The Analysis of Playing Styles Across Different Developmental Stages of Football

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Abstract

Until recently, playing styles within football have been assessed on subjective perceptions of performance, with limited performance indicators implemented to quantify these tactical aspects of performance. Furthermore, notational analysis research to date has often overlooked Youth football, predominantly examining First teams in elite competitions. As a result, the current study aims to identify key performance indicators that effectively describe the tactical patterns of play and compare these components of performance across critical stages of footballing development (Under 16s, Under 18s and First teams).

Three thousand, three hundred and eleven final third entries were analysed over the course of 45 matches, equally distributed across three age-groups, during the 2018-2019 season. The sample consisted of 10 Under 16 teams, 16 Under 18 teams and 16 First teams Both univariate (Kruskal-Wallis H tests & Mann-Whitney U tests) and multivariate data analysis (Principle Component Analysis) methodologies were employed to effectively compare playing styles across the age groups.

Results found statistically significant differences across a variety of performance indicators, compared with the younger age groups, the First team were observed to display a significantly greater number of; final third entries (H_2*= 7.242, p=0.27*), passes (H_2*=7.371, p=0.025*), crosses (H_2*=18.880, p<0.01*), forward-diagonal actions (H_2*=6.392, p=0.041*), ball recoveries via a loose-ball (H_2*=9.906, p<0.01*) and build-up play in 'Wide Areas' (H_2*=16.475, p<0.00*). In addition to this, crossed assists were more apparent in First team performances (H_2*=9.328, p<0.01),* along with assists from 'wide areas' *(H_2=7.701, p=0.021)* and possessions that were interrupted or lost *(H_2=10.025, p<0.01).* Interestingly, Under 18s were seen to bridge the gap in many of the measured metrics, including final Third entries, number of crosses, backward and forward actions, ball recoveries via tackles and loose-balls, dribbled assists, possession outcome. It was however identified that Under 18s exhibited significantly more regains in the midfield zone (H_2*=11.512, p<0.01*), than the other age groups. Under 16s on the other hand, were observed to be inferior to the older ages groups in many of the performance indicators, however it was found that they displayed a

significantly greater number of dribbles ($H_2=11.221, p<0.01$), backward actions ($H_2=8.172, p=0.017$), forward actions ($H_2=6.576, p=0.037$), ball recoveries via tackles ($H_2=9.420, p<0.01$), build-up actions in the defensive zone ($H_2=8.416, p=0.015$), assists via a dribble ($H_2=8.801, p=0.012$) and shooting opportunities created ($H_2=10.232, p<0.01$).

Principle component analysis identified 7 different factors that had eigenvalues of over 1.0 and accounted for 79.21% of variance within the dataset. These factors grouped performance indicators into clusters, that described different features of a team's playing style. These were labelled as possession type (PC1), direction of attack (PC2), ball recovery width (PC3), build-up width (PC4), defensive build-up (PC5), reduced attacking-midfield build-up (PC6) and defensive pressure (PC7). Between age groups, the most apparent differences in playing style were in possession width (PC4), defensive build-up (PC5) and defensive pressure (PC7).

The study found that there were significant differences in playing styles across the age groups, with First Teams deploying various methods of attack to penetrate the oppositions backline. This suggests that First teams tended to display more elaborate-based football that demonstrated their tactical prowess, utilising the width of the pitch in both offensive and defensive phases of the game. Under 16s on the other hand, were more aggressive in their time spent in and out of possession and were observed to be more reliant on individual ability, displayed by the significantly greater percentage of dribbles used and self-assisted goals. Under 18s were often seen to bridge the gap, demonstrated in build-up width (PC4) and defensive build-up (PC5) and were seen to utilise a more passive defensive approach that relied upon ball recoveries in the midfield zone. Ultimately, the differences in the patterns of play across the age groups, suggests that younger players are more independently focused when attempting to breakdown their opposition's defence. Furthermore, younger age groups were not observed to utilise the entire space available which can be found in the width of the pitch, suggesting that younger teams have a weakened ability to tactically influence the game, compared to their First team counterparts and are more reliant on an individual's attributes. Therefore, it is suggested that coaches consider supplementing training methods to facilitate the education of player's tactical understanding and ability.

Table of Contents

List of Tables

List of Figures

1.0 Introduction

1.1 Introduction to Performance Analysis

The intense competitive nature of modern-day sport has increased the importance of marginal gains in order to achieve an advantage over the opposition, and as a result performance analysis has become a popular method in the attempt to attain superiority across all sports.

The process of performance analysis consists of the collection and interpretation of data, encompassing technical, tactical, physical, and cognitive aspects of performance with the ultimate goal of enhancing individual or team performance in order to better understand the components of success (McLean et al. 2019). Unlike other disciplines surrounding sports, performance analysis is the examination of live performance through observational methodology carried out during or post competition. This unique feature of performance analysis provides the discipline with greater ecological validity in comparison to biomechanical laboratory-based experiments, conversely studies can however be affected by a greater number of variables (O'Donoghue 2014).

Primarily utilised as part of the coaching process (Hughes and Franks 2015), performance analysis is particularly prominent in team sports; with complex interactions regularly occurring between individual athletes and their opposition, reflecting defensive and offensive behaviours of performance. The accumulation and interpretation of data regarding a team or individual's performance allows a coach to identify strengths and weaknesses. In turn, this facilitates the modification and creation of training sessions to further improve players' development, tactical understanding and decision-making abilities. In this respect, performance analysis embodies the design, evaluation and overall analysis of sports and can describe the emergence, persistence and modification of coordinated patterns of movement (Passos et al. 2017). Ultimately, offering coaches qualitative and quantitative feedback to deliver a comprehensive learning tool for athletes.

Traditionally, the feedback process is fulfilled via a coach's perception of the game (Hughes and Franks 2004). In a study by Franks and Miller (1986), it was documented that a coach's ability to recall in-match events tends to be less than half (45%) of all crucial incidents that occur during a

match. Presenting clear limitations to the feedback process via a coach's recollection, potentially inhibited by the subjective observations of performance. Coinciding with this, a more recent study found this recall percentage to be 59% for experienced coaches (Laird and Walters 2008). With advances in modern technology and the need for accurate feedback, performance analysis has become an integral part of the coaching cycle (Hughes and Franks 2015; Nicholls et al. 2019). Through the use of performance analysis and video-feedback, the interference of bias perceptions via the coach's recollection is reduced and objective data can be used to interpret the complexities of a match, providing an impartial and holistic feedback mechanism (Hughes and Franks 2004). Over recent years, performance analysis has developed exponentially (O'Donoghue 2014; Gómez-Ruano 2018), with research encompassing: player requisition (Pastor-Vicedo et al. 2017), coaching behaviours (Franks et al. 2001), injuries incidence and physical analysis (Reilly 1996), technique and tactics in sport (Bate 1988; Fernandez-Navarro et al. 2016; Liu et al. 2016), normative profiling (Hughes and Churchill 2005; Waldron and Worsfold 2010), movement analysis (Reilly 1996; Aquino et al. 2017), analysis of referees' performances (Coleclough 2013) and key performance indicators (Jones et al. 2004; Castellano et al. 2012; Lago-Peñas et al. 2017).

1.2 Match Analysis & Key Performance Indicators in Football

Match analysis, a more concentrated aspect of performance analysis, is regularly used in elite team sports. It is the process of utilising match footage to examine the behavioural events of a team or individual that occur during competitive performance. As a result, this practice facilitates the interpretation of a performance via the examination of previous action (Hughes et al. 2012) at both individual and collective levels. The introduction of match analysis has not only contributed to the success of a team's competitive performance but has also been implemented to improve player requisition (Pastor-Vicedo et al. 2017) and player development (Hughes and Franks 2004). Furthermore, the application in elite sports has allowed coaches to practice match analysis methodologies concentrating on opposition performances that recognising reoccurring patterns of play. Enabling the creation and development of strategies in order to counter the oppositions strength, while also exploiting their weaknesses (Carling et al. 2008). Consequently, the contemporary coaching process has been described as the continual cycle of training and competition with coaches providing interventions to support player development, as displayed in Figure 1. In collaboration with match analysis, this process allows coaches to supplement training and competition with objective information regarding performance (Carling et al. 2006). For this

reason, the analysis component of the system is considered an integral part of the process (Hughes and Franks 2004).

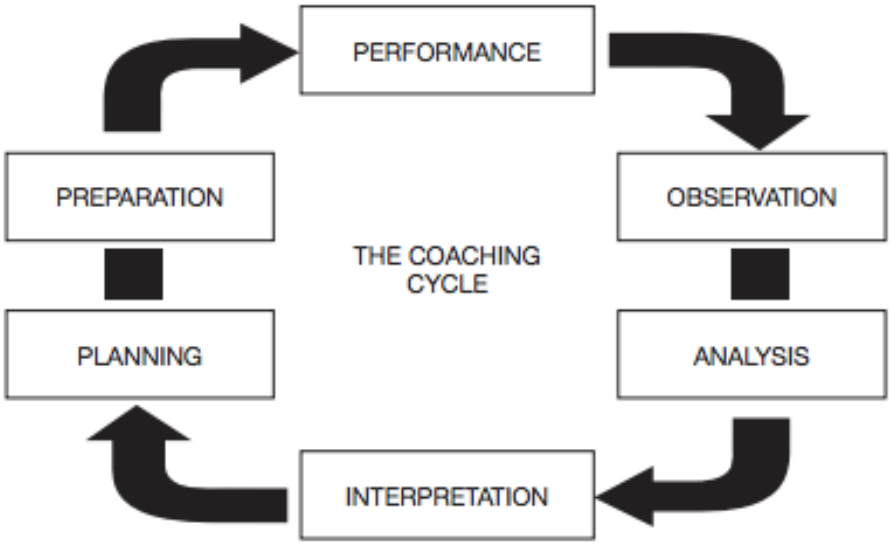


Figure 1. The Coaching cycle & role of performance analysis within the system (Carling et al. 2006).

