Motor Programs as Indicators of Penalty Direction in Soccer

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Abstract

Introduction*: Many football games are decided on penalties and usually in championship final games. When seeking to anticipate movements, differences in amplitude can harm players because the informational movement appears to be spread "globally" throughout the action and should be coded at several levels. Thus, it would be interesting to analyze the entire period of the kick, since the player begins his run to approach the ball to recognize the motor patterns used in the kick that identify his direction.* ***Objective****: The objective of this study is to identify patterns of behavior in penalty kicks that may indicate the direction of their action / kick and in my moment they appear.* ***Methodology****: The sample consisted of 21 subjects hitting a penalty kick, 18 males and 3 females with an average age of 22.18 ± 2.44 years and two goalkeepers with college football experience. The tests consisted of a battery of two penalty kicks for each subject in order to score. The kicks were recorded by a video camera with a front view of the goal goal and the back of the batter. The kick phases were divided into the starting leg position; first step leg; angle of the elbow in relation to the body seen from behind; angle of the elbow in relation to the displacement line seen from above; direction of the tip of the supporting foot and position on the goal where the kick was. Each kick was preceded by a start signal. The data were analyzed from the registration of each variable and the position of the goal in which the ball was kicked, considering it in three sectors: left, right and central.* ***Results****: The main results indicated that the variable "Leg of the first step" had 81% of the kicks associated with the direction of the goal; 52.4% of second kicks had repeated the pattern of behavior and 84.6% had repeated the pattern of behavior regardless of the goal position. The variable "Elbow angle in relation to the body seen from behind" had 81.8% repeated behavior pattern regardless*

of the goal position and the variable "Elbow angle in relation to the displacement line seen from above" had 81% association with the sector of the goal in which the ball was kicked; 52.4% of second kicks had repeated the pattern of behavior and 91.7% had repeated the pattern of behavior regardless of the goal position. ***Conclusions****: The main conclusions indicate that it is possible to relate the kick location with the batter's body information; the start of the race seems to indicate that there is a prior intention of movement programs; the decision of where to hit the penalty appears to be made before contact with the ball and more closely to the placement of the support foot and with this relationship, the size of the goal to be defended by the goalkeeper could be reduced, increasing the possibility of defense.*

Keywords: Motor Program; Sport; Cognitions

1. Introduction

Many games are decided on penalties. Generally, decisions for maximum penalties are made at decisive championships. In the 9 recent world football matches from 1982, 26 games were decided by maximum penalties, including in two finals, totaling 240 kicks. Among the winning teams, 86.1% of the penalties hit were converted, showing a gap that should be studied when looking for sports performance in football.

In the literature, it is possible to find studies that analyze the characteristics of young people considering the variables of physical and quantitative nature, accounting for the number of touches on the ball or shots on goal, mentioning motor skills (Neves, 2010). Silva-Junior et al. (2011) also analyze soccer players according to their physical characteristics, emphasizing that muscular endurance, speed and acceleration are motor skills.

With regard to specific goalkeepers, Gonçalves (2010) compares them with players from other positions. In his study, the goalkeeper has lower aerobic capacity and greater agility and vertical thrust than other players. Other authors dedicate themselves to studying behavioral variables saying that the team actions at the moment of the recovery of the ball possession are modified according to the current result and the quality of the opponent (Andrade, 2010).

Almeida (2010) analyzes the offensive sequences in youth soccer and reduced situations of 4 and 7 athletes, also demonstrating the importance of analyzing the player's cognitive aspect. This line is reinforced with the studies of Giacomini, Soares, Santos, Matias and Greco (2011) when they affirm that the quality in sports performance, in collective sports games, is related to cognitive abilities, especially with knowledge.

There are also authors such as Ruschel, Haupenthal, Hubert, Fontana, Pereira, and Roesler (2011) who studied the simple reaction time and football players. His study found no differences in Visual Reaction Time between categories, but only Auditory Reaction.

Bourne et al. (2013) analyzing penalty in handball supports the hypothesis that the anatomical regions closest to the ball would be better informative for anticipation and Roca et al. (2013) state that qualified soccer players, compared to less skilled players, make more precise anticipations and decisions due to quantitative differences in their perceptual and cognitive processes.

