

Dr. Adam Owen (Ed.)

# FOOTBALL SCIENCE & PERFORMANCE COACHING

Foreword by  
**Steve  
McClaren**

**Develop an Elite Coaching Methodology  
With Applied Coaching Science**

**PREPARE • PERFORM • RECOVER**

MEYER & MEYER SPORT

## Football Science & Performance Coaching

*Many thanks to my wife Nicky for her assistance in the project and continued personal support for everything.... and also to my boys Rhys and Dylan for their constant enthusiasm and hard work!*

Dr. Adam Owen (Ed.)

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# FOREWORD



Throughout my career in the game as a coach, assistant manager and manager, one of the greatest shifts within the game itself has come through the integration of sport science. The influence it has in the game across many areas and club departments is significant. Increasing performance and exploring the finer details to gain a competitive advantage is something towards which every coach aspires. The education aspects of football science are fundamental and, in some cases, still underdeveloped and under-utilised; however, with every passing season, it becomes more evident within the top teams' preparation, performance and recovery.

This book brings together many different components of high-performance coaching and, as a result, provides readers with an insight into how the game is evolving – not only from a training perspective, but also from the influence on competition. Understanding the tactical demands of the game is significant to all individuals wanting to improve their work in the game; however, how we train or coach players to perform these tactical details in the best possible state should be the key target of all practitioners in the future.

Technical coaches, performance staff, medical practitioners and directors within the game will enjoy the content of this book and be able to integrate many components of it into their daily coaching or educational roles. Maximising the holistic link between the technical, tactical and physical details of the game has not only led to increased technology, analysis and specific personnel utilised within the game from a performance aspect, but additionally has ensured player injury is minimised. This book perfectly blends the research and development with practical, integrated coaching detail and provides a great coaching resource for all individuals wanting to develop their knowledge of the game.

## **Steve McClaren**

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*Former Head Coach of Middlesbrough FC, England National Team, FC Twente, VfL Wolfsburg, Newcastle United FC*

*FIFA Technical Advisor*

# PREFACE

Throughout the last few decades, the sporting landscape has seen many changes, notably the inclusion and professionalization of sport science and coaching. With football being the most participated and viewed sport throughout the world, the financial revenue generated within the game has led to significant demand and popularity for football science-based research. Not only has this research led to the improvement in player development, performance and further analysis over time, but it has also led to the development of new theories and methodology across all elements of the game. As a result of various investigations into training methodology, nutrition, psychology, testing and monitoring of players, head coaches, performance coaches and technical support staff are able to justify working practices with greater efficiency. Bringing together some of the fundamental aspects of football science and performance coaching within this book, I feel it is possible to engage all individuals with a thirst to evolve on a practical, or academic, level. The primary aim of this book is to provide a unique blend of modern football-specific research trends with innovative coaching theory and methodologies implemented at the elite level. Over time, many individuals within the game have questioned the implementation of sport or football science; however, as the players' ever-growing educational level of sport science, and their own understanding of what is required to prepare, perform and recover, has grown substantially over the past decade, being able to justify decisions, interventions and methods to enhance player development has never been greater. As a technical or performance coach, sport scientist or medical staff member, evolution through growth mindset is vital in order to remain ahead of the competition. The flow of the book is based on a holistic approach to coaching science with a very applied and scientific overview of many practically linked, justified developmental training areas of football.

Having worked across many clubs, countries, continents and levels of the game from youth academy to elite UEFA Champions League and International level, within various high-pressure roles over a sustained period of time, I am delighted to bring together an incredible group of collaborators, highlighting the excellent football science work performed across these multidimensional but practically linked areas. Harnessing the academic and research side of the game and directly underpinning it with a successful and high-level practice-based approach is exactly what this book was constructed for.

I hope you enjoy reading it as much as I enjoyed the development of the project.

Also thank you to the excellent contributors for their time and effort in bringing the book to life in a very applied way.