Match analysis methodologies have grown popular within sport science literature over recent years, with the intention of generating a comprehensive insight into the patterns and properties of a team's performance. In the attempt of better understanding the determinates that influence success during competition, match analysis in sport has prompted researchers to define key performance indicators that reflect desirable outcomes (Araripe Medeiros et al. 2014). These variables are defined as *"a selection, or combination, of action variables that aims to define some or all aspects of performance"* (pp. 167, Hughes and Franks 2004) and resultingly, researchers have constructed operational definitions for these variables. By using a standard set of definitions within their own sport, performance analysis literature is able produce higher standard of work with accurate and consistent data, ultimately promoting future research (Williams 2012).

Early match analysis research has categorised these performance indicators, often segregating variables into match descriptors and indices of biomechanical, tactical and technical elements (O'Donoghue 2014). These studies have frequently explored the relationship between various action or performance indicators and successful performance or outcome, in particular; possession (Jones et al. 2004; Lago-Penas and Dellal 2010; Castellano et al. 2012; Collet 2013), passes (Reep and Benjamin 1968; Hughes and Franks 2005; Yue et al. 2014), ball recovery (Barreira

et al. 2013; Almeida et al. 2014; Claudio Alberto et al. 2016) and shooting opportunities (Hughes and Franks 2005; Mahony et al. 2012; Bostanci et al. 2018; Michailidis et al. 2018), both resulting in a goal or an attempt at goal. These variables are often indices that display behaviours while in possession of the ball and are considered significant features that result in the creation of a shooting opportunities. This is largely due to the primary determinant of performance that defines success: the number of goals scored by each team (Michailidis et al. 2018).

Performance analysis literature has however eluded the examination of playing styles, particularly across the younger population. With many studies employing a single offensive variable, the number of passes (Hewitt et al. 2016), to label a team's approach. As a result, inconsistencies can be found when defining a team's playing style, opening teams up to subjective assessments regardless of the objective nature of performance analysis. In addition to this, research has often only reported two styles of play, "elaborate" and "direct". Football has been identified as a complex and dynamic game in which is simultaneously influenced by multiple variables (Lago 2009). Despite this, other metrics of performance have not been considered in much detail, ignoring a multivariate approach and the utilisation of space, time and task (Hewitt et al. 2016).

Furthermore, literature on Youth populations in football seems to have been dismissed by many (Rosenbloom et al. 2006; Smith et al. 2013). This is fairly surprising, given the increasing professionalism of Youth football and the practical implications of performance analysis, which are generally focused on the development of players and enhancing decision-making. Alongside this, Youth players are stated to have different needs and abilities from the elite or adult population (Rosenbloom et al. 2006), leaving the majority of previous research, which focuses on adult teams, inapplicable to this population. Youth populations have however been examined in terms of their technical, tactical, physical and perceptual-cognitive abilities; in which it has generally be found that younger players exhibit a lesser capacity to perform. For example, physically, adolescent players exhibit lower VO_{2MAX} outputs compared to their Senior counterparts (Stølen et al. 2005). Additionally, Youth Teams have been reported to display significantly inferior technical and tactical abilities (Teoldo da Costa et al. 2010; Sevil Serrano et al. 2017). This was also found when examining the cognitive-perception, where it is found that older, more experienced players exhibit superior cognitive-perceptions (Williams et al. 2012), including decision-making and anticipation skills. This highlights the need to assess the differences in playing styles across ages, in order to

enhance the understanding of Youth football, as well as the coaching process associated with their development.

1.3 Aims of the Study

Despite the extensive number of studies and the importance of player development through performance analysis methodologies, research has often eluded younger populations (Smith et al. 2013). In addition to this, the profiling of a team's playing style has considered a limited number of variables, ignoring the spatial and temporal aspects of a team's tactical approach. As a result, the aim of this study is to contribute to the understanding of playing styles across different stages of footballing development, using a univariate and multivariate approach. The study will therefore (i) establish key performance indicators used to effectively profile a team's playing style and (ii) compare the tactical approaches across three different stages of football development (Under 16s, Under 18s and First team). In order to gain a holistic understanding of a team's playing philosophy; the study aims to establish tactically relevant determinants of performance, working towards the differentiation of playing styles across different developmental stages of football.

2.0 Literature Review

2.1 Game Style

Common observations amongst football coaches, analyst, media outlets and fans, have generated terms that reflect a team's playing style. These styles have been considered to directly impact performance (Michailidis et al. 2018) and are used in the profiling of a team's patterns of play (Fernandez-Navarro et al. 2016; Lago-Peñas et al. 2017), which in turn can be used to help predict future performance (Lago and Martín 2007). The most famous empirical playing style previously described is FC Barcelona's short, frequent passing – known as "Tiki-Taka" (Sarmento et al. 2014b; Hewitt et al. 2016; Lapresa et al. 2018). It is used to draw opposition defences out of position, utilising a sharp change of pace in a vertical direction toward the opposition's goal, exploiting the spaces created by the short passes. Another popular style is referred to as "counter-attacking" or "direct" football (Sarmento et al. 2014a; Fernandez-Navarro et al. 2016), previously used to describe the likes of England's National team during 1980's (Kempe et al. 2014). This style of play repeatedly utilises a high percentage of forward and long passes, regularly exploiting the team's aerial ability with direct balls played into the penalty area. Teams and coaches often have their own playing philosophies (Wright et al. 2011) that are mirrored in the team's patterns of play and are often referred to in academia as one of two brands; 'elaborate' or 'direct' football. These are then supplemented with specific tactical adjustments to exploit the strengths of their own players and weaknesses of the opposition during competition (Zambom-Ferraresi et al. 2018), as well as in order to combat the situational variables of the match.

Performance analysis literature has started to investigate the importance of playing styles, some through the subjective labelling of a team's offensive phase either "elaborate" or "direct". Typically, elaborate, or otherwise known as "possession-based" football, is recognised by the retaining the ball and using the width of the pitch to penetrate defences (Lapresa et al. 2018). Executing a high number of passes (Lago-Penas and Dellal 2010) or extended duration of control of the ball (Tenga and Larsen 2003). On the other hand, "direct" or "counter-attacking" styles are established through forward, direct transitions, with attributes that display short attack durations (Tenga and Larsen 2003) and a fewer number of passes (Hughes and Franks 2005). As far as describing playing philosophies, literature is yet to quantify either style of play using any other

action variable other than the number of passes before a shot (Hewitt et al. 2016); leaving a team's tactical approach vulnerable to subjective perceptions of the patterns of play exhibited.

These opposing philosophies have additional intersecting facets, including the temporal, spatial and task variables of an attack. Playing styles have typically been described using a univariate approach – with the number of passes describing a team's tactical patterns (Hughes and Franks 2005). The absence of clear operational definitions regarding playing styles therefore leaves the categorisations of possession prone to varying degrees of continuity across the literature. The direct approach of a team has been outlined by Tenga and Larsen (2003) to feature; counter-attacks, direct set-pieces, attacks with at least one long pass, attacks that execute a maximum of two passes and attacks that move quickly over the midfield area of the pitch. Agreeably, these variables are all characteristics of direct football. Although many of these measures remain subjective to the observer, with no clear definition of what constitutes a counter-attack and the subjective measure of speed across the midfield adding to the potential of observer error. In contrast, Hughes and Franks (2005) simply recognised direct possessions to exhibit a low number of passes.

These studies reveal the disparities concerning the variables that form a team's playing style and consequently clarification is necessary to improve the profiling of a team's patterns of play. A team's playing style is governed by a combination of complex interdependent parameters (Gómez et al. 2018) and it has been stated by Hewitt et al. (2016) that performance analysis literature needs to take a multivariate approach, including a spatial and temporal element. With this in mind, a study by Fernandez-Navarro et al. (2016) has offered alternative playing styles, incorporating various determinants of performance. The traditional styles of "elaborate" and "direct" possession were still included, but the study also considered; ball regain width, use of crossing, possession width, progression of attack and defensive approach. This study has effectively managed to profile the elite level, depicting a team's reliance on multiple attributes of performance. Unfortunately, the study's data analysis process, principle component analysis, does not take into consideration the larger values when utilising a scoring system to determine the directness of a team's attack. Given that all variables, except pass direction, were formatted as percentages, the larger values would be expected to dominate the dataset and therefore bias the findings (Abdi and Williams 2010). In order to accurately profile the approach of a team, it has been highlighted that tactical relevant indicators should be employed (Garganta 2009). For this

reason, key determinants of performance need to be addressed in order to successfully depict a team's game style.

