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# Differences in movement behaviour between successful and less successful goalkeepers in the interception of corner kicks

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## ABSTRACT

The aim of this study is to analyze the movement behavior of young football goalkeepers when they try to catch balls from corner kicks. Goalkeepers were classified on their success during the interception, creating two groups of analysis, successful and less successful goalkeepers. The most successful goalkeepers obtained a higher success rate with a motor behavior characterized by moving your hands later and therefore catch the ball later than goalkeepers less successful. These results show that the specific requirements of catch a ball from a corner kick are similar to the requirements of catch balls in other sports. They are therefore less similar to the anticipation of future actions on projections of global equities football. **Key words:** MOVEMENT BEHAVIOR, FOOTBALL GOALKEEPERS, CORNER KICKS

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## INTRODUCTION

From the literature, it is well known that experts and successful players anticipate better and different than novices and less successful players (e.g. Mann, Williams, Ward & Janelle, 2007; Ward & Williams, 2003; Williams, 2000). For instance, Williams, Davids, Burwitz and Williams (1994) showed that experienced football players decided faster when they are required to anticipate pass destination in a projection of open play situations in football.

However, some studies indicate that experts do the opposite, namely they wait longer before acting. For example, Oudejans, Michaels and Bakker (1997) reported that expert catchers move later than novices in the task of catching a fly ball. The expert observed for a longer time the initial ball flight path and as a result could make a better prediction where and when the ball would arrive and as a consequence showed a more superior catching performance. Similar in a penalty experiment by Savelsbergh, Williams, Van der Kamp and Ward (2002) where expert goalkeepers waited longer with their action in stopping a penalty task. In a second experiment this issue is explored further by ranking the participants based in their ability to predict the direction in a penalty kick. Again, the successful goalkeepers perform close to foot-ball contact and thus initiated their action later than novices (Savelsbergh, Van der Kamp, Williams & Ward, 2005). This way they could retrieve valuable information about the positioning of the non-kicking leg necessary for optimizing the task performance. Thus, these studies indicate that it is not always useful to react as fast as possible, but an advantage to take more time in order perceive more useful information in order to improve the anticipation about the very near future.

It is common for researchers to compare expert and novice athletes on basis of the level at which they perform. The ones that act at top level are considered the experts and the one who perform at recreation level is seen as novice. However recent studies (Savelsbergh et al. 2005; Savelsbergh, Onrust, Rouwenhorst & Van der Kamp, 2006; Vaeyens, Lenoir, Williams & Philippaerts, 2007; Savelsbergh, Haans, Kooijmans & Van Kampen, 2010) shows that new insights can be obtained when a so-called within design is used. When researchers are interested in comparing successful and less successful performance in a specific task the use of within task design is more appropriate. It's particularly important to identify differences intra-groups because experts are not always successful in a specific task. In order to compare expertise in a specific task, groups are created as a base within task criterion such as number of penalties saves (Savelsbergh et al., 2005; Whiting, 1986), the ability to predict the future destination of the ball in volleyball in order to try to block it (Sáez-Gallego, Vila-Maldonado, Abellán & Contreras, 2013) or the percentage of catches in corner kicks, as we show in the current experiment.

In a previous research, Abellán, Savelsbergh, Contreras and Vila-Maldonado (2016) investigated the anticipation behavior and coordination pattern of young football goalkeepers by describing the task "catch a ball from a corner kick". Results show that failures are explained by a combination of a poor anticipation behaviour, characterized by a too fast initiation of their run up, and a poor coordination pattern of their hands and jump action.

Therefore, the principal aim of the present study is to determine whether differences in movement behaviour exist between successful and less successful goalkeepers when they have to intercept a corner kick. Do successful goalkeepers wait longer with the initiation of their action in order to retrieve more information about the ball flight and therefore initiate their run-up later than less successful goalkeepers? Or do successful goalkeepers need only a small amount information about the early ball flight in order to predict where and when the ball will come and as a result will initiate their run-up faster than less successful goalkeepers? To

be more specific, two types of constraints were manipulated, task constraints (intercept a corner kick) and organismic constraints (differences between successful and non successful goalkeepers) in order to examine movement and anticipation behaviour of goalkeepers. We predict to see differences on movement behaviour and performance across differences groups of analysis, according with the idea that successful athletes use anticipated strategies to perform better and different than less skilled athletes (Ward & Williams, 2003).

## METHODS

### Participants

Twenty-two young goalkeepers playing in one of the three highest Spanish junior leagues took part in this experiment. Eleven goalkeepers played in the highest Spanish junior league and eleven goalkeepers played two leagues lower than the highest Spanish junior league. Participants were subsequently divided into two groups, successful and less successful goalkeepers, based on their ability to intercept corner kicks (see for details the results section). All participants and their coaches were informed of the nature of the study and took part voluntarily.