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# INTRODUCTION: APPLYING SCIENCE IN COACHING

When discussing the roles of coaching, performance or medical practitioners within football, it is possible to generally define the process across three main focus areas: PREPARE – PERFORM – RECOVER. As a result, one of this book's priorities was to take the readers through interesting and modern training sections, highlighting the novel coaching approaches researched and used throughout the footballing world and delivered by some of the most innovative leaders in their specific areas of expertise surrounding performance coaching and football science.

Before diving into the first section, the cultural and societal impacts of football have been stressed alongside the game's progression from its origin to the now globally unrecognizable sport loved by millions of fans. Within this introduction, the focus was to expose the reader to the sporting evolution of the game and how the financial strength of its attraction has not only professionalized football to a higher level, but how it has driven a sporting media explosion around the world. This section not only covers the game's colossal socio-cultural development, but correspondingly how the changes have influenced the player development process along the way.

The reader then moves into the first key segment of the book, PREPARE. It is here that all individuals involved within the game – be they fans, players, coaches or performance practitioners – should understand the actual processes involved with the preparation of football athletes from a physiological, technical, tactical and psychological perspective. Furthermore, understanding the actual demands imposed on the players both within the training environment and competitive match-play is something that is of paramount importance to adequately PREPARE to PERFORM. The PREPARE section will investigate and cover the game demands in significant detail, revealing difference across both male and female game aspects while exploring further the hormonal and biochemical outcomes associated with high-level football performance. Having attended to the foundations and targets of what is required to PERFORM and the demands endured by players physically, the book moves into the psychological and mental skill developmental areas from a preparation perspective.

Described by many within the game as one of the most untapped, or under-utilised, areas of sporting performance, especially football, how leading practitioners in this specific area are researching, investigating and subsequently preparing their players across the world is fundamental to the reader in order to enhance their knowledge and practical

capability thereafter. Bringing a unique look at psychological training intervention to maximise the development of creative players is something that all coaches, irrespective of their specialist area, crave within the game. The PERFORM section suggests in great detail not only how future talent is developed from a creative mind perspective, but also how incorporating visual perception and specific cognitive behaviour may identify the next generation of elite-level players and enable better coaching processes. From a PREPARE perspective, the PERFORM section includes a chapter on an extremely hot topic: long-term athletic development. Within all sporting contexts, especially within current elite football settings, never has there been such an investment into academy-based structures and talent management or identification. By presenting an improved insight into maximising skill development while embedding a long-term athletic development process within the talent phase of the player pathway, the book provides a modern and successful working process in this key area.

Having gained an insight into the preparation of players through a broad but modern, innovative spectrum, moving towards the second key section of the book, PERFORM builds on the PREPARE foundations already discussed. This segment highlights and exposes exactly what it takes to PERFORM at the top level of the game and how practitioners or coaches can provide the platform from which to progress the performance level of the players. Gaining a better or complete understanding of player capability through testing and monitoring in order to maximise performance, manage health and wellbeing, as well as stimulating enhancement through specific adaptation training is covered in this section of the book. Exposing the readers to the areas of training load management and invisible monitoring will provide a detailed overview of what coaches or performance practitioners can do to ensure their players remain in the best state to optimise performance, while at the same time reducing the injury risk to players. Chapters in the PERFORM section cover key topics that are fundamental to the development and management of players in a 'high-performance' environment. This section also introduces how artificial intelligence (AI) and data science in the football world can assist the ever-growing data management processes used by industry specialists. Describing the monitoring and assessment tools used within the game on a daily basis, plus the use of AI in decision-making aspects, the next section, and arguably one of the most important factors when it comes in the form of preparing to PERFORM, is training methodology. As a result of many contemporary research studies investigating performance markers and injury rates in elite sport, it is compelling to suggest that if the daily training content is poorly managed through an insufficient methodological approach, inadequate training session design or underconditioned players, then not only subsequent poor performance prevails, but also significant rates of injury. In order for both individuals and teams to reproduce a high-performance level and PERFORM continually through regular and congested periods each week for multiple seasons across a career, significant cohesive elements must align.