2.2 Goal Scoring Opportunities

2.2.1 Shots at goal

Match analysis literature in football has often focused on goal scoring opportunities. This is because of the primary objective of the sport, requiring a team to score more goals than the opposition team. In an early study by Reep and Benjamin (1968) it was concluded that one in every ten shots resulted in a goal, underlining the significance of goal scoring across both domestic and international competitions. In a recent study by Bostanci et al. (2018), differentiating indicators of performance across elite sides during the 2016 European Championships were examined. It was observed that teams that reached the knockout rounds of the competition were able to perform a greater number of total shots (69.44 ± 31.17) and shots on-target (25.56 ± 11.95), in relation to the teams that exited the competition in the group round (32.50 ± 6.72, 9.38 ± 4.10 respectively). This reinforced earlier studies, including Sgrò et al.'s (2015) research, who identified that scoring opportunities during the 2012 European Championship were indicative indicators of a match's outcome.

This notion was clearly demonstrated by Castellano et al. (2012), identifying that winning teams across three World Cup competitions demonstrated significantly more goals (2.2 ± 1.2), compared to teams that were either drawing (0.9 ± 0.8) or losing (0.4 ± 0.6). Furthermore, the study documented that the total number of shots and number of on-target shots were both clear determinants of performance across these competitions. Displaying that successful teams are better equipped to create shooting opportunities at goal, with the enhanced ability of converting these shots into goals. This has since been supported at a domestic level, in the findings of Yue et al. (2014), who examined 50 top flight matches in the German league. It was found that the conversion rate, known as 'shot efficiency', was a prominent determinant of success. Reflecting the ability of superior teams to convert a significantly greater average of shots:goals compared to their inferior equivalents (0.2158 ± 0.0981; 0.0396 ± 0.0673, respectively). Suggesting that the efficacy of a team's shooting opportunities, unsurprisingly correlate to success.

Accordingly, goals have rightfully received the definitive label of success in performance analysis literature. However, unlike other invasion games, football exhibits a limited frequency of goals (Tenga et al. 2010b) and subsequently these occurrences cannot be representative of a team's playing style (López Bondia et al. 2017). For this reason, more common incidences have been documented to more accurately reflect the underlying tactical approaches of a team, including shots at goal (Castellano et al. 2012; Yue et al. 2014; Bostanci et al. 2018) and final third entries (Bate 1988).

2.2.2 Assist Actions

Although the effective conversion of shooting reflects successful performance, it is important to distinguish the source of the incident via the examination of events prior to the incident. For this reason, multiple studies have therefore investigated at the assist action, incorporating the technique and location of the event to identify the penultimate action leading up to a goal or shot. Existing studies on the penultimate actions have found mixed findings, with Smith et al. (2013) documenting that 42.2% of goals from a Blue Square Premier League football club First team were achieved via the employment of crosses. This study, did however exercise a case study methodology, which consequently prevents the findings to be exclusive to this singular club, leaving the results inapplicable to the wider population. The findings of Carling et al. (2006), contrastingly identified that assist actions during the 2002 World Cup tended to originate from either a cross (29%) or a pass (29%). When compared with the 1998 World Cup, significant difference can be observed regarding the two assist methods (18% and 47%, respectively), with passing being the more prominent assist method.

These same studies, identified that the majority of goals were scored from assists originating from central areas outside of the penalty area. In fact, Smith et al. (2013) identified that the domestic side achieved 57.8% of goals from assists in this position, coherent with Carling et al. (2006) who noted that more than 50% of goals scored by the 1998 World Cup winners (France) were also converted from this area. These findings are in part, consistent with a more recent study by Andrade et al. (2015), who observed over 1,000 goals during the 2008 Brazilian Championship. The research found that the majority of goals were assisted by an action that was performed in the central areas outside of the penalty area (29.8%), with the second most prominent assists occurring from the area left of the penalty area (25.4%). The method and locality of an assist has

proven to offer teams valuable information regarding the efficacy of an attack; however, it is only partially able to encapsulate a team's style of play and therefore other tactical determinants of performance should be considered to supplement the analysis of goal scoring opportunities and the penultimate actions.

2.3 Possession

Due to the dynamics of invasion sports such a football, having possession allows a team to influence the direction of the ball in the pursuit of scoring a goal, while simultaneously restricting the opposition's attacking potential. As a result, match analysis studies in football have taken a particularly keen interest in possession as a key determinant of success (Reep and Benjamin 1968; Jones et al. 2004; Claudio et al. 2019) and are often suggested to reflect a team's style of play; with short periods of possession categorised as a direct approach and longer periods presented as elaborate attacks.

Embracing the notion that goals are typically scored while in possession of the ball (Jones et al. 2004), many would expect a correlation between possession and success to be clear. This was not the case according to the findings of Stanhope (2001), who identified that possession of the ball during the 1994 World Cup was not an influential contributor to the success of a team. From a logical perspective, the greater the time in control of the ball, the greater the potential to enter the opposition's third in order to create a shooting opportunity (Hughes et al. 1988). Despite the intuitive argument, the general consensus on possession is not clear.

An initial study by Bate (1988), reviewed literature surrounding possession and the value of retaining the ball. The available data was interpreted to display possession-based patterns of play to be a less favourable tactic compared to a direct approach. Bate stated that the greater number of possessions a team is able to achieve, the greater their chances are of entering the "critical scoring area" – now referred to as the final third. In turn, entry into this area was noted to increasing the probability of creating a goal scoring opportunity.

On the other hand, more recent studies have examined the superiority of teams in the top European leagues; where it has been documented that the top teams were able to maintain a greater percentage of possession compared to their lesser counterparts, regardless of the score-

line, ultimately resulting in a higher degree of success (Bloomfield et al. 2005). Lago-Ballesteros and Lago-Penas (2010) analysed 380 matches in the Spanish league during the 2008/09 season, which identified that the league's top teams had a greater amount of time in possession of the ball (55.57% ± 6.20), opposed to the middle and bottom tiered clubs (48.33% ± 2.81, 49.04% ± 2.59, respectively). This was then reinforced by Collet (2013) who examined a total of 6,078 matches, spanning across various top European domestic leagues and International competitions (5,478 domestic leagues, 395 Champions League, 205 Europa League, 299 national team matches). Possession was gauged as a percentage of time in which the team controlled the ball. The outcome of the study discovered that possession was a key determinant of success at a domestic level. Moreover, Champions League and International competitions proved that possession remained a significant feature of success performance, however was considerably reduced suggesting other variables may play a more important role in success at this level. Coherent with these studies, Castellano et al. (2012) observed the key discriminants between successful and unsuccessful teams across three international competitions (2002, 2006 and 2010 World Cup competitions). Similar to Collet's (2013) findings, it was observed that ball possession was significantly greater in winning teams during the 2006 and 2010 World Cup competitions (52.4% ± 7.2, 52.4% ± 6.0, respectively). Meanwhile, the 2002 World Cup did not display significantly greater ball possession for successful teams (49.8% ± 7.0); potentially exhibiting the evolution of tactical approaches in elite sport and the prominence given to the ideology of possession-base football.

The disparity between the aforementioned studies should take into consideration the differences in competitions analysed, the tactical evolution of football, as well as the various key performance indicators employed to measure possession. Outlined by Kempe et al. (2014), these various gauges of possession range from; number of ball contacts (Hughes et al. 1988), number of possessions (Bate 1988), duration of possession (Jones et al. 2004; Claudio et al. 2019), percentage of time on the ball (Peñas and Acero 2007; Collet 2013) and number of passes (Reep and Benjamin 1968; Hughes and Franks 2005). This ambiguity between studies regarding the metric of 'possession' exposes the indice to varying levels of reliability and consistency.

Ultimately, possession as a key performance indicator, can be described as the broad categorisation of a team's patterns of play; of which does not comprehensively measure, nor recognise, the intricate interactions and behaviours of either offensive or defensive players that

cause successful penetration of opposition's defensive block. Due to its limited insight into a team's playing style, possession has been noted to provide a general description of performance (Mahony et al. 2012). Unlike the majority of possession orientated research, Tenga and Sigmundstad (2017) studied the duration of possessions in the lead up to a goal scoring opportunity. The study found that attacks that lasted 12 seconds or longer appeared to be a significantly more effective method of attack for the top teams of the Norwegian top league (19.2 seconds ± 5.9 versus 10.8 seconds ± 3.7). Alongside this, a study by Hughes and Churchill (2005) used duration of attack as a measure of possession. Again, supporting the concept that successful teams are able to maintain possession for longer periods compared with their unsuccessful counterparts. Observing that successful teams were capable creating goal scoring opportunities more frequently in possessions lasting longer than 20 seconds.

The implications of these two studies are far more valuable than the previous possession-based research by implying that successful teams have a higher calibre of player, demonstrating a greater tactical and technical capacity in successfully maintaining possession in order to create shooting changes. Through the isolation of individual attacks, the studies are able to consider the offensive approach of a team prior to a goal or shot; with quicker possession durations symbolic of counter-attacking methodologies and longer durations of possession representative of a more patient, elaborate approach. This aspect of possession can therefore more effectively describe a team's approach while in possession, describing a team's ability to maintain the ball, as well as their approach of attack – quick versus patient play.

2.4 Passing

Commonly used in the debate regarding possession versus direct football, passes have been given extensive attention by researchers. This action of transferring possession of the ball between team mates in order to create and exploit space, has been labelled as an integral tactical element of football. In fact, the initial notational analysis study by Reep and Benjamin (1968) spanning 15 years and covering over 3,000 matches, found that 80% of goals were scored as a result of passing sequences of 3 or less. This study therefore advocated a direct approach in terms of footballing philosophies, implicating that fewer number of direct passes are the most effective method at exploiting the oppositions defence. This study was later replicated by Hughes and Franks (2005), however on this occasion data was normalised across the number of actions per attack. The

results demonstrated that successful teams displayed longer possessions with a greater number of touches, opposing the innovative study of Reep and Benjamin (1986).

