Towards a Rupture in Sport: Using a Functional Model to Understand and Intervene in Soccer

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Abstract

Changes in education are needed. Working with models allows understanding phenomena's and solving problems in every field. A model can be a very useful instrument because representing reality allows an understanding of some of its aspects. Today's available means and instruments allow a strategy of understanding sport considering its complexity and taking into account its functionality in order to improve intervention. We've tested a simple and functional model in order to understand one typical situation in soccer: the penalty kick. The model proposed by Fernando Almada, $t \geq t'$, was used to analyse a set of penalty kicks from the last FIFA World Cup 2010. From the analysis we can conclude that this model allows identifying and understanding the importance of the temporal relations between the goalkeeper and the striker actions as well as identifying relevant variables to be considered and their interdependencies.

Keywords: Sport, Soccer, Performance, Model, Coaching

1. Introduction

1.1. The Conceptual Framework

Sport, through its motivations impact on individuals and, therefore, in societies can be a powerful tool. But, as any tool, its use depends on the ones who use's it and what can they do with it.

Soccer is the world's most popular form of sport being played in every nation without exception (Reilly & Williams, 2003). All this attention influences, naturally, the research done by a wide range of scientists and fields, from sport sciences to economy, from education to medicine, from sociology to religious studies, for example.

Regardless the natural field of interest in which this sport, or some of its specific aspects, is analysed, the intent is usually to contribute to understand and/or to enhance the intervention over the phenomena and its interactions with what's around it, using it as a mean to an end.

But the trend has been to analyse sport or some of its specific activities based on a simplistic or partial vision of the phenomena due to the means and instruments (conceptual and material) used by those who analyze it or the *imaginarium* that has dominated.

However, we have achieved a moment where we believe that it is important to better understand sport itself so that real and functional aspects can be identified in order to improve the intervention through sport and soccer in particular.

We believe that is necessary to go from a conception of world and science that was very useful but that is overcome nowadays to an understanding of the phenomenon itself, not in absolute terms but in its functionality by taking into account the notion of science proposed by Popper (1963), based on conjectures and refutations, in its falsifiability.

Today's available means and instruments allow a strategy of understanding sport considering its complexity. An Era where the most important was the isolated or independent disciplinary knowledge of each phenomenon, or part of the phenomenon, where the whole was the sum of its parts has to be left behind.

When considering the complexity of the phenomenon it is necessary to take into account the knowledge from different types of science, no longer in an isolated and independent manner, but in an integrated way (already possible and even desirable) considering their interdependence and dialectical relations.

1.2. The Use of a Model

A model is an instrument which, by representing the reality from a certain point of view, allows an understanding of some of its aspects, the dialectical interconnections and relationships between those aspects, where the main purpose is not to explain the reality as true or assuming the results of some trials as valid for all phenomena, but as an instrument for profitable processes of knowledge in order to understand some aspects (not forgetting that each part should represent the dynamics of the whole) of the reality considering its complexity.

However, one of the limitations of using models is their liability of error because although they represent the reality, they are always partial representations of reality, which leads to conceptual options in the choice of the highlighting aspects according to the pursuit of objectives, which requires from the beginning, the option for some assumptions at the expense of others (Cartwright, 2006).

As Popper (1963) said, it is possible (and already even desirable) to develop a concept of science based on conjectures and refutations, in the creation of models that enables the understanding of some aspects of reality considering that the truth does not exist, that there are no certainties, and where more important than trying to prove something is to show that something can be refuted, tested.

In sport, from a functional analysis of the situation and man itself, it is possible to set a model that allows understanding and explaining the phenomenon. But will a simple and functional model allow an interpretation that enhances the uses that can be done with sport? And will it be useful in order to understand some typical situations in soccer? If so, then we can assume that this model, as any model, must not only allow us to understand and intervene on a specific situation but in every particular case.

2. Methods

2.1. The Model

Considering soccer as a collective sport, according to the taxonomy proposed by Fernando Almada (Almada, Fernando, Lopes, Vicente & Vitória, 2008), the main variables are the role to play and mastery of group dynamics. This author proposed the use of a simplified model that allows understanding and explaining the activity which can be represented by $\mathbf{t} \geq \mathbf{t}'$, in it's most simple form, where **t** is the time for the offensive action and **t'** time of the defensive action (Almada *et al.*, 2008).

In every situation in soccer there is a space (**e**) that the ball must travel to achieve the goal and another space (**e'**) to be traveled by the defenders so they can intercept the ball. These spaces travelled at speeds **v** and **v'**, respectively, take times **t** and **t'** (**e=v.t**) to be overcome. When the defenders time (**t'**) is bigger than the time that the ball (**t**) will take until it crosses theirs ways, the attacking team is successful and progresses to score (**t<t'**) (Almada *et al.*, 2008).