### Apparatus

Movement behaviour of the goalkeepers was recorded by video-camera (Sony handycam DCR-HC42E PAL), positioned on the top of the opposite side of the kicker (see Figure 1). The camera was positioned to the other side after the end of the first 10 corner kicks.

### Procedure

Goalkeeper was required to catch a ball out of a corner that is kicked either from the left or right side (10 kicks each). The side order was randomized over the participants. Each trail started with the goalkeeper situated at the goal line just before the corner kick (see Figure 1). Two right footed players kicked the balls and rotated after every two kicks. Goalkeepers and players were instructed to perform the corner kick like they would do in a match.

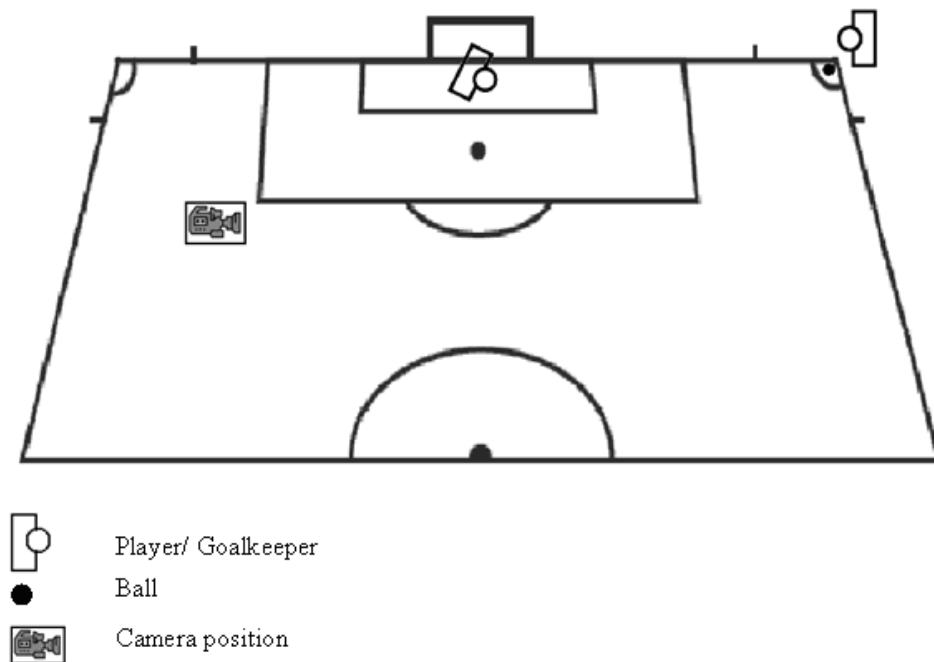


Figure 1. Top view of the experimental setup.

### **Dependent Variables and Analysis**

Performance and movement behaviour of young goalkeepers are studied. In order to study movement behaviour of the goalkeepers two independent different ways to analysis are carried out (according with Abellán et al., 2016). Anticipation behaviour of the goalkeepers is studied by the so-called “From kick analysis”. The coordination pattern of the goalkeepers is observed by means of “From catch analysis” (see dependent variables and analysis section for more information). The video recordings (see Figure 1) were analysed frame by frame. Two different types of data were obtained by the analysis.

### **Performance data**

The performance of the goalkeepers was analysed as follow:

- The percentage of catches: percentage of trials in which goalkeeper did catch the ball.

A T- TEST was carried out to compare the percentage of catches per Group (Successful vs. Less successful).

### **The temporal aspects of the movement**

The movement behaviour of the goalkeepers was analysed. The variables were analysed from the moment of kick by kicker and from the moment of catch by goalkeeper. All variables were calculated in seconds. The variables from the kick analysis were:

- The run up time: time between the first touch by kicker and the goalkeeper start to move.
- Time of the jump: the time between the first touch of the kicker and start of the jump by the goalkeeper.
- The start of the movement of the hands: the time between the first touch of the kicker and start of the hands in direction of the ball.
- The catch time: the time between the first touch of the kicker and the catch of the ball. When goalkeepers did not catch the ball, the catch time was obtained from the time in which goalkeepers touch the ball or the ball passes close to their hands.

The variables analysed by from the catch analysis were:

- The movement time of the hands: the time between the start of the hands in direction of the ball and the catch of the ball.
- The movement time of the jump: the time between the start of the jump and the catch of the ball.
- The time of the run up: the time between the goalkeeper start to move and the catch by goalkeeper.
- The time of the ball flight: the time between the first touch of the ball and the catch by goalkeeper.