This study originates from the theory of motive communication, a study previously carried out by Araújo, Caniçali, De-Bortoli, and De-Bortoli (2003) where a strong relationship was found between information sent by the attacker at the time of the penalty and the direction of the ball and it is based on the expectation of knowing if it is possible to decrease the penalty taker's advantage and increase the chances of the goalkeeper to save the penalty from the early identification of the direction of his shot.

The objectives are to identify if there is a pattern of behavior in penalty kicks that may indicate the direction of their action / kick; verify that the kicking motor program is organized before commencing displacement or is defined during commuting for execution and identifying positive motor communication during a penalty kick.

For this, hypotheses H0 were formulated: penalty kicks follow random motor patterns and H1: penalty kicks follow predefined motor action patterns.

2. Method

Kind of study

Inductive, transversal, empirical

Sample

The sample consisted of 21 penalty takers, 18 males and 3 females with an average age of 22.18 ± 2.44 years and two goalkeepers with college football experience.

Instruments

The tests consisted of a sequence of two penalty kicks for each subject in order to score. The kicks were recorded by a video camera with a front view of the goal goal and the back of the batter. The kick phases were divided into the starting leg position; first step leg; angle of the elbow in relation to the body seen from behind; angle of the elbow in relation to the displacement line seen from above; direction of the tip of the supporting foot and position on the goal where the kick was directed. Each phase described above was considered as a study variable (Chart 1).

TABLE 1 - Variables and their respective execution indicators.

Variable	**Indicators**		
V1 – Starting leg position	P: Parallel leg	D: Diagonal leg	X: Unable to identify
V2 – Leg of the first step	P: Parallel leg	D: Diagonal leg	
V3 - Angle of the elbow in relation to the body seen from behind	P: <33 degrees	X: >33 and <66 degrees	D: >66 degrees
V4 - Angle of the elbow in relation to the displacement line seen from above	P: <33 degrees	X: >33 and <66 degrees	D: >66 degrees
V5 - Direction of tiptoe support	P: Parallel	C: Center	D: Diagonal
V6 - Position on the goal where the kick was directed	P: Parallel	C: Center	D: Diagonal

Procedures

Each kick was preceded by an audible start signal and between kicks an interval of not less than 60 seconds or more than 120 seconds was observed. The data were analyzed from the registration of each variable and the position of the goal in which the ball was kicked, considering it in three sectors of the same dimension: left, right and central.

Statistical analysis

The results were analyzed descriptively. The conclusions were counted and variables V1 to V4 were related to the sector in which the ball reached the goal (V6). The first kicks and then the second kick of each subject were related. Subsequently, the first was related to the second kick of each subject.
The variable V5 was disregarded in the presentation of the results because it was noticed that, at least in the way it was proposed, there was no clarity in its interpretation. Thus, it was decided to disregard it.

Ethical care

This study observed the ethical standards that aim to preserve the physical and psychological integrity of the participants, protecting them from any possible risks, during and after their participation. All subjects were volunteers and, after being informed of the study protocol, expressed their acceptance to participate by signing a free and informed consent form with two witnesses. The data from the study is stored in a specific location and only researchers have access to it.

3. Results

Figure 1 shows the percentage results of the relationship between variables V1 to V4 and variable V6. The data are presented in three columns. The first refers to total kicks, the second to the first kicks and the third to the second kick of each subject. It is observed that the variables V2, V3 and V4 showed a greater relationship with V6 in the second kick.

