**30.0%**	**30.0%**	**70.0%**

VI. CONCLUSION

This paper tries to study the art of penalty kick and its importance. We can observe that goalkeeper pre-penalty movements affect the shooters accuracy. Anxiety is reported to negatively affect performance of the shooter. The amount of penalty missed by the shooter is more than the amount of penalty saved. This is because of high pressure conditions and psychological effects on shooter. The goal keeepers' distractions play an important role in saving the penalty kicks.

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