For each dependent variable separately, a Group (Successful vs. Less successful) x Corner direction (Left vs. Right) ANOVA with repeated measurement design on the last factor was carried out with Alpha level set at 0.05.

## **RESULTS**

Of a total of 440 corner kicks 414 could be used for further analysis.

### **Performance Data**

In Table 1 the average performance is presented separately for each goalkeeper. Based on the percentage of catches, the twenty-two goalkeepers are ranked from successful to less successful. As the Table 1 shows,

the playing level (League) of the goalkeepers is not perfectly correlated with the catching success in this task. This justifies the use of the within-design.

Table 1. Ranking of catchers, league and group classification

Rank	Percentage of catches	League	Group
1º	100	1	Successful
	100	1	Successful
	100	1	Successful
4º	95	3	Successful
	95	1	Successful
6º	94.44	1	Successful
7º	94.12	1	Successful
8º	90	3	Intermediate
	90	3	Intermediate
	90	3	Intermediate
	90	1	Intermediate
	90	1	Intermediate
13º	89.47	3	Intermediate
14º	88.89	3	Intermediate
	88.89	1	Intermediate
16º	85	3	Less successful
	85	1	Less successful
18º	84.21	3	Less successful
19º	82.35	3	Less successful
20º	75	1	Less successful
21º	64.71	3	Less successful
22º	61.11	3	Less successful

Three groups are created, based on the successful catches. A successful group, these are goalkeepers with a percentage of catches more than 90% ( $> 90$ ), a less successful group, which are goalkeepers with a percentage of catches less than 86% ( $< 86$ ). Participants with percentages between two groups (range 87 - 90) are defined as an intermediate group. This type of analysis resulted in a distribution of seven successful (mean age=17.86, SD=0.69 years; mean experience=10.57, SD=1.99), eight intermediate (mean age=17.38, SD=1.06 years; mean experience=8.38, SD=4.53 years) and seven less successful (mean age=17.71, SD=0.76; mean experience=9.14, SD=3.58 years) goalkeepers. Due to the focus of the study, the

intermediate group is excluded from further analysis. A T-test revealed significant differences ( $t(12) = 5.066$ ,  $p = .000$ ), that is, the successful group (96.94%) showed better catching performance (as expected) from corner kicks than intermediate group (76.77%). These two groups are used for further analysis of the temporal aspect of the movement.

### ***The temporal aspects of the movement***

The mean group scores of movement behaviour analysed from the moment of kick are presented in Table 2.

Table 2. Means and standard deviations for movement behaviour (in seconds) in corner kicks analyzed from kick. Asterisk (\*) mark significant group effects in right and left analysis. Accent (^) mark significant group effects in total analysis

	Successful			Less successful		
	Right	Left	Total	Right	Left	Total
Run Up	0.60 ± 0.18	0.63 ± 0.23	0.61 ± 0.18	0.53 ± 0.14	0.54 ± 0.24	0.54 ± 0.18
Jump	1.55 ± 0.22	1.72 ± 0.13	1.66 ± 0.13	1.45 ± 0.08	1.53 ± 0.21	1.51 ± 0.14
Hands*^	1.60 ± 0.17	1.73 ± 0.13	1.66 ± 0.11	1.43 ± 0.02	1.53 ± 0.19	1.48 ± 0.10
Catch	1.89 ± 0.15	2.04 ± 0.13	1.97 ± 0.10	1.77 ± 0.09	1.88 ± 0.26	1.81 ± 0.15

The Table 2 showed that the less successful group seem to perform faster or moved earlier than the expert group for all the variables considerate. The Group (Successful vs. Less successful) x Corner direction (Left vs. Right) ANOVA with repeated measurement for each dependent variable separately revealed significant main effect of group for the start of the movement of the hands ( $F(1,13) = 11.32$ ,  $p = .006$ ) and main effect for Corner direction (right/left) ( $F(1,12) = 10.55$ ,  $p = .007$ ) for the start of the movement of the hands. These findings show that the successful goalkeepers initiated their catch actions (variable 'hands') later in comparison to less successful goalkeepers.

The mean group scores of movement behaviour analysed from the moment of catch are presented in Table 3.