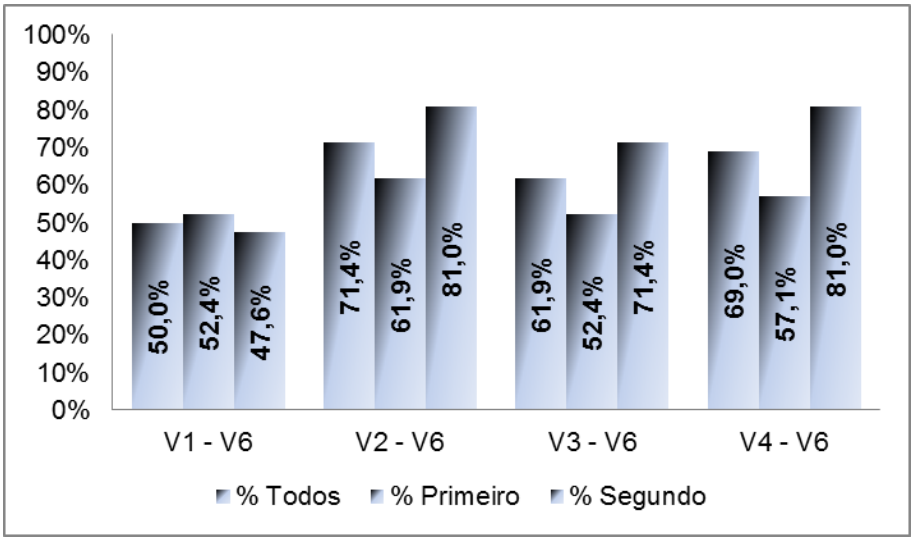

Figure 1. Relationship between variables V1 to V4 with the sector in which the ball reached the goal (V6). *Todos: All; Primeiro: First; Segundo: Second

When the behavior patterns between the first and second kicks for each subject were analyzed, it was observed that the variables V2 and V4 had a higher percentage of repetition of the combination between the variable and the goal sector (Figure 2), that is, repeated pattern and sector.

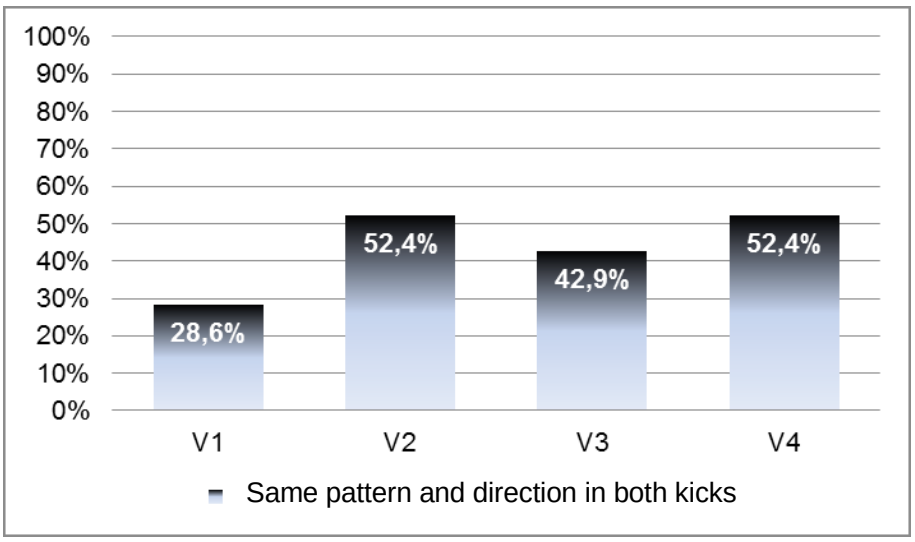

Figure 2. Repetition of the movement pattern and sector of the goal for each subject, in both kicks.

When the behavior patterns between the first and second kicks for each subject were analyzed, regardless of the sector in which the ball reached the goal, it was observed that the variables V2, V3 and V4 had a percentage above 80% of repetition of the combination between the variable and the target sector (Figure 3), that is, when you changed V6, you adjusted the other variables as well.