Individuals involved with the development of football players (coaches or support staff) have seen the understanding, progression and implementation of strength and conditioning, speed development and high-intensity football-specific endurance training exponentially over the last decade. Furthermore, developing their knowledge of where these components fit within the methodology of training, how to maximise specific training games in the weekly microcycle program, as well as periodising a training phase or understanding the benefits of tapering strategies in assisting their players to arrive on a match day in optimal condition may be of equal or more importance. Optimising the physical profile and status of players is only a part of the performance target, as from a coaching, performance and practitioners' viewpoint, where the physical outcomes fit into the tactical and technical development of the player or team as a whole is fundamental to performance progression. The end of this PERFORM section is dedicated to the intricacies of monitoring the technical and tactical loads across the training week and further exposure to the tactical strategies used within the game at the elite level. This section was developed with the thought of providing a clearer view for how the tactical elements of the game may enhance practitioners' decision making and strategy when it comes to designing specific multifunctional training sessions or drills to fit a specific game model or tactical plan.

The last section of the book is RECOVER. This part of the book outlines in greater depth the nutritional requirements of the sporting demands in order to maximise performance and PREPARE, PERFORM and RECOVER the players. This section highlights in a very practical way key nutritional theories and interventional strategies that are currently used at the very top level of play, while detailing the importance nutrition plays across all aspects of performance coaching. Optimizing the fuelling and recovery of training and competitive match-play is of great significance if players are to ever reach the performance goals set. The impact of nutrition on physical exertion, psychological decision-making processes while recovering the body between training and competitive match-play, emphasise its fundamental role as a key concept of football science. As nutrition is covered within the RECOVER section, it is vital that all individuals within the sporting world have a sound understanding concerning specific recovery modalities available to football athletes and how the research concerning this area can be used to maximise the efficiency and recovery of players.

As the book takes the readers through this latter section focused on elements of the game that fall under the RECOVER theme, based on the exponential growth of fixture demand imposed on players, the subject understood as fixture congestion is currently under the microscope and debated not only within clubs themselves, but very prominently discussed by technical staff members within the media. Fixture demand is becoming a fundamental aspect of elite-level football and a topic that, as a result, requires clear strategies to not only develop robustness in players, but also to navigate a squad through

the demands faced. Based on new research findings in this area, it is vitally important to understand the physiology and biochemical aspects that come as a result of fixture congestive periods. Provision of recent research and focused areas to consider when faced with periods of fixture congestion in football are included here. The very last chapter within the RECOVER section of the book addresses the incidence and rehabilitation of injury in the football world and research supporting these topics. In addition to recovery from injury phases, this part of the book covers the area known as the return to play period, which includes football-specific rehabilitation processes that focus on all key stakeholders involved with this process, understanding the need to return the players safely to full training and competitive match-play while reducing the risk of re-injury.

# CHAPTER 1

## THE WORLD THROUGH FOOTBALL

Dr. Jožef Križaj

Modern football is rapidly evolving in all components of the game. According to the literature in this area, continued evolution of tactical demands, such as increased high-speed and intense pressure and counter-pressing in terms of ball recovery techniques, require players to have improved physiological, physical and general motor skills than previous years (Križaj et al., 2019). It is common knowledge that football is now played at a faster pace, with many more high-intensity periods during the game (Mohr et al., 2003). Within the English Premier League, for example, high-intensity running distance increased by 30% and action frequency by 50% in the time period from 2006 to 2013 (Barnes et al., 2014). Research has also contributed to the knowledge that high-speed running distinctly varies between playing levels (Bangsbo, 2014).