Table 3. Means and standard deviations for movement behaviour (in seconds) in corner kicks analyzed from catch. Accent (^) mark significant group effects in total

	Successful			Less successful		
	Right	Left	Total	Right	Left	Total
Hands	0.30 ± 0.05	0.31 ± 0.07	0.31 ± 0.06	0.33 ± 0.07	0.34 ± 0.09	0.33 ± 0.07
Jump	0.30 ± 0.05	0.31 ± 0.05	0.32 ± 0.05	0.33 ± 0.06	0.35 ± 0.06	0.34 ± 0.06
Run Up	1.29 ± 0.28	1.41 ± 0.26	1.40 ± 0.17	1.24 ± 0.17	1.33 ± 0.27	1.29 ± 0.19
Ball Flight^	1.89 ± 0.15	2.04 ± 0.13	1.98 ± 0.09	1.77 ± 0.09	1.88 ± 0.26	1.82 ± 0.15

The ANOVA revealed significant main effect of Group for the dependent variable time of the ball flight ( $F(1,13) = 5.589$ ,  $p = .036$ ). This finding indicates that the time of the ball flight was significantly longer in the corner kicks catches by the successful goalkeepers in comparison to the less-successful group.

## DISCUSSION AND CONCLUSIONS

The aim of this study was to examine differences in performance and movement behaviour between successful and less successful goalkeepers in catching balls out of corner kicks. As expected, the successful group was significantly more accurate intercepting corner kicks, waited longer to initiate their hands, nearer to the catch and catching the ball later in comparison with the less successful group. It appears that the difference between successful and less successful goalkeepers in intercepting corner kicks is determined by a combination of when to move their hands in order to catch the ball and when finally catch the ball. Results in the run up time reveal a difference with findings in Abellán et al. (2016). In previous research (Abellán et al., 2016), goalkeepers obtained an earlier run up (0.53 seconds) in successful trials in comparison with the present chapter (0.63 seconds) in successful group. Also the run up time differ significantly between successful and non successful trials whilst here there are no significant differences between successful and less successful goalkeepers. Maybe this difference is because in Abellán et al. (2016) they compare successful with failure within the same goalkeepers and in the present study it compare successful and less successful goalkeepers and also we included successful and non successful trials into the analysis in each group. Therefore, it is interesting to incorporate new studies of both types of analysis, that is, successful versus non successful trials and successful versus less successful goalkeepers, in order to obtain more clear findings.

Studies focused on the interception behaviour of corner kicks by goalkeepers are very scarce (for exceptions see Abellán, Sáez-Gallego & Contreras, 2015 and Abellán et al., 2016 in football and Cañal-Bruland et al., 2010 in field hockey). However, analysis of goalkeeper's performance in football are available with respect to the task of penalty kicks (e.g. Navia, Van der Kamp & Ruiz, 2013; Noël & Van der Kamp, 2012; Savelsbergh et al., 2002, 2005; Williams & Burwitz, 1993). Findings of Savelsbergh et al. studies indicated that expert and successful goalkeepers wait longer and perform (that is start their dive) when the kicker is nearer to the foot-ball contact. Similar strategies have been reported in catching fly ball experiments (Oudejans et al., 1997; Rodrigues, Vickers & Williams, 1999). For example, Oudejans et al. (1997) showed that expert catchers are more accurate in catching fly ball by a later initiation of their movements than novices. In the present study, similar findings are observed. The successful goalkeepers wait longer with the initiation of a response, probably in order to retrieve more information about the ball flight. If the goalkeepers in order to retrieve more information indeed look longer at the ball is not established in this study.

From kick analysis is used to investigate anticipation behaviour of goalkeepers in catching fly balls from corner kicks. Such is previously mentioned, in the present study successful goalkeepers waited longer to move their hands in order to catch the ball. Moreover, although there were no significant differences, results in the run up time show the tendency that successful goalkeepers waited longer to start their run up. In experiments involving projections of open play in football, such as Williams et al. (1994), found that experts perform more accurate and faster than novices. Moreover, the findings of the present study support the theory that specific task requirements to catch the ball out of a corner kick are more similar to the requirements to catch a fly ball in other sports, such as baseball (Oudejans et al., 1997) than with the requirements of anticipation test in open play situations in football. In this task the urge for anticipation is maybe less required and the goalkeepers apply a more 'on-line' control in their catching action. As a consequence of this on-line control the anticipation of the ball flight is of less importance, because they constantly monitor the ball in flight. There are a lot of studies that support the idea that the fly of the ball offers a relevant information in order to predict the final destination (Müller & Abernethy, 2006; Reina, Moreno & Sanz, 2007; Vaeyens et al., 2007).



The goalkeepers' coordination pattern is studied by means of the from catch analysis. This analysis revealed no differences between the successful and less successful goalkeepers (except in the time of the ball flight). Probably, all the goalkeepers of the current study have achieved a good coordination level. If more novice goalkeepers took part in the experiment, differences in coordination pattern would be apparent.

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