In a study that observed goal scoring during the 1982 World Cup by Bate (1988), it was found that 48% of goals were scored with 0-1 passes. Unfortunately, this study did not acknowledge set-pieces as a separate method of attack and incorporated them with attacks from open play. Which have since been identified to be a key contributor to goal scoring opportunities (Yiannakos and Armatas 2006; Hewitt et al. 2016). Despite this, the study also found that 84% of goals were scored with fewer than 4 passes being completed, contrastingly passing sequence of over 11 or more, resulted in 0 goals. When compared with a Hughes 1986 (as cited by Bate 1988), a similar outcome was observed with 94% of goals scored exercising 4 passes or less. This study was however examining England international squads which due to previous work of Reep & Benajmin (1968) had famously adopted the direct football philosophy (Kempe et al. 2014) and consequently may represent England's playing style in the 1980's.

Since, a more inclusive study on international performance has been completed. 147 goals from 64 matches of the 2006 World Cup were analysed by Acar et al. (2009). The study noted that like previous work, 0-4 passes during a possession resulted in 54% of goals, while 29 percent of goals came from sequences executing more than 5 passes and the remainder accounted by set-piece or miscellaneous goals. At domestic level, similar findings were found. Tenga and Sigmundstad (2017) observed 997 open-play goals from the Norwegian top flight of football spanning across three seasons. The study identified that successful teams exhibited a significantly greater number of goals using passing sequences between 0-4 actions (17.9 ± 6.3), compared to the lesser teams (9.7 ± 3.7). This outcome was suggested to be relevant to the counter-attacking strategies imposed by the successful teams, due to the attributes of direct football, utilising forward passes and dribbling in the pursuit of exploiting an imbalanced defence. As a result, the number of passes a team exhibits during an attack can successfully depict a team's playing philosophy.

The emphasis on frequency of passing has evolved to investigate deeper context, including; pass length (Mitschke and Milani 2014; Bostanci et al. 2018; Michailidis et al. 2018), direction (Carling et al. 2006; Bostanci et al. 2018), execution method (Acar et al. 2009; Mitschke and Milani 2014) and location (James et al. 2002). Execution method has examined the part of the foot used in order to perform the pass and may be of practical importance for a coach in terms of player

development, however provide minimal insight when profiling a team's playing style. Pass direction, length and location however, could project the strategic approach of a team. With forward passes presenting a more direct and potentially penetrative approach, and passing length displaying a team's technique in displacing the opposition's defence, using either short or long passing philosophies.

Previous literature exploring the variable of action directions in relation to success has identified that significantly more goals are scored using higher percentages of forward passes in the build-up to scoring a goal (Bostanci et al. 2018). In fact, Carling et al. (2006) identified that the superior teams exhibited an average of 25 passes in central areas, 70% of which were in a forward direction. While inferior teams displayed 15 passes on average, with 63% of passes being in a forward direction. Suggesting that higher quality teams have a greater passing accuracy when penetrating their opposition's defensive block and a higher percentage of forward passes could suggest a direct approach (Fernandez-Navarro et al. 2016).

In a similar capacity, passing length is often associated with playing styles. With Barcelona's infamous 'Tiki-Taka' football utilising a high frequency of short passes to penetrate their opposition; opposed to early English football that utilised the long-ball strategy to get the ball into the optimal scoring zone as quickly as possible. After studying over 28,000 passes during the 2012 European Championships, Mitschke and Milani (2014) found that the execution of most passes were low and short (47.4%). This was predominantly due to the fact that this type of pass enables a team to effectively maintain the ball, displayed by the 93.1% success rate, minimising the risk of losing the ball. Michailidis et al's (2018) study notes that most goals (18.4%) stemmed from passes of greater than 10 meters in distance, closely followed (17.1%) by passes shorter than 10 meters. In contrast to this Bostanci et al.'s (2018) study found that long balls were counter-indicative of goal scoring, meaning that the greater the usage of passes over the distance of 35m, negatively affected the chances of soring. Most likely due to the increased chances of a long-ball being intercepted or misplaced. These studies do not unanimously recognise passing distance as a determinant of performance, however this aspect of passing can provide an insight into the playing style of a team.

Understandably, build-up play as feature of performance has been linked with success, not only because of the ability of penetrating the opposition's defence by passing or dribbling, but also the

maintenance of the ball to inhibit opposition to score. These determinants of performance provide various avenues for describing a team's playing style using a multi-variate approach, by using a spatial, temporal and task related overview, opposed to the current univariate method that only considers the sequence length.

2.5 Ball Recovery

As displayed by the previously mentioned literature, many studies isolate the build-up play and resultingly disregard the defensive actions prior to a goal. Given that the key objective of the defensive phase is to prevent the opposing team from scoring, defensive attributes should therefore be regarded as a crucial element of a team's playing style. Methods of ball recovery patterns have been examined by Barreira et al. (2013), who found that direct ball recoveries were more frequent that those from indirect recoveries (77.3% verses 22.3%, respectively). In other words, the regaining of possession during open-play, via methods such as tackles and interceptions, were more common compared to those starting from a set-piece. These results were consistent with findings from Almeida et al. (2014), who identified that the majority of ball recoveries occurred from a tackle or interception (52.5%), opposed to set-plays (24.6%). Displaying the significance of a team's defensive approach during open play.

Two styles of defensive characteristics are often documented during open play, "high" versus "low" pressure (Fernandez-Navarro et al. 2016). High-pressure defensive methodologies have become popular over recent years; with the likes of Liverpool's "Gegen-press" and some of the world's elite, effectively demonstrating the strategy (Bell-Walker 2006) by pouncing on their opposition high into their opposition's half, attempting to force mistakes. While low-pressing tactics are often associated to inferior teams, setting up an organised defensive block in front of their penalty area to remain compact and resultingly, hard to penetrate (Barreira et al. 2013). These categorises are often implemented in literature under the assumption that the location of ball recoveries effectively displays the defensive tactics of a team (Fernandez-Navarro et al. 2016).

The investigation into the locality of regains in possession, has established that the 'Middle Third' – comprising of attacking-midfield zone & defensive midfield zones (Figure 3), are responsible for the majority of ball recoveries. In a study by Claudio Alberto et al. (2016), it was documented that possessions were most frequently lost (48.9%) in the attacking-midfield zone. This is assumed to

be because of the increased defensive intensity in these areas, with often an increased number of defenders to repel the ball away from the defending team's goal. An earlier study by Barreira et al. (2013) supported these findings, in which it was found that the majority of regains during the 2010 World Cup occurred in the central 'fefensive-midfield zones'. Similarly, Smith and Lyons (2017) analysed four World Cup competitions, in which it was found that across all international competitions ball recoveries made in the 'Middle Third' of the pitch resulted in the majority of goals. These findings are similar in domestic leagues, as displayed by Tenga et al. (2010a) who identified that in the Norwegian professional men's league, were able to regain the ball most frequently from Defensive and Middle Thirds of the pitch (51.6% and 45.5%, respectively). It was however found, that recoveries made in the final third had a considerably higher goal scoring rate (32.7%) compared to the defensive and middle thirds (8.6% and 11.7%, respectively).

In regard to a team's game style, the defensive attribute of defensive pressure has been distinguished to be extremely prevalent. As discussed, the majority of research that has measured ball recoveries, have often come to the same conclusion. Deducing that goals are more likely to develop as a result of high-pressing methodologies, opposed to a low-pressure block (Barreira et al. 2013). This is explained by the distance from goal, preventing defenders the opportunity to reorganise when possession is lost closer to their own goal. In fact, high-pressing tactics are documented to correlate directly with the efficiency of a team's attack; demonstrating the exploitation of imbalanced defences, denying team's space to attack while simultaneously enhancing the chances of scoring upon recovery of possession (Fernandez-Navarro et al. 2016).

2.6 Situational Variables

As already established, performance analysis protocols utilise a unique methodology, undertaking data collection on complex interactions and behaviours between teams during live competition (James et al. 2002). As a result, performance analysis studies have a greater ecological validity given the un-intrusive nature of the methodology. However, these measured variables are exposed to, and influenced by an increased number of external factors (O'Donoghue 2014), including the location of a match (home/away), match status (winning/drawing/losing) and phase of the game (1^{st} half/2^{nd} half). The influence of these context related variables has been explored by researchers in order to gain an understanding into the impact on performance, highlighting the

tactical adjustments made by team during an ever-evolving match (Taylor et al. 2008; Konefał et al. 2018).

2.6.1 Match Location

Often mentioned in the lead-up to a match is the importance of the "home advantage". This phenomenon has been demonstrated by various studies to effect teams on a behavioural level and can be rationalised by the observed changes in playing style (Taylor et al. 2008). The effect of match location has been examined across a variety of variables. In a study by Lago and Marín (2007), exploring 170 matches in the Spanish 2003-2004 season, it was identified that home teams had significantly more (+6%) possession than when playing away. In a similar study by Lago (2009), it was found that overall possession was not significantly affected by the location of a match. There was however, a similar finding to previously mentioned Lago and Marín's (2007) study, whereby away teams were observed to be less capable of maintaining possession in the attacking third (-6.4%) compared to when playing at home. As noted by Taylor et al. (2008), of whom found no significant differences between the match location and the analysed technical parameters; when discussing his own results, the inconsistencies found between studies is assumed to be down to the differences in playing standards across the assessed leagues. In a more recent study, Almeida et al. (2014) analysed the effects of match location during the 2011-2012 Champions League. The results displayed a significant increase in possessions being regained in areas higher up the pitch for teams that were playing at home. Finally, an investigation into 380 Spanish First Division matches during the 2012 – 2013 season by Liu et al. (2016), identified that home teams were capable of displaying a greater frequency of assists, shots and shots on-target, compared to when playing away.