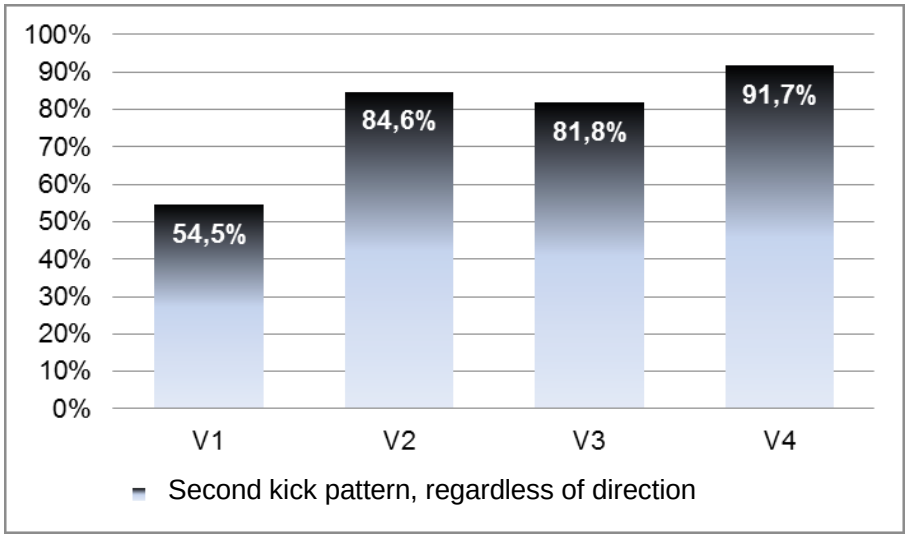

Figure 3. Repetition of movement pattern for each subject, in both kicks.

4. Discussion

When analyzing the results, it is noticed that the signs of motor communication are present when

more than one study variable is mapped. If we consider that the second kick may have more dedication from the subject because the psychological load of the repetition may be stronger, we observe values of relation between the variables very high. These results confirm Bourne et al. (2013) when they state that the informational movement appears to be spread "globally" throughout the action and to be coded in motion at various levels. The way in which this information is extracted appears to be skill dependent, and as an attempt to quantify the most pertinent (or disturbing) information to artists across the spectrum of skills in making anticipatory judgments. They even recommend that it would be useful to investigate the informative value of individual location trajectories as well as the relative movement within specific anatomical structures.

Another study that partially supports this analysis aimed to find out the differences that exist depending on the level of competition in laterality, the kick zone and the effectiveness of the penalty in professional professional soccer athletes. The results found showed that the most effective kickers were not the ones who play at a higher level of competition, although the differences found are reduced (Palau et al., 2010). Considering driving communication as a reality, this result confirms the study gap for further systematization of specific training, as it would be expected that athletes with a higher competitive level would have better results in this analysis.

When analyzing a study with tennis players, Smeeton, N.J. & Huys, R. (2011) state that differences in range of motion can impair the anticipation of stroke direction in low-qualified tennis players. This discovery may help to understand how deceptive actions can elude individuals with a low level of skill, while individuals with a higher level of skill are unaffected, reinforcing the hypothesis that there is a codification of the movement.

An interesting data that should be highlighted is the study by Roca et al. (2012). They identified that the average number of hours accumulated per year during childhood during specific soccer activities was the strongest predictor of perceptual-cognitive knowledge. Specific soccer practice activity during adolescence was also a predictor, although its impact was relatively modest. No differences were found between the groups regarding the number of other sports involved during development, or for some of the main results achieved.

The different values in each variable may be related to the fact that some body segments are more strongly related to the kick sector. Navia et al (2013) suggest that visual behavior can be very different in each situation. In a study with goalkeepers, they identified that when the goalkeeper makes the base for the defense, his gaze approaches the ball just before the kick to later direct his attention to the playing field in front of the ball. These results suggest that the athletes studied do not pay attention to the other variables prior to contact with the ball.

This factor could be explained with the argument that, during the teaching / learning process, it would be essential to isolate the disturbing factors of success in tasks, including the decrease in the focus of attention (Silva et al., 2012), but the body variables prior to kick may not be disturbing factors, but relevant signs of its direction. But one must pay attention to the anticipation performances. Qualified players differentiate themselves by perceiving low-dimensional dynamic structures in all deceptive and non-deceptive actions while less qualified players are deflected by exaggerated movement, which may reflect on the perception of range of motion in these actions (Smeeton, NJ & Huys, R ., 2011).