Using this model, in a penalty kick situation, there is a space (**e**) that the ball must travel to enter the goal, and another space (**e'**) to be traveled by the goalkeeper so he can intercept the ball. If the goalkeeper's time (**t'**) is less or equal than the time of the ball (**t**) until they reach a possible point of interception then the ball is defended (**t'<t**).

Figure 1

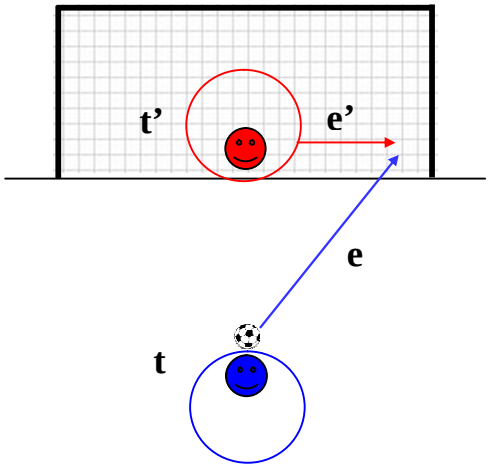

Figure 1: Representation of the Model in a Penalty Kick in Soccer.

To test the presented model and its ability to understand a specific situation in soccer, we'll consider and analyse a set of penalty kicks trying to understand the phenomenon, considering its complexity, and identify which factors influence both players (striker and the goalkeeper) and their actions.

2.2. The Method of Analysis

Based on this model we have studied ten penalty kicks from the last FIFA World Cup games in 2010 and from the videos of the situations we've measured some variables using Kinovea 0.8.15.

Knowing the space (**e**) that the ball should travel to the goal (approximately 11m), the dimensions of the goal (2,44mx7,32m), that one second of video contains 25 frames (0,04 seconds each frame), we have measured:

- the moment when the goalkeepers began their movement in relation to the strikers kick*;*
- the time the goalkeepers took to move up to the possible locations to intercept the ball (**t'**)*;*
- the time that the ball took to reach the goal or be intercepted (**t**)*;*
- the ball average speed (**v**) in each situation.

3. Results

From the collected data, in average:

- Goalkeepers began their movement 0,37 seconds before the ball being kicked and started their movement later in situations when goal was scored (0,35 versus 0,39 seconds in missed goal situations);
- After the ball being kicked, goalkeepers took 0,38 seconds in their actions regardless of being successful or not (stopping goal or conceding it);
- Goalkeepers had a total movement time of 0,75 seconds, being slightly faster when goal was scored (0,74 seconds) that when wasn't (0,76 seconds);
- The ball took 0,4 seconds to reach the goal, taking less time when no goal was scored (0,37 seconds) that when entered the goal (0,43 seconds);
- The ball was kicked at an average speed of 96 km per hour, being slightly slower when goal was scored (92,5 km/h) that in missed/saved situations (100 km/h).

In average, in situations when goal was scored, and contrary to what could be expected, the ball was kicked with lower speed (92,5km/h) than in the situations where the goal was missed (100km/h) giving less time to the goalkeepers to make their decisions based on the ball time (t). In these situations, we have also noticed that the goalkeepers started their movement later related to the striker kick (0,35 seconds before the kick) while in the non goal situations goalkeepers started their movement 0,39 seconds before the kick, even though they would have been slightly faster in the goal situations (0,74 seconds opposed to 0,76 seconds).