The main focus for any type of coaching is to provide the best possible platform for players to develop to the best of their ability, which subsequently leads to the best possible planning and preparation of training content ensuring they grow with the modern and innovative approaches within the game. The complex nature of football in terms of motor, technical skills and tactical abilities – psychosocial alongside cognitive



skills – places a huge requirement of a strategic and multi-dimensional approach to planning and the training session design phase. Throughout the season, football coaches and performance practitioners are constantly searching for answers in justification of what to train, when to train and how to train in terms of weekly tapering strategies and periodised training programmes. When it comes to providing the answer to these questions, it is imperative that a holistic approach is taken and digested to make the best decisions for performance development. When discussing a holistic approach within the game and maximising performance as a coach, medical or performance practitioner, it is necessary to continually expand the understanding of the game using 'football science' as a way of making better decisions, justifications and improving expertise.

Due to the aforementioned complexity of football, the scientific monitoring of the game should incorporate findings from both the natural and social sciences. As a coach, it may be worthwhile to study research findings from the fields of sports training (physical and physiological diagnostics, physical training and conditioning), sports medicine (injury prevention and rehabilitation), motor learning, methodology (methods of football training in relation to tactics and technique), methods of match analysis, sports psychology, sports sociology, game and training demands specific to women's football, youth and talent development. An overview of the main research findings in each focus area would enable coaches to provide an enhanced training session design to bring the overall training and playing ability to a higher performance level. The point is to put various pieces of information together like a puzzle in order to generate a meaningful and manageable systematisation of the most important developmental and progressive cornerstones of football.

Moreover, applied scientific research in the area of football science provides reliable data and identifies the important factors influencing performance levels. Scientifically sound and justifiable training strategies in football are essential for the continued development of match performance, but integration of the scientific research must be understood on a practical level to be of use. Simply producing a vast amount of data from different diagnostic areas in football can confuse coaches and have no impact on the coaching process. The research data should present the core areas of performance in a simple manner. As you will read throughout this book, applied scientific theory is important for player development and the creation of successful and modern training strategies. In almost all cases, the creation of a meaningful football training strategy requires a hybrid approach with broad and specific knowledge of all areas.

## FOOTBALL – JUST A SIMPLE GAME?

From a socioeconomic perspective, modern football is a mega-media event due to it being one of the most profitable global sports markets, with finance and money the main drivers in the management process of the game at the elite or professional level. Transfer fees, player salaries as well as broadcasting rights for matches are constantly increasing. In this context, it is clear that global football could not develop independently without the overall social context of modern society. The multidimensional construct of sport, in our case football, is shaped, changed and reshaped by its relationship with society (Heinemann, 1983).

Today's professional football in all its manifestations has a much more complex structure than the simple basic idea of the game. Modern football is a multidimensional construct, composed not only sociologically but also politically, economically and legally in very different ways. These factors have had and continue to significantly impact on the popular team sport, resulting in the fact that football is in a constant process of transformation due to these internal and external factors.



As a result, it is not surprising that modern football has undergone many changes through its historical development. Rule changes can be observed during the evolution of the game, such as the modern offside rule and the back-pass rule, etc. Broadcasting technology (digital technology) and the sports broadcasting market have significantly changed since the mid-1990s, kickstarting the globalisation process of sports marketing. Nowadays, social media platforms increase the relationship between football players, clubs and fans while stimulating modern and innovative opportunities for revenue. In addition, there are improvements in technical support equipment for the officiating and conduct of football such as goal-line technology and video assistant referee systems.

It is vitally important to understand from an external perspective where the legal changes within the game have significantly changed the face of football. The infamous Bosman ruling changed the conditions for player transfers between clubs, which fundamentally changed the contractual relationship between players and football clubs in Europe (free transfer at the end of the professional contract period). The Bosman ruling was, and still remains, one of the most important factors for the increase of football migration within the European continent. It appears that 'push-pull' factors in the form of better economic and social conditions (Magee and Sudgen, 2002; Lee, 2010) are mainly responsible for the migration of football players.