2.6.2 Match Status

Like the location of a match, the match status (winning, drawing, losing) has also been considered an influencing factor, effecting the tactical approach of a team (Bloomfield et al. 2005). This variable acknowledges the evolving score-line and consequently presents the adjustments of tactical styles made by a team in order to control the situation. Consolidating this notion, studies have highlighted the increased amount of possessions both successful and unsuccessful teams obtain when losing (O'Donoghue and Tenga 2001; James et al. 2002). With Lago-Penas and Dellal

(2010) displaying Spain's La Liga 2008-2009 season, whereby possession was seen to increase 0.04% or 0.09% when losing, compared to when drawing or winning respectively. These findings could be interpreted to display a change in style by the winning team, trying to maintain defensive security and allowing the losing teams to have possession in safe areas; or display the adjustments made by the losing team, attempting to maintain possession and apply offensive pressure on the opposition. This was coherent with Lago's (2009) study, with losing teams having significantly more possession of the ball. Lago goes on to elaborate on the in-match modifications of playing styles, explaining that Espanyol exhibited a more possession-based approach when losing in the aim of dictating the match. Opposed to their counter-attacking style when in winning or drawing positions. In regards to the variation of performance indicators across different score-lines, losing teams have been noted to display a greater percentage of possession (Lago 2009), as well as an increased number of crosses and dribbles (Taylor et al. 2008). Meanwhile, winning teams are expected to complete an enhanced number of clearances, interceptions and aerial duels, as well as a fewer number of dribbles and passes (Taylor et al. 2008). It has also been found that teams are able to score significantly more goals when a match is level (66.3%), compared to when losing or winning (16.8% and 16.9%, respectively). This is to be expected, given that the initial state of all games, commencing as a level playing-ground, providing a bias towards the drawing match state.

2.6.3 Game Phase

Another variable that has been established to influence performance is the game phase, or time of the match. The variable is based on the understanding on fatigue, with performance deteriorating as the match progresses (Sarmento et al. 2014b). The impact of time has unsurprising witnessed the decline in performance, which can be seen in the physical (Mohr et al. 2005), technical and tactical (Teoldo da Costa et al. 2010) parameters of performance. Armatas and Mitrotasios (2014) found that the 2012 European Championships displayed results of this nature. It was discovered that most of goals were scored in the second half of the match (57.9%), with the 21.1% of all goals scored occurring in the final 15 minutes of a match, although these findings were not identified to be statistically different. Yiannakos and Armatas (2006) again found this same outcome, with significant differences between halves. The first half made up for 42.6% of goals from the 2004 European Championships, while 57.4% came in the latter half of the matches. These findings have been reports to represent the deuteriation of players; specifically, Reilly (1996) reported that defenders are prone to declining performances as the match continues, in turn, gifting an

advantage to the attackers. Ultimately, as explained by Sarmento et al. (2014), performance analysis literature has clearly established the influence of situational variables such as the "home advantage", evolving score-line and match phase. Highlighting the technical and tactical adjustments made on a team level (Carling et al. 2006), in order to adapt to the ever-changing context of the match.

2.7 Youth Football

It is clear match analysis methodologies are a popular method to enhance the coaching process, despite this there is a clear absence of published research that describes the patterns of play in relation to Youth football (Smith et al. 2013). Literature on elite samples have been argued to provide information relevant to aiding the coaching of Youth players by providing normative data for Youth players to aim to achieve. Despite this, Youth players have unique requirements (Rosenbloom et al. 2006) and abilities, including their physical (Stølen et al. 2005; Djaoui et al. 2014; Harley et al. 2010), mental (Williams et al. 2012), tactical and technical capabilities (Teoldo da Costa et al. 2010; Sevil Serrano et al. 2017; Smith et al. 2013).

Harley et al. (2010), identified that elite Under 16 football players tended to complete an average total distance of 7672 meters (± 2578), which is considerably less than Djaoui et al. (2014) reported elite Senior players to exhibit 10894.6 (± 889.8). Similarly, Stølen et al. (2005) overview journals across various populations and concluded that Youth players exhibit lower VO_{2MAX} outputs than Senior players. In small sided games, Alberto et al. (2019) identified that Under 17s performed significantly lower scores in regards to the total distance covered 1733.2 (± 167.6), maximal speed 19.4 (± 1.2) and number of accelerations 13.5 (± 3.6) when compared to Under 19 and Senior team performances (total distance 1963.6 ± 119.7 & 1957.0 ± 145.5; maximal speed 20.6 ± 1.2 & 20.7 ± 1.2; number of accelerations 19.8 ± 7.9 & 20.7 ± 5.1, respectively). These differences are attributed to the different stages of maturation allowing older players to achieve higher levels and intensities.

In terms of cognitive abilities, the tactical study of Folgado et al. (2012), found that the use of wide areas in small sided games are directly influenced by age. The use of width in football creates space for the team in possession and is therefore considered to be a tactically superior attribute. Using Ipwratio as a metric that reflects the utilisation of both lateral and vertical areas of space, it

was found that younger teams, such as Under 9s, exhibited far superior *Ipwratio* scores (U9 = 2.287 ± 1.629, U11 = 1.130 ± 0.435, U13 = 0.883 ± 1.026) of which measures the maximum distances between players in relation to width and length, where higher values indicate a greater player dispersion. Interestingly, Schumacher et al. (2018) identifies a plateau effect at Under 16 level, where this group were seen to obtain similar sustained attention scores (1491.6 ± 247.5) to Under 17 (1525.1 ± 186.), Under 19 (1542.6 ± 174.2), Under 23 (1520.9 ± 218.4) subjects and slightly lesser scores compared with the Professional Team (1650.7 ± 206.6), however this difference was found to be statistically insignificant. Schumacher's findings suggest that these age groups have similar concentration levels, however their utilisation and awareness of spatial aspects of football, as highlighted by Folgado and colleges, are far inferior when compared to their older counterparts.

A unique study by Smith et al. (2013) recognised this lack of literature applicable to Youth populations. This piece of literature examined 86 matches following several key age-grouped teams, all from the same Blue Square Premier League club. Recognised as critical stages of development, due to the transition of players into elite squads (Vaeyens et al. 2005), comparisons were made between the attacking methods of the Under 16s (U16), Under 18s (U18) and First team squads. The study identified that no statistically significant differences were found between the percentage of forward passes, duration of attack and assist action. It was however found that all ages showed variances in the number of actions leading up to a goal, demonstrating the First team's ability to maintaining possession. Furthermore, the assist location between U18s and First team were seen to show disparities, with the First team utilising the wings more frequently than the U18s.

Despite Smith et al. (2013) having exclusively investigated a singular club, the study pioneeringly hinted toward the notion that a club's playing philosophy may run through the Blue Square Premier League club. Not only that, the study has given an insight into the strategical approach of Youth Teams. Highlighting that the First team presented tactically astute performances, utilising the entirety of the pitch. Tactically, a study by Teoldo da Costa et al. (2010), observed the differences between Youth squads, from Under 11 through to Under 20. The study identified that no differences were found between the Under 15 and Under 17 teams, similar to the findings of Smith et al. (2013). Similarly, the study identified that older age groups were more likely to display higher values reflecting their tactical superiority over the younger age groups, with Under 11's

scoring offensive width and length values of 42.74 (± 28.96) while Under 17s achieved a score of 67.51 (± 25.84). The biggest discrepancies in tactical indices were found to be between the Under 17 and Under 20 teams. This can be likened to the previously mentioned study by Smith and colleagues, who distinguished tactical differences between First team and under 18 teams.

It is important to acknowledge the demands of Youth football. When compared to the elite, or the latter stages of player development, younger players possess less physical, technical and tactical abilities. For example, the demands of Youth football have been explored; with younger teams displaying a greater intensity in their performance (Pereira Da Silva et al. 2007), while older ages perform a greater distance covered and distance sprinted (Harley et al. 2010). These disparities in physical attributes across age groups exposed Youth Teams to the adaptation of attacking strategies in accordance to their capabilities as players (Mara et al. 2012). As a result, technical and tactical attributes can be expected to differ between ages.

2.8 Relevance of Study

In summary, it has been established that performance analysis literature has generated performance indicators in order to predict match outcome and describe a team's style of play (Rein & Memmert 2016; Gomez et al. 2018). These variables, particularly those that represent reoccurring interactions that are associated with success, are influential in differentiating playing styles. Recent studies have generally proposed two standardised terms to describe a team's tactical approach and the performance indicators underpinning these styles remains inconclusive. The absence of definitive metrics across performance analysis literature has consequently limited the efficiency of research concerning game styles. With few studies including a comprehensive perspective that incorporates multiple in-match variables relative to the task, time and space of the actions (Hewitt et al. 2016; Gómez et al., 2018).

