

# Game States in Soccer

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## Introduction

The main objective of soccer is to get past an opponent's defense and score a goal. Consequently, most novel strides in analytics today focus on goal-centered metrics and indicators e.g. Expected Goals (xG) that measures the likelihood of a shot becoming a goal. However, there does not exist a method to conceptualize the processes behind creating goal-scoring chances for performance enhancement. Unlike baseball and American football that comprise of select events that constitute a distinct play, soccer is a very continuous sport. This makes analyzing games a more complex and tedious task

## Objectives

To create a framework that classifies attacking drives in soccer games into comprehensive and discrete game states. This will train video analysis software to systematically breakdown the attacking process into game states for efficient performance analysis

## Materials and Methods

Video footage from soccer matches in European leagues were analyzed in detail. Independent situations that defined specific game states were identified based on the following factors:

- Location of attacking players in specific zones of the field (figure 1)
- Proximity to goal post
- Location, relative to defending team structure
- Proximity to nearest defender
- Numerical Advantage

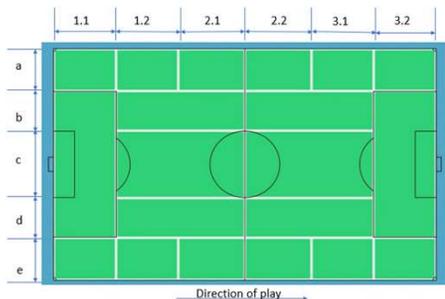


Figure 1- Grid dividing soccer field into zones

## Results



Figure 2 - Equilibrium Game State

This state occurs when the attacking team has not broken into the defending team's structure, meaning there is no instantaneous attacking threat to the defending team. It is typically characterized by location – in specific zones and relative to the defending team structure. In Figure 2, the attacking team has possession in zone (2.2,d) and is yet to break through the defending team's lines



Figure 3 - Progressive Game State

This state is characterized by getting into the defensive team's structure and essentially progressing the ball, towards the goal. It is characterized by location relative to the defending team, and also proximity to goal post. The closer a player is able to get to the goal, the more progressive state the play is in.



Figure 4 - Favorable Game State

This state occurs when the ball has been progressed into the final third (i.e. zones 3.1 and 3.2), but is in a low threat area e.g. wide areas (horizontal zones 1 and 5) or surrounded by defenders blocking passing lanes. This state indicates a potential chance-creating situation due to proximity to goal post. Taking creative risks and finding space is key to moving to a higher game state is key, as the attack typically starts to get outnumbered by the defense.



Figure 5 - Disruptive Game State

The disruptive state is an indicator of a clear chance creating opportunity. It is characterized by possession in the more central zones of final third (i.e. 3.1-3.2,b-d) proximity to nearest defender (<1m) and direction of movement (towards the goal post). This state tends to be short lived due to the dependence on proximity to nearest defender. Therefore, quick decision making and spatial awareness are required to advance the game state to the final state.



Figure 6 - Golden Game State

This is the final game state where the clear goal scoring chance is provided. This typically occurs when a player is in the penalty box possession (3.2, b-d), and has enough space to strike the ball (with any part of the body) into the goal post. Finding space away from the nearest defender through swift movements is key to get in the right position and score with as little touches

## Conclusion

This model serves as the foundation to a vast array of applications ranging from predictive video analysis to automation of pressing models. Further improvements could feature unique qualitative attributes of players and video game simulation.