In this context, Maguire (2009) explains how modern sport is embedded in global networks of interdependent chains consisting of global flows and unequal (economic) power relations. Migration to a foreign (richer) football club can be described as a successful step in a player's career. The transnational mobility of football players appears to be ongoing processes based on their own achievements and the aforementioned unequal power relations between the local place of origin and the international place abroad (Engh and Agergaard, 2015). In this context, Poli (2010) characterises international football migration not only as the creation of economic opportunities but also as a



*Figure 1 Edgar Davids became one of the first and most high-profile Bosman transfers when moving from Ajax to AC Milan.*

process inextricably linked to the biographies (qualities) of individual players. In general, football migration can be considered as an essential part of the globalisation processes in the sports industry (Taylor, 2007).

It can be suggested that the basic organisational form and structure of football in today's modern society is subject to the constant influence of this society, and all technological, political, economic and legal developments can be considered a source of social change in the globalised field of football.

*picture alliance/dpa | Omar Zoheiry*



## SOCIO-CULTURAL FACTORS ON PLAYER DEVELOPMENT

Following the general findings outlined earlier about the influence of society on the game, the question arises how socio-cultural or environmental factors influence the development of the individual football player. Many young players have the vision and desire to play at the highest level possible, but talent alone is certainly not enough to become a professional footballer. In this particular case, a major dilemma can arise for coaches: is the young player's goal too high? Maybe, but if not, what can be done to move forward and make that desire a reality?

Maybe the young footballer is lucky enough to be in the right place at the right time, and a scout from the right club where that player fits the profile takes notice. But to be

honest, that’s the best-case scenario, and it rarely happens. There is still no magic formula to becoming a professional footballer, with only a small percentage of young players selected to play at the highest level possible. Luck cannot be planned, but it is possible to identify the factors that lead to a successful football career.

## Recommended youth sport policies to integrate the 3Ps PERFORMANCE, PARTICIPATION & PERSONAL DEVELOPMENT

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Reference: by J Côté and DJ Hancock IJSP 2014 *Designed by @YLMSportScience*

1. Regulate length of season to 3 or 4 months, with a maximum of 6 months
2. Limit lengthy travel to organized competitions
3. Introduce ‘grass-roots’ sport programmes that focus on trying different sports
4. Do not implement a selection process of more ‘talented’ children until the specialization years
5. Provide healthy competitive opportunities, but do not overemphasize winning and long-term outcomes such as championships
6. Discourage early specialization in one sport
7. Allow children to play all positions in a given sport
8. Design play and practice activities that focus on fun and short-term rewards
9. Promote deliberate play within and beyond organized sport
10. Understand children’s needs and do not ‘over coach’







Coutinho et al., (2016) claim that the development of a player in terms of their football career is a complex process that is difficult to explain due to the large number of influential factors. Forming a meaningful master plan for player development requires a holistic approach with a broad understanding of all these possible influencing factors. This is where the discussion about the right methodological learning approach for talent development begins, which, of course, is not always easy to define. Ultimately, not forgetting that coaches and practitioners are always dealing with individuals who have their own and specific predisposition (talent) for a particular sport. At the beginning of the talent development process, no one knows which methodological approach will fit the specific predisposition of an individual sports talent to develop the individual talent in the best possible way.

In this context, it should be noted that observation of the player on the field (scouting) in combination with functional diagnostics may not be sufficient to identify all influencing factors with regard to further player development. The main goal of physical and physiological diagnostics by measuring basic motor skills, such as strength, endurance, coordination, speed and agility, is to obtain some information about the specific performance profile of the individual. Feichtinger and Höner (2014) claim that social circumstances should also be considered when assessing a player. This statement is quite logical and understandable. Results of physical and physiological partial diagnostics of strength, endurance, coordination, speed and agility performances are always an expression of a certain reaction to a certain physiological task. The information obtained from diagnostics does not fully represent the performance level of football players in the overall context. This explains why football coaches often do not rely purely on diagnostics (science) in selection processes, but rely primarily on their coaching experience and a 'good eye' for perspective football players.