When considering the possibility of repetition of the sector in two shots, the results do not make it possible to affirm that there is a repetition of goal sectors, as it seems that there was an alternation in the choice of runs. Thus, if each kick is analyzed in isolation, there may be a disturbance of interpretation. Analyzing the seven-meter handball shot, equivalent to the soccer penalty, Bourne et al. (2011) state that the objective of any follow-up work should be to identify which, if any, of the dynamic structures of observers the opportunity to distinguish between different movements in a reliable way.

We believe that players are better able to learn and consolidate their decision making (do it) than acquire conceptual knowledge (know what to do), as they show in explaining what, how, when and why technical-tactical actions performed on the playing field. As a result, his performance in the field is of a higher standard than his theoretical declarative and procedural knowledge.

This position seems to be the same as Garcia et al. (2011) when they consider that the variability training is more effective than the specificity training for handball and Navia et al. (2013) when analyzing the direction of the attention of a group of experienced futsal goalkeepers in the task of defending a penalty, simulated in the laboratory and under two different response conditions: without initial movement and with moving to position themselves in defense. In their conclusions they say that it would be interesting to analyze the entire kicking period, since the player starts his run to approach the ball, with the aim of understanding the extent to which (or not) the divergence of visual strategies between the different responses takes place.

The most relevant data obtained in this study is the large percentage of repetition of patterns between the first and second kicks, regardless of the sector of the goal in which the ball was thrown and some variables, a higher percentage.

From the goalkeeper's point of view, the literature seems to bring similar results, as the study by Navia et al. (2013), which indicates that goalkeepers direct their anticipatory attention to the lower areas of the ball. By analyzing cricket batsmen, they responded to video simulations of opponents by throwing a cricket ball in conditions of high and low contextual information. Qualified scouts were more accurate, demonstrated more effective search behaviors, and provided more detailed verbal reports of thinking (McRobert et al., 2011), reinforcing the understanding that driving communication in soccer could be better trained in soccer, especially for soccer players. goalkeepers.

An explanation that suggests that there is no predetermination of motor programs in penalty kickers is a consequence of the studies by Palau et al. (2010). The results found by them showed a tendency for kickers to choose the side of the goal according to their laterality, or preferred kicking leg. Right-handers tended to kick on the right side of goalkeepers and ominous on the left side, that is, diagonal kicks, according to the criteria of this study. But the results also indicated that sinister first division players did not confirm this trend. The authors' interpretation is that the analyzed subjects may have greater capacity for variability in their execution, which supports our hypothesis.

This argument seems to be suitable for field players as well. According to a study by Roca et al. (2013), in 11 versus 11 football with life-size images, skilled players reported more accurate anticipation and decision-making than less skilled players, with their superior performance being supported by differences in search behaviors for specific tasks and processes of thinking.

5. Conclusion

The analysis of isolated results and almost outside the real context of the game is very difficult because it takes the pressure away from the task linked to performance a little, and can convert an ultimate game action into a playful task. This is a limitation of the studies, which makes interpretations almost always assumptions. For this reason, this study is positioned to test a hypothesis inductively, without mathematical proof, but with argumentation.

Thus, it seemed evident that it is possible to relate the kick's location on the goal with the batter's body information, as there is a good percentage of relationship between the kicker's body variables and the direction of the ball. With this relationship, the size of the goal to be defended by the goalkeeper could be reduced by at least a third, increasing the possibility of defense.

The displacement of the goalkeeper prior to the kick could be a stressful factor for the batsman, which would cause benefits to the goalkeeper, just as the start of the race seems to indicate that there is a prior intention of movement programs. The decision of where to hit the penalty appears to be made before contact with the ball and more closely to the placement of the support foot, which would give the goalkeeper a temporal advantage to start the move towards the defense and, mainly, to the correct side of the goal.

Some limitations of this study are related to the number of subjects and the distance between the test situation and the real game. In order to minimize this limitation, the sequence of kicks was sought, which seemed interesting, since a pressure value was added to the kicker in the second attempt that seemed positive. As a suggestion for future studies, a series of at least five kicks could be used for each subject.

6. Acknowledgement

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