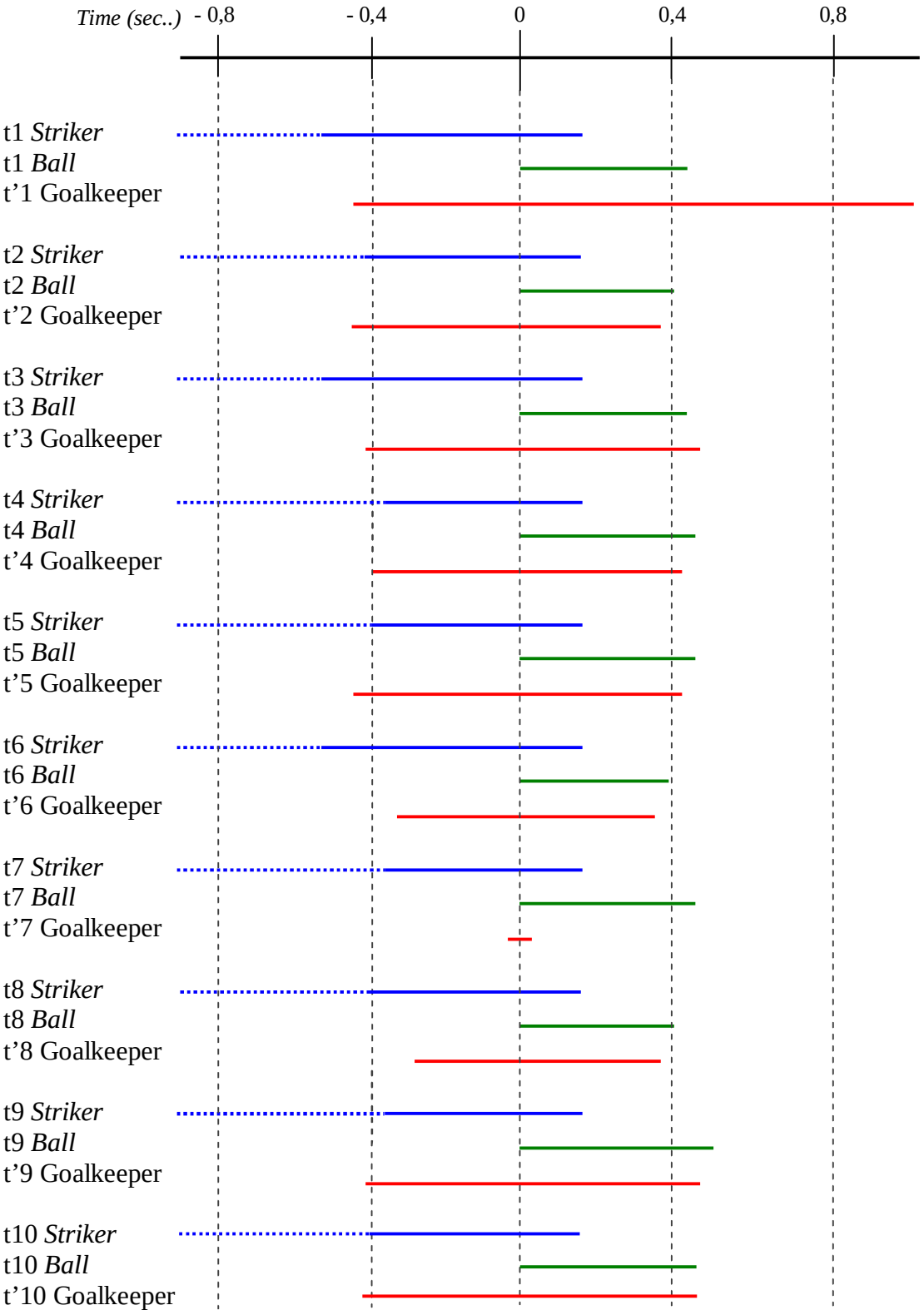

Figure 2. Data summary considering the correlation between the goalkeeper and striker times for each analysed situation.

4. Discussion

In six penalty kicks **t** was less than **t'**. This means that the striker scored and the goalkeeper didn't manage to intercept the ball. In the other four cases, **t'** was less than / or equal to **t** so the benefit was for the goalkeeper and no goal was scored.

However, more then that data itself, it is important to realize their cause. Thus, more than the average of the obtained data, the important thing is to realize the trends that this data shows and understand how through the interactions that can be established it is possible to identify aspects to consider in the training of different players.

In all penalty kicks, the goalkeepers started their displacement before the kick was made.

The collected data is coincident with similar obtained by authors like Morya, Ranvaud & Pinheiro, 2003, that found that the goalkeepers tend to start their displacement at about 0,4 seconds before the striker hit the ball.

This confirms what several other authors mentioned that as the ball takes only a few hundredths of a second (about 0,4 seconds) to reach the goal, if the goalkeepers start their movement only after the kick they have little chances to be successful (e.g., Bar-Eli, Azar, Ritov, Keidar-Levin & Schein, 2007; Savelsbergh, Van Der Kamp, Williams & Ward, 2005; Palacios-Huerta, 2003).

5. Conclusion

Through the analysis of these penalty kick situations we can conclude that this model allows us an understanding of the inherent variables to this (and other similar) situations. For goalkeepers to increase their chances of avoiding the goal, for example, and contrary to what the data interpretation may apparently indicate, they must not only increase their displacement speed or start their movement earlier (if possible), but they should rather focus on the relationship with the striker in order to determine the opponent's possibilities and understand, as soon as possible, in which direction the ball will be kicked.

In this sense, and having as a reference this model, it is important to know how each player reacts and is influenced in his time (**t** or **t'**) and how the changes can be managed so that he can still have advantage in relation to the opponent. It is also important to remember that either **t** or **t'** will be influenced by factors such as physiological or psychological (e.g. Jordet, Hartman, Visscher & Lemmink, 2007), among others.

We can than conclude that this model allows identifying and understanding the importance of the temporal relations between the goalkeeper and the striker actions in soccer as well as identifying relevant variables to be considered and their interdependencies. This can be a very useful instrument in order to understand and intervene in sport, specifically in soccer. This can be also important because if we consider the motivation that sport arouses in children and youngsters it also contributes to make changes in education by introducing the work with models not only to understand phenomena's and solve problems in sport but also in other fields and subjects like mathematics, physics and so on.

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