In addition to this, literature has tended to focused on technical-tactical performance indicators and the profiling of top European team performances (Zhou et al. 2018). Given that the main intention of match analysis within the coaching cycle is to support player development, literature is eluding the developmental stages of academy football (Raya-Castellano & Uriondo, 2015; Harrop & Nevill, 2014). This is most likely due to the economical phenomenon that is elite football. As a result, performance analysis literature appears detached from the practical application of the

discipline and has subsequently inhibited the development of performance analysis as a feedback mechanism at an academy and Youth level. It can be argued that studies that concentrate on First team performance could provide insightful for Youth Teams. Potentially allowing coaches to modify training to replicate situations similar to those found in Senior football, in the pursuit of developing First team specific attributes and skills within the players (Raya-Castellano & Uriondo, 2015). This could however result in Youth players becoming unidimensional in their approach to footballing philosophies and henceforth, Youth specific research is required.

Finally, performance analysis studies have gravitated towards the offensive sequence of events that result in a shot at goal. This is due to the primary objective of the sport; requiring a team to score more goals than the opposition and as a result, the majority of studies have labelled a goal as a measure for success (Michailidis et al. 2018). The research that concentrates on the build-up to a goal or shot, regularly excludes offensive patterns of play that result in possession loss, attainment of set-pieces or alternative outcomes. As a result, these studies do not obtain a comprehensive understanding of the sport (Ruiz-Ruiz et al. 2013). Given the increased frequency of final third entries and association to success (Bate, 1988), a better insight into a team's playing style can be achieved.

In conclusion, this study aims to use established performance indicators to effectively describe the patterns of play that define a team's playing style in the lead up to final third entries. In conjure with this, the study aims to identify the differences between key developmental stages of football (Smith et al. 2013; Vaeyens et al. 2005), under 16s, under 18s and First team matches.

3.0 Hypothesis

After examining the surrounding literature, the following hypothesises (Table 1) have been established in order to fulfil the objectives of the study.

Table 1. Table of hypothesises for present study.

Research Hypothesis	Null Hypothesis
Research hypothesis 1: Goal scoring opportunities will significantly decrease at each age group.	*Null hypothesis 1:* Goal scoring opportunities will **not** significantly decrease at each age group.
Research hypothesis 2: Goal scoring locations will be significantly different between each age group.	*Null hypothesis 2:* Goal scoring locations will **not** be significantly different between each age group.
Research hypothesis 3: The assist action prior to a goal scoring opportunity will be significantly different between each age groups.	*Null hypothesis 3:* The assist action prior to a goal scoring opportunity will **not** be significantly different between each age groups.
Research hypothesis 4: The assist location prior to a goal scoring opportunity will be significantly different between each age groups.	*Null hypothesis 4:* The assist location prior to a goal scoring opportunity will **not** be significantly different between each age groups.
Research hypothesis 5: The average duration of a successful attack will significantly increase at each age group.	*Null hypothesis 5:* The average duration of a successful attack will **not** significantly increase at each age group.
Research hypothesis 6: The average number of actions through successful attacks will significantly increase at each age group.	*Null hypothesis 6:* The average number of actions through successful attacks will **not** significantly increase at each age group.
Research hypothesis 7: The average number of passes will significantly increase at each age group.	*Null hypothesis 7:* The average number of passes will **not** significantly increase at each age group.
Research hypothesis 8: The percentage of wide build-up play will significantly increase at each age group.	*Null hypothesis 8:* The percentage of wide build-up play will **not** significantly increase at each age group.

Research hypothesis 9:
The percentage of forward actions will significantly increase at each age group.

Null hypothesis 9:
The percentage of forward actions will **not** significantly increase at each age group.

Research hypothesis 10:
The ball recovery method will be significantly different between age groups.

Null hypothesis 10:
The ball recovery method will **not** be significantly different between age groups.

Research hypothesis 11:
The ball recovery location will be significantly different between age groups.

Null hypothesis 11:
The ball recovery location will **not** be significantly different between age groups.

*Research hypothesis 12: The p*laying styles will be seen to differ at each age group.

*Null hypothesis 12: The p*laying styles will **not** be seen to differ at each age group.

4.0 Methodology

4.1 Research Design & Sample

The research study employed a nomothetic, multidimensional methodology (Anguera and Mendo 2013; Claudio Alberto et al. 2016) incorporating the observation and quantification of technical-tactical actions. The study utilised a single observer, that underwent intra-reliability tests to ensure the consistent interpretation of predefined measures (Table 3). All while exercising a non-participative observation, removing interactions between the observer and participants, maintaining a non-intrusive approach of analysing performance (Claudio Alberto et al. 2016), granting results a higher degree of ecological reliability (O'Donoghue et al. 2018). The use of an observational methodology enhances the understanding of dynamic interactions and behaviours during a live environment, utilising a realism approach (O'Donoghue et al. 2018) that facilitates the comprehensive analysis of performance (Smith 2018). Prior to the start of the research protocol, the study was granted ethical approval by the football club and academic institution.

	Games	Final Third Entries	Number of Shots	Number of Goals
First Team	15	1189	391	46
Under 18s	15	1138	429	59
Under 16s	15	984	410	76
Total	45	3311	1230	181

Table 2. Summary of Data Collection

The research sample was comprised of 45 matches, evenly distributed between three age groups (Table 2), during the 2018/19 season. Considered to be at critical stages of football development (Vaeyens et al. 2005; Smith et al. 2013), the three age-groups included: Under 16s (ages 14-16), Under 18s (ages 16-18) and First team (ages 18+). All teams played in a league format; with First team matches being played in the 'Premier League', U18 matches in the 'Football League Youth Alliance South-West Division', and U16 matches in the 'Football League Youth Alliance Games Programme'. From these observed matches, 16 teams from both the First and Under 18 age groups were analysed, with 10 different teams being observed from the Under 16 group, resulting

in a total of 42 different teams observed. Teams were seen to play each other on a maximum of two occasions (once at home and once away) and performances were averaged when a team was observed more than once.

4.3 Intra-Reliability

As noted by Hughes & Franks (2005), notational analysis protocols that utilised computerised systems, such as the present study, are susceptible to operational and software errors. For this reason, tests for intra-reliability through Cohen's Kappa tests and percentage error were carried out prior to the data collection process (Hughes 1998; Hughes et al. 2004). Two First team matches chosen at random were analysed using a test-retest design with a 21-day delay in an attempt to avoid biasing the results via the potential of a learning effect. Each nominal variable was individually tested, using the Cohen's Kappa equation (Equation 1), where the accepted value was set to ≥ 0.8O (O'Donoghue and Holmes 2014). Values between 0.8 and 1.0 are considered to display a very good strength of agreement, with 0.6 to 0.8 values showing a good strength of agreement (Altman 1991). Meanwhile, percentage error tests were carried out on Possession Duration and frequency data such as Number of Passes, of which utilised the percentage error equation (Equation 2), where significance levels were set to ≤ 5% (Hughes et al. 2004).

Equation 1. Cohen's Kappa Equation

$$K = \frac{(P_o - P_c)}{(1 - P_c)}$$

Equation 2. Percentage Error Equation

$$Percentage\ Error\ = \sum \frac{mod(V_1 - V_2)}{V_{mean}} \times 100\%$$

Similar to that found by Lago (2009) and as displayed in Table 3, all variables scored values that were under the accepted limit of 5% (<0.05). As a consequence, each performance indicator was considered to display a strong correlation between observations and therefore were considered to display a strong level reliability.

Table 3. Percentage Error (%) and Kappa values for intra-observer reliability.

Variable	Intra-observer
Possession Duration	4.02%
Total Distance	3.10%
Average Action Distance	3.29%
Number of Actions	3.83%
Number of Passes	2.34%
Number of Crosses	1.47%
Number of Dribbles	2.55%
Ball Recovery Method	0.97
Ball Recovery Location	0.78
Build-Up Action	0.97
Build-Up Location	0.81
Build-Up Direction	0.87
Assist Action	1.00
Possession Outcome	1.00
Possession Outcome Location	0.83
Shot Outcome	1.00
On-Target Outcome	1.00
Off-Target Outcome	0.99

4.4 Procedure

With institutional ethical approval, all footage was provided by a Premier League club, in which video materials utilised a fixed aerial, wide-angle perspective. Each match was viewed using video analysis software, SportsCode V11.2.25, where final third entries were analysed. These instances are recognised elements that reflect a successful outcome (Bate 1988) and prove to be more frequent than goal-scoring opportunities. Subsequently, the analysed matches were processed through a systematic observational methodology; where ball possessions resulting in a final third entry were examined and predefined action variables (later turned into key performance indicators) (Carling et al. 2006; O'Donoghue et al. 2018) were measured (Table 3) using a tagging panel (Appendix 8.3) in order to effectively capture a team's playing style. Time codes were automatically inserted by SportsCode software for each data entry, allowing the calculation of time related variables. Over 3,000 data entries were then transferred into IBM SPSS V.25 for further analysis.

4.5 Key Performance Indicators

Relevant key performance indicators were established through the findings of previous research (Table 4). The criteria for observed incidents was generated under the notion of Bate (1988) who identified that final third as the “critical scoring area”. Stating that all goals, unless under unusual circumstances, are scored from this third of the pitch. Given that entries into the final third are more frequent than shots at goal, it was expected to more accurately display the playing styles of a team, reflecting both successful (creation of shooting opportunities) and unsuccessful (termination of attack) attacks.

Ball possession was defined to originate from the moment a player gains enough control of the ball to influence its direction (Pollard & Reep 1997). Conversely, possession was considered to end once; the ball had gone out of play, an opposition player successful interrupted the direction of the ball, or the referee paused the game for an infringement (Jones et al. 2004).