However, the level of performance in football is determined by many influencing variables. The process of player and talent development should include physical, physiological, sociological and psychological aspects, as the performance level of a young football player is influenced by all these aspects (Williams and Reilly, 2000; Zuber et al., 2016). For example, Gagné (2010), in his theoretical model, 'Differentiated Model of Giftedness and Talent (DMGT 2.0 framework)', defines social influences as 'environmental catalysts' that have a significant impact on an individual at both the macro- and micro-theoretical levels.

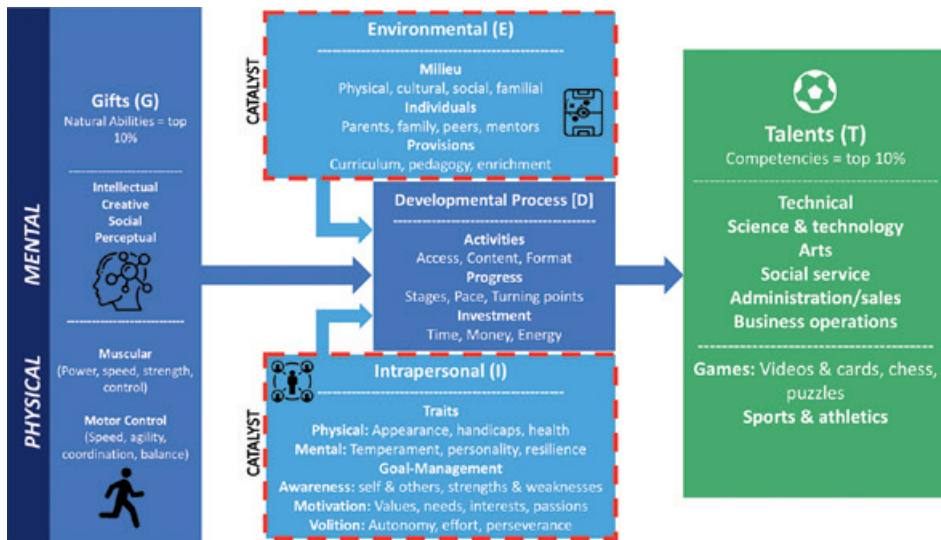


Figure 2 Adapted from Gagné (2010) theory 'Differentiated Model of Giftedness and Talent (DMGT).

The development of a football player seems to be a comprehensive process, however, during their developmental stages, the player learns not only motor and tactical skills but also socio-psychological skills that are important for successful interaction with their teammates on the field. In addition, they are also constantly learning behavioural strategies in their relationships with teammates, coaches and parents during daily life and leisure time (Križaj and Doupona, 2017). From a sociological perspective in relation to social learning and development, Coakley (2015) calls this environmental influence the 'internalisation model', which sheds light on the importance of these factors during a player's developmental process.

To conclude, the development of a football player is a multidimensional and interdisciplinary process that requires the coordination and promotion of the various technical, tactical, physical, mental and socio-cultural skills of the individual.

From a sociological point of view, it could be said that the explanation of success in football cannot be based only on the notion of talent and individual physical abilities. It seems that social forces shape lives (Collero, 2013) and, consequently, level of performance, so it's vitally important to grasp this notion for all practitioners within the game as a starting point when working with a group of individuals.

Coaches, performance practitioners and key medical staff in professional football should consider the socio-cultural and psycho-social background of each footballer to facilitate a high level of performance and working relationship. Such an assessment method would

also significantly complement scouting and applied diagnostics by providing a holistic overview of a player and create 'conditions for success' in football player development (Križaj et al., 2016).

## COACHING CONSIDERATIONS

- Applied scientific research in football provides reliable data and identifies the important factors that influence performance levels.
- Scientifically sound and justifiable training strategies in football are essential for the continuous development of match performance.
- Professional football, in all its manifestations, has a much more complex structure than the simple basic idea of the game.
- The basic organisational form and structure of football in today's modern society is subject to the constant influence of that society, and all technological, political, economic and legal developments can be seen as a source of social change in the globalised field of football.
- The development of a player in terms of their football career is a complex process under the influence of various off- and on-pitch factors.
- The process of player and talent development should include physical, physiological, sociological and psychological aspects.

