



Methodological Approach to Evaluate Interactive Behaviors in Team Games: An Example in Handball

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ABSTRACT

In this paper we describe a method to evaluate interactive behaviors in Team Games, most precisely goalkeeper interaction with defenders. The aim of this study is to understand the performance of a handball goalkeeper, not only by the results of their own actions, but by integrating in the model the interactive actions between goalkeeper and defenders. The requirements of observational methodology are observed to gather data and we used sequential analysis and polar coordinates techniques to analyze data. The data are gathered from a natural environment where players have their behaviors, i.e., from handball matches in high level competitions context. Using an observational tool specially created and validated by an expert panel, the data was registered in a sequential way to make possible the sequential analysis with lags, prospective and retrospectively made.

The results show the goalkeeper performance is significantly associated with defenders actions.

Author Keywords

Observational methodology, sequential analysis, interaction, handball, goalkeeper.

INTRODUCTION

The evaluation of a goalkeeper performance in Handball is normally made considering only the balls received in relation with the balls saved by this player. This equation is very poor to translate goalkeeper's performance during a

match. In fact, the goalkeeper makes actions according to the player who is throwing to the goal. But, this situation isn't always a simple and direct confrontation between goalkeeper and the attacker with the ball. Most times, goalkeeper makes actions and moves in a complex situation, where the attacker with ball and the defender(s) which made opposition are present and make necessary, to the goalkeeper, give attention to that. We can consider three kinds of different main situations when goalkeeper is defending the goal in Handball: 1) During a 7 m throw or in a 1x0 situation after a counter-attack; 2) when the throw is made with a defender between the attacker and the goal; 3) when the attacker is in the middle of defence or is trying to score a goal from the wing, with opposition.

Except for the first case, we always have a complex situation with interactions between goalkeeper, defender(s) and the attacker who is trying to score a goal.

The question is: How to evaluate the goalkeeper performance considering this reality? How can we analyze this performance without considering these interactions?

The Goalkeeper Cooperation with Defence: A Special Need and a Special Skill

The velocity of the ball and the distance, from where the throw takes place, make impossible to the goalkeeper to react and stop and save the ball. Because of the place from where the throw is made, near the goal, and the velocity of the ball, he needs to anticipate the attacker action and calculate the probability of the ball location on the goal. This behavior is a tactical one and, in order to make decisions correctly, he must consider all the signs he can perceive on advance from the ball, from the attacker and from defenders.

Considering the three different main situations related to goalkeeper when he is defending the goal: 1) During a 7 m throw or in a 1x0 situation after a counter-attack; 2) when the throw is made with at least a defender, between the

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attacker and the goal; 3) when the attacker is in the middle of defence or is trying to score a goal, with opposition, from the wing, we easily identify a direct confrontation in the situation 1 between goalkeeper and the shooter and a complex situation (case 2 and 3) where interactions between goalkeeper, defender and attacker are a reality [6].

In Handball more than 50% of shots made have a defender between the ball and the goal or the attacker who throws is in constraint by defenders actions or position, like we wrote before (points 2 and 3). That means the cooperation between goalkeeper and defenders is a necessary skill to both kind of handball players, defenders and goalkeeper, in order to maximize their actions and have efficacy in intent to protect their goal.

This cooperation is more effective when defenders “attack the attack”, this means, when defenders are pro-active and create constraints to the attacker shot action, intervening on decision making concerning this offensive skill, decreasing the possibilities of choice concerning the placement of ball on the goal. Thus, defender gives to goalkeeper the possibility to anticipate the location of the ball on goal increasing his efficacy. However, the defender position is a positional constraint for the goalkeeper and also for the attacker with ball and as important as the defender actions against attacker and the distance between these two players. Having someone that it makes possible for the goalkeeper to anticipate actions, from an attacker with ball and understand what he is trying to do give him a possibility of winning the duel against the shooter. Considering all these reasons, doesn't make sense to evaluate the goalkeeper performance without analyzing goalkeeper/defender and defender/attacker interaction, when this interactive behavior is a significant part of goalkeeper behavior during a match.