Pitch locations were collected using a pitch graphic that was divided into areas. Under the assumption that pitches were set at a minimum of 100 yards by 70 yards (The FA 2019a), the graphic was divided into a 10 by 7 zones, whereby one zone was approximately 10 yards by 10 yards. This collection process enabled the pitch location to be categorised into larger zones. Pitch location, in regards to passing and ball recovery, have been examined to varying degrees, with areas ranging from three lateral zones (Tenga et al. 2010a), up to six (Fernandez-Navarro et al. 2016). The current study aimed to implement a detailed insight into the utilisation of the pitch and given the dissection of the pitch (10x7), five equal zones parallel to the goal lines were established as seen in **Figure 3**. In regards to the horizontal division of the pitch, prior studies have frequently used the edge of the penalty area to distinguish wide zones (Barreira et al. 2013; Andrade et al. 2015; Fernandez-Navarro et al. 2016). This dissection of the pitch was implemented for analysing ball recovery and build-up action locations.

As stated by Bate (1988), shooting opportunities are unlikely to occur from outside the final third, for this reason the present study utilised a more intricate dissection of the pitch for both the assist and shot location, as seen in Figure 4. The data collection process was concluded by the extrapolation of raw data from SportsCode into Microsoft Excel V.16.26 and IBM SPSS.

Table 4. Tagging panel table of action variables operational definitions.

Category	Action Variable	Definition
Ball Recovery Method		The first action that originated possession.
Open-play	Tackle	When a player successfully takes the ball away from the player in possession and maintains possession (Liu et al. 2013; OPTA 2019).
	Duel	When a player successfully takes the ball in a contested ball, these include aerial duels (OPTA 2019).
	Interception	When a player intentionally intercepts a pass by moving into the line of the ball (Liu et al. 2013; OPTA 2019).
	Recovery/Loose Ball	When a player regains possession from a loose ball or the ball has been played directly to them (Liu et al. 2013; OPTA 2019).
	Defensive error/Turnover	When a defensive player makes a mistake to give the opposition possession of the ball (Liu et al. 2013; OPTA 2019).
	Goal-keeper	When the goal keeper is regains possession in open-play through a save, catch (Liu et al. 2013) or smother (OPTA 2019).
	Restart	When open-play has resumed following a stoppage made by the referee or a goal.
	Other	Unaccounted for initial actions, and/or rebounds for shots.
Set-piece	Corner	When open-play has resumed following the ball leaving the field of play at the opposition's touch-line after touching an opposition player.
	Throw-in	When open-play has resumed following the ball leaving the field of play at the side-line after touching an opposition player.
	Free-kick	When open-play is resumed following an illegal action by the opposition team, outside the defending team's penalty area.
	Penalty	When open-play is resumed following an illegal action by the opposition team, inside the defending team's penalty area.
	Goal-kick	When open-play has resumed following the ball leaving the field of play at the defensive touch-line, after touching an opposition player.

Build-up actions	Pass	An intentionally played ball from one player to another (Taylor et al. 2008; Williams 2012; Liu et al. 2013; Wallace and Norton 2014; OPTA 2019).
	Cross	A pass from a wide position to a specific area in front of goal (Liu et al. 2013; Smith and Lyons 2017; OPTA 2019).
	Dribble	The intentional movement of the ball, in order to travel or beat an opponent (Liu et al. 2013; OPTA 2019). A dribble is recognised when a player takes two or more touches of the ball.
Outcome actions	Attack stopped	The interference, but not loss of possession (Teoldo da Costa et al. 2010).
	Possession lost	The turnover of possession (Teoldo da Costa et al. 2010).
	Shot	An attempt directed to the goal, in the intention of putting the ball into the net (Liu et al. 2013; OPTA 2019).
	Rebound shot	A consecutive attempt directed to the goal.
	Own goal	Any action made by a defending player to result in the ball crossing the goal-line (OPTA 2019).
Shot outcome	On-target	Any attempt at goal where the ball does, or would, crossing the goal-line, without the intervention of the goal keeper (OPTA 2019).
	Goal	Any attempt at goal that crosses the goal-line (Liu et al. 2013; OPTA 2019).
	Saved	Any attempt at goal where the ball is stopped by the goal keeper to prevent the ball crossing the goal-line (Liu et al. 2013; OPTA 2019).
	Off-target	Any attempt at goal where the ball goes wide of the target, missing the goal or hitting the woodwork (OPTA 2019).
	Missed	Any attempt that goes wide of the goal (Liu et al. 2013; OPTA 2019).
	Post/Woodwork	Any attempt that hits the woodwork and does not result in a goal (OPTA 2019).
	Blocked	Any attempt that at goal that is blocked by a defender – excluding the goalkeeper (Liu et al. 2013; OPTA 2019).

Direction	Forward	The direction of the ball following an action that results in vertical movement directly towards the opposition's goal (Figure 2).
	Forward-diagonal	The direction of the ball following an action that results in a vertical and lateral movement indirectly towards the opposition's goal (Figure 2).
	Sideways	The direction of the ball following an action that results in lateral movement (Figure 2).
	Backward-diagonal	The direction of the ball following an action that results in a vertical and lateral movement indirectly away the opposition's goal (Figure 2).
	Backward	The direction of the ball following an action that results in vertical movement directly away from the opposition's goal (Figure 2).

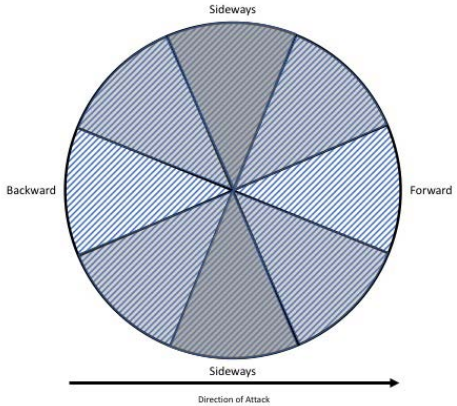


Figure 2. Direction of build-up action in relation to playing direction.

Location		
Build-up action	Defensive zone	Actions that occur in the defensive zone (Figure 3).
	Defensive-midfield zone	Actions that occur in the defensive-midfield zone (Figure 3).
	Midfield zone	Actions that occur in the midfield zone (Figure 3).
	Attacking-midfield zone	Actions that occur in the attacking-midfield zone (Figure 3).
	Attacking zone	Actions that occur in the attacking zone (Figure 3).
	Left channel	Actions that occurring in the left channel (Figure 3).
	Central channel	Actions that occurring in the central channel (Figure 3).
	Right channel	Actions that occurring in the right channel (Figure 3).

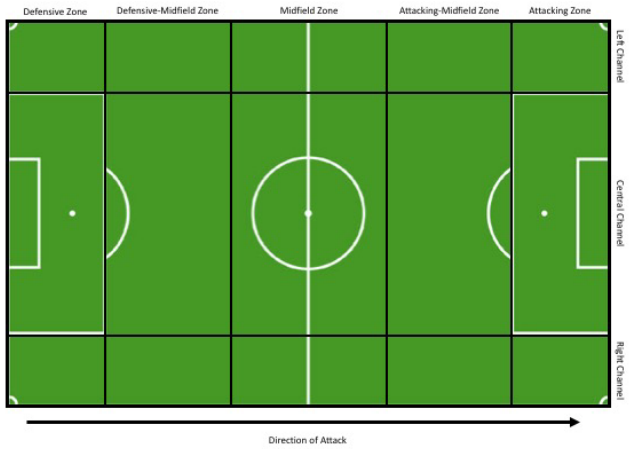


Figure 3. Pitch location in relation to build-up actions, divided into five vertical zones and three horizontal zones.

Assist action		Assist action that occurs in the corresponding zone (Figure 4). Specifically, where the final pass or cross leading to the recipient of the ball scoring a goal

	(Liu et al. 2013; OPTA 2019).	*Figure 4. Pitch location in relation to shots and assists. Divided into; six areas inside the box, and six outside the box and one in the own half of the attacking team.*
Inside the box	Assist actions that occur inside the penalty area (A1, A2, A3, A4, A5, A6 in Figure 4).	
Outside the box	Assist actions that occur inside the penalty area (B1, B2, B3, B4, B5, B6 in Figure 4).	
Own half	Assist actions that occur inside the penalty area (C1 in Figure 4).	

4.6 Statistical Analysis

Initially, 3,311 final third entries were averaged by team per match, in Microsoft Excel; producing 90 rows of data equally spread across the age groups (30 per age). The data was then exported from Microsoft Excel to SPSS, where Kruskal-Wallis Tests were used for multiple variables. This test was chosen given the non-parametric nature of the dataset and enabled the comparison of the three groups at a univariate level (O'Donoghue 2010). These non-parametric tests were followed up with post-hoc Mann-Whitney U Tests in order to identify any statistical differences found between the age groups.

In addition to the univariate approach above, a multivariate process known as Principle Component Analysis (PCA) was employed in an attempt to differentiate between the playing styles of each age groups. This method of analysis is a reduction technique that produces a smaller set of independent factors based on correlated variables (O'Donoghue 2010) and has been used in performance analysis to identify higher order performance indicators (O'Donoghue 2008). This process of reducing performance indicators enables the generation of more concise metrics that represent different dimensions of performance (O'Donoghue 2012). The principle components (factors) are assigned an Eigenvalue which signifies the "weighting" or importance of this factor, with higher numbers being greatest importance; reflecting how much variance the component accounts for (O'Donoghue 2012). As described by Parmar et al. (2017), this technique retains the complexity of multiple variables by cataloguing similar variables together. As a result of this process, Fernandez-Navarro (2016) used it in adults to define various aspects of performance, in which 12 different playing styles were established and comparisons between teams were apparent. Using this approach, it is therefore intended to examine the differences in playing style between age groups using the principle components produced. The following performance indicators were computed for each team's performance and entered into SPSS to undergo PCA and were converted to percentages to avoid any artificial inflation of variables within the analysis (O'Donoghue 2012):

- Average duration (normalised as a percentage).
- Average number of passes (normalised as a percentage).
- Percentage of build-up actions in a backward direction.
- Percentage of build-up actions in a backward-diagonal direction.
- Percentage of build-up actions in a sideways direction.
- Percentage of build-up actions in a forward-diagonal direction.
- Percentage of build-up actions in a forward direction.