## REFERENCES

To view the references for chapter 1, scan the QR code.



# PREPARE

Football Demands -  
Ready or Not?



## CHAPTER 2

# DEMANDS OF THE GAME

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Interest in the physiology of football and the competing players has grown exponentially throughout the last decade; however, the integration of physiology within football has been evident since the early 1970s (Reilly and Thomas, 1976). Subsequently, this key integration has significantly contributed to more understanding of football training, competition and the overall performance through the decoding and breakdown of the sports influence on the function and structure of the player's body. As a result, the key identification and determinants of football performance have been created, contextually providing great insights into training optimisation, injury reduction and comprehending optimal performance.

Understanding the demands imposed on players through training and competitive match play, discussed later in this chapter, will hopefully enable a key insight into where football science and performance components evolution begins. This chapter profiles the specific energy demands of match play, the requirements of players physiological characteristics, while reviewing competitive contextual factors that affect performance demands and subsequent outcomes.



## FOOTBALL CHARACTERISTICS AND GAME DEMANDS

Football as a sporting contest is characterised by alternating or intermittent bouts of work and recovery across various intensities and speeds, and is defined as a team sport of mixed aerobic and anaerobic activities (Stølen et al., 2005). During match play, players are required to execute random movement patterns of a multifaceted nature including explosive, maximal and near-maximal activities in multidirectional and linear natures (Di Mascio et al., 2015). These specific high-powered and exerting movements are also frequently interspersed with low-intensity jogging, walking, shuffling and standing actions. As highlighted from research surrounding the time-motion analysis of football athletes, activities occur across varied durations within the 90-plus minutes of match play, but are influenced by an array of factors, such as environment, opposing players, tactical requirements, technical and psychological capacity. Match play induces many complex physiological demands that highly tax all three energy systems: aerobic, lactic and alactic anaerobic (Figure 1) (Dolci et al., 2020). Due to the well-reported intermittent and acyclic nature of football, the in-play or dominant system at any given time point in a competitive game will depend upon the intensity of the performed activity (Figure 2). Typical characteristic football drills or activities performed in training sessions are generally dominated by each of the three energy systems and evolved as a result of the 'Training Session Design' phase, which will be discussed later in the PERFORM section of the book. Figures 3A–C highlight examples of specific drill types that elicit a predominantly different energy system when preparing the football athlete.

Aerobic Energy System	<ul style="list-style-type: none"> <li>• Energy production in the presence of oxygen</li> <li>• Slow energy production but huge amounts of energy can be generated</li> <li>• Metabolic by-products: water, carbon dioxide</li> </ul>
Anaerobic Lactic Energy System	<ul style="list-style-type: none"> <li>• Energy production in the presence of oxygen</li> <li>• 10-second to 3-minute durations</li> <li>• Dominates in high-intensity activities of 30 seconds to 2 minutes</li> <li>• Energy sources: muscle and liver glycogen</li> <li>• Medium capacity of generating ATP (but large amounts can be generated)</li> <li>• Metabolic by-products: lactate, H<sup>+</sup></li> </ul>
Anaerobic Alactic Energy System	<ul style="list-style-type: none"> <li>• Energy production in the presence of oxygen</li> <li>• Duration to 10 seconds</li> <li>• Dominates in the first seconds of short, explosive burst of exercise</li> <li>• Energy sources: splitting phosphagens (adenosine triphosphate [ATP], phosphocreatine [PCr])</li> <li>• Quick capacity of ATP generation (but low amounts can be generated)</li> <li>• Metabolic by-products: Adenosine diphosphate (ADP)</li> </ul>
In football, an interplay of all three energy systems is needed	<ul style="list-style-type: none"> <li>• The wide spectrum of activities in football requires a complex interplay of the aerobic and anaerobic energy systems</li> <li>• Throughout match play, a complex physiological demand is evident, which highly taxes all three energy systems</li> <li>• The three systems provide energy via multiple and interrelated processes</li> </ul>

Figure 1 Energy demands of football. (Data adapted from Gastin et al. 2021 and Dold et al. 2020.)