Analyzing Goalkeeper/ Defence Interaction

To assess goalkeeper performance, considering the situations 2 and 3, we must analyze the defender's behavior and the influence he has on the goalkeeper, also considering the interaction between defender and shooter concerning actions and distance between players. We need to understand the influence of the defender positional and behavior constraint, related to the shooter and goalkeeper, in the defensive process.

Using observational methodology and considering multi-events, we believe it's possible to find patterns that give the possibility to understand the goalkeeper performance with more accuracy. With this methodology we guarantee make possible a qualitative and quantitative analysis of data [1].

Types of Data and Variables

Multi-events (Multievent Sequential Data) [2], i.e., events that co-occurred, when registered sequentially give the possibility to gather data considering goalkeeper action related to the defender and attacker actions that co-occurred.

The variables considered in this model are: 1) related to the goalkeeper position and movement on goal: initial position on the goal; moving to the left or right side anticipating the ball location; 2) position on the goal related to defender: behind defender; on the left side; on the right side; 3) goalkeeper action when he is defending the goal: move to the front; jump; stay on position; moves laterally on the line goal; get down; 4) related to defender during defence process: attack the man with ball giving him pressure; press the shooter and contact him; stay on defence position with arms down; stay on defence position with arms up; move laterally and intent to decrease free space to the attacker; stay, jump and try to block the ball; move in front and try to block the ball; 5) defender position on playfield in relation with attacker: near attacker; far from attacker; on the side of ball arm; on contrary side of ball arm; on middle position of the attacker body; 6) the attacker position on playfield when he tries to throw into goal: wing position on left or right side; in 6m zone; in central backward zone; in lateral backward zone on left or right side; 7) the result of the sequence: goal; goalkeeper save; ball throw out the field play; the defender block the ball; defender intercept the ball.

Analyzing Data with Sequential Analysis and Polar Coordinates

Sequential analysis with lags is one of the analysis techniques used on observational methodology that was developed by Bakeman & Gotman with support of Saket [3]. The goal of this technique is to detect patterns of behavior or regularities of behaviors when they are sequentially registered.

Using sequential analysis with lags we can detect and find regular association between behavior criteria and the events we have registered, on prospective and retrospective way. Using this technique analysis we can detect patterns of behavior that occurred during a competition, from goalkeeper in relation with defender and attacker. Looking prospectively from goalkeeper behaviors criteria to behaviors that happens on lag 1, 2 or 3 until the end of sequence, we know if the association between behaviors are significant, considering the level of significance we use (0,05). If the results on lag 1, 2 or 3 are significant, that means the probability of behavior criteria activate behaviors on lag 1, 2 or 3 is significant too.

Considering the events related with the result of defensive sequence, ball saves by goalkeeper for example, as criteria behavior and using retrospective sequential analysis, from this behavior backward, we can see behaviors that happens in lags -1,-2,-3 until the beginning of the sequence, looking for significant results.

A sequential analysis process is a particular kind of probabilistic process, which allows us to know the structure of behavior flow [4].

Other technique used on observational methodology is polar coordinate technique that has a double strategy: reduce data

and give the possibility to represent, on vectorial way, the complexity of inter-relations established between different variables of an *ad hoc* system [5].

CONCLUSIONS

Using this model to evaluate goalkeeper performance we have more accuracy in the evaluation because we consider all the situations that can happen during a match and not only the situations of direct confrontation between goalkeeper and shooter. Considering interactive behaviors between goalkeeper, defender and shooter, we guarantee more similarity with goalkeeper behavior in her natural environment, in this case, on playfield during a match competition.

The results show how significant are positional and action constraint of a defender on shot action and on goalkeeper behavior trying to save the ball. Giving a different weight to the different situations according the match occurrences of events, considering direct confrontation and others different situations, we can obtain the final result of goalkeeper performance. Besides, if we are interested, we can isolated the goalkeeper performance in direct confrontation from de others that depends on cooperation and interactions.

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