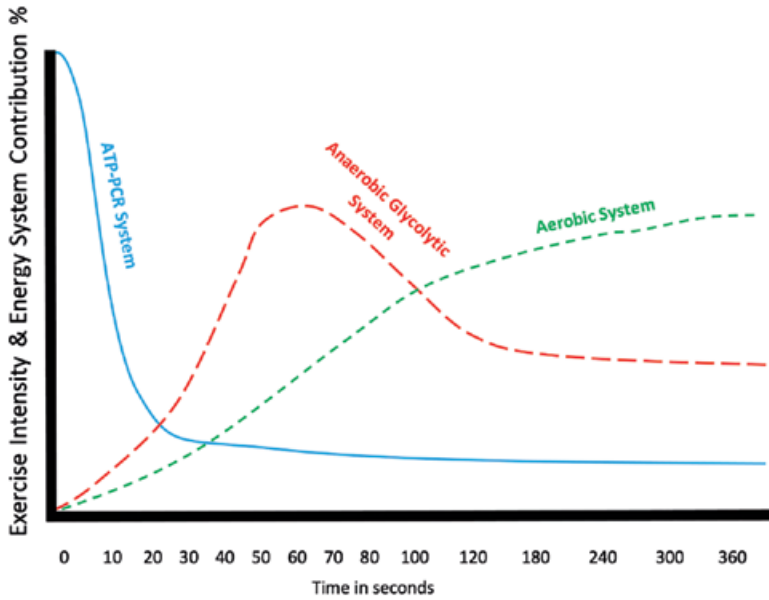


Figure 2 Energy System interaction during exercise depending on activity intensity and its duration.

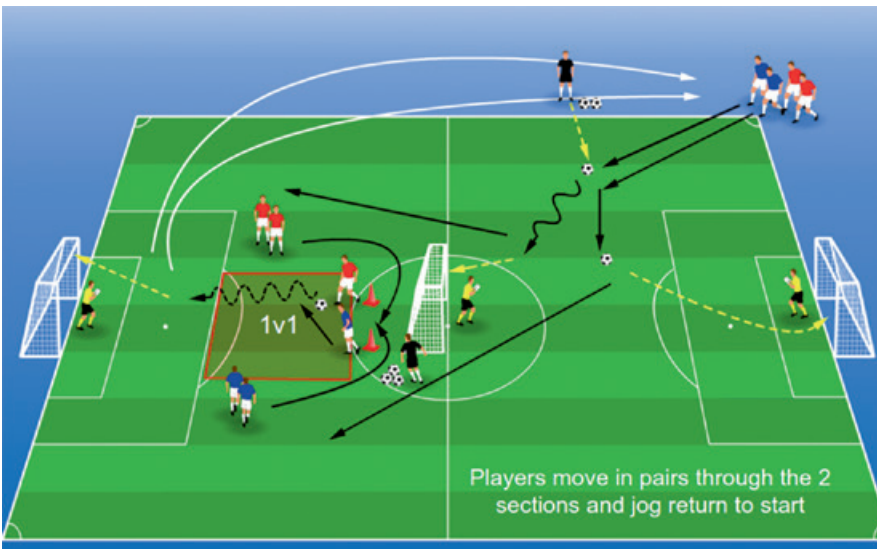


Figure 3A Football-specific drill dominated by each energy systems. Figure 3A shows players sprinting to receive the ball and shooting into the relative goal before walking to join the back of the group near the red box. On the coach's command, players then sprint through the cones and compete in a 1v1 situation before jogging to the beginning (2 sets of 6 repetitions).