- Percentage of build-up actions in defensive zone.
- Percentage of build-up actions in defensive-midfield zone.
- Percentage of build-up actions in midfield zone.
- Percentage of build-up actions in attacking-midfield zone.
- Percentage of build-up actions in attacking zone.
- Percentage of build-up actions in wide areas.
- Percentage of build-up actions in central areas.
- Percentage of ball recovery actions in defensive zone.
- Percentage of ball recovery actions in defensive-midfield zone.
- Percentage of ball recovery actions in midfield zone.
- Percentage of ball recovery actions in attacking-midfield zone.
- Percentage of ball recovery actions in attacking zone.
- Percentage of ball recovery actions in wide areas.
- Percentage of ball recovery actions in central areas.

Table 5. Description and measurement of key performance indicators.

Category	Key Performance Indicator	Definition	Measurement
Build-Up Descriptors	Possession duration (seconds)	The average time of a team's attack.	Calculated by the averaging the time of a team's attack per match.
	Total distance (meters)	The average distance of a team's attack.	
	Distance per action (meters)	The average distance per action of a team's attack.	
	Number of actions	The average number of actions per attack.	Data was collected and normalised by calculating the percentage from all of these events made by a team during the whole match.
	Number of passes	The average number of passes per attack.	
	Number of dribbles	The average number of dribbles per attack.	
	Number of crosses	The average number of crosses per attack.	
Build-Up Locations	Percentage of defensive zone actions	Percentage of the average number of times that the team performed an action in the defensive zone (next to own goal) from all the actions made by the team.	Calculated by taking the average number of times that the team performed an action and the number of times that the team performed the action in the area corresponding to the performance indicator. Hence the percentage (normalised data) was calculated from these data.
	Percentage of midfield-defensive zone actions	Percentage of the average number of times that the team performed an action in the defensive-midfield zone from all the actions made by the team.	
	Percentage of midfield zone actions	Percentage of the average number of times that the team performed an action in the midfield zone from all the actions made by the team.	
	Percentage of attacking-midfield zone actions	Percentage of the average number of times that the team performed an action in the attacking-midfield zone from all the actions made by the	

		team.	
	Percentage of attacking zone actions	Percentage of the average number of times that the team performed an action in the attacking zone from all the actions made by the team.	
	Percentage of central zone actions	Percentage of the average number of times that the team performed an action in the central areas of the pitch from all the actions made by the team.	
	Percentage of wide zone actions	Percentage of the average number of times that the team performed an action in the wide areas (left and right wings) of the pitch from all the actions made by the team.	
Build-Up Direction	Percentage of backward passes	Percentage of the average number of times that the team performed an action in a backward direction from all the actions made by the team.	Calculated by taking the average number of times that the team performed an action and the number of times that the team directed the action in the direction corresponding to the performance indicator. Hence the percentage (normalised data) was calculated from these data.
	Percentage of backward-diagonal passes	Percentage of the average number of times that the team performed an action in a backward-diagonal direction from all the actions made by the team.	
	Percentage of sideways passes	Percentage of the average number of times that the team performed an action in a sideways direction from all the actions made by the team.	
	Percentage of forward-diagonal passes	Percentage of the average number of times that the team performed an action in a forward-diagonal direction from all the actions made by the team.	
	Percentage of forward passes	Percentage of the average number of	

		times that the team performed an action in a forward direction from all the actions made by the team.	
Ball Recovery Method	Percentage of tackles regains	Percentage of the average number of times that the team performed a tackle to regain possession from all the regains made by the team.	Data was collected and normalised by calculating the percentage from all ball recoveries and the corresponding ball recovery method made by a team during the whole match.
	Percentage of duels regains	Percentage of the average number of times that the team performed a duel to regain possession from all the regains made by the team.	
	Percentage of interceptions regains	Percentage of the average number of times that the team performed an interception to regain possession from all the regains made by the team.	
	Percentage of goal-keeping regains	Percentage of the average number of times that the team a goal-keeper regained possession from all the regains made by the team.	
	Percentage of loose-ball regains	Percentage of the average number of times that the team a recovered a loose ball to regain possession from all the regains made by the team.	
	Percentage of defensive-error regains	Percentage of the average number of times that the team exploited a defensive error to regain possession from all the regains made by the team.	
	Percentage of set-piece regains	Percentage of the average number of times that the team performed a set-piece to regain possession from all the regains made by the team.	
	Percentage of miscellaneous regains	Percentage of the average number of times that the team performed a	

		miscellaneous action to regain possession from all the regains made by the team.	
Ball Recovery Location	Percentage of defensive zone regains	Percentage of the average number of times that the team regains the ball in the defensive zone (next to own goal) from all the regains made by the team.	Calculated by taking the average number of times that the team regained possession of the ball and the number of times that the team regained the possession of the ball in the area corresponding to the performance indicator. Hence the percentage (normalised data) was calculated from these data.
	Percentage of defensive-midfield zone regains	Percentage of the average number of times that the team regains the ball in the defensive-midfield zone from all the regains made by the team.	
	Percentage of midfield zone regains	Percentage of the average number of times that the team regains the ball in the midfield zone from all the regains made by the team.	
	Percentage of attacking-midfield zone regains	Percentage of the average number of times that the team regains the ball in the attacking-midfield zone from all the regains made by the team.	
	Percentage of attacking zone regains	Percentage of the average number of times that the team regains the ball in the attacking zone from all the regains made by the team.	
	Percentage of central regains	Percentage of the average number of times that the team regains the ball in the central area from all the regains made by the team.	
	Percentage of wide regains	Percentage of the average number of times that the team regains the ball in the wide areas from all the regains made by the team.	
Assists Method	Percentage of passed assists	Percentage of attacking sequences that finish with a passed assist from all the attacking sequences made by	Data was collected and normalised by calculating the percentage from all of these events made by a team

		the team.	during the whole match.
	Percentage of crossed assists	Percentage of attacking sequences that finish with a crossed assist from all the attacking sequences made by the team.	
	Percentage of dribbles (self-assisted) assists	Percentage of attacking sequences that finish with a dribbled assist from all the attacking sequences made by the team.	
	Percentage with no assists	Percentage of attacking sequences that finish with a no assist from all the attacking sequences made by the team.	
Assist Location	Percentage of (C1) own-half assists	Percentage of the average number of times that the team performed an assist from the defensive half (C1) of the pitch from all the assists made by the team.	Calculated by taking the average number of times that the team assisted a goal and the number of times that the team assisted a goal in the area corresponding to the performance indicator. Hence the percentage (normalised data) was calculated from these data.
	Percentage of outside-box (B1, B2, B3, B4, B5, B6) assists	Percentage of the average number of times that the team performed an assist from the outside the box from all the assists made by the team.	
	Percentage of inside-box (A1, A2, A3, A4, A5, A6) assists	Percentage of the average number of times that the team performed an assist from inside the box from all the assists made by the team.	
	Percentage of central zone assists	Percentage of the average number of times that the team performed an assist in the central areas of the pitch from all the assists made by the team.	
	Percentage of wide zone assists	Percentage of the average number of times that the team performed an assist in the wide areas (left and right wings) of the pitch from all the assists	

		made by the team.	
Possession Outcome	Percentage interrupted/lost	Percentage of attacking sequences that are interrupted or from all the attacking sequences made by the team.	Data was collected and normalised by calculating the percentage from all of these events made by a team during the whole match.
	Percentage of shooting opportunities	Percentage of attacking sequences that finish with a shot from all the attacking sequences made by the team.	
	Percentage of rebounds	Percentage of attacking sequences that finish with a rebounded-shot from all the attacking sequences made by the team.	
	Percentage of own-goals	Percentage of attacking sequences that finish with an own-goal from all the attacking sequences made by the team.	
Shot Outcome	Percentage on-Target	Percentage of shots that were on-target from all the shots made by the team.	Data was collected and normalised by calculating the percentage from all of these events made by a team during the whole match.
	Percentage off-Target	Percentage of shots that were off-target from all the shots made by the team.	
	Percentage scored	Percentage of shots that went in the goal from all the shots on-target made by the team.	
	Percentage saved	Percentage of shots that were saved from all the shots on-target made by the team.	
	Percentage missed	Percentage of shots that missed the goal from all the shots off-target made by the team.	
	Percentage blocked	Percentage of shots that were blocked from all the shots off-target made by the team.	

	Percentage hit the Post	Percentage of shots that hit the post from all the shots off-target made by the team.

5.0 Results

5.1 Descriptive Statistics

The present study analysed a total of 45 matches, 15 matches from each team's respective league. A total of 3,311 incidents were identified to meet the criteria of resulting in a successful attack, specifically a final third entry. After carrying out a Krustal-Wallis H test, it was identified that there were significant differences in the number of final third entries created across the teams (H_2= *7.242, p=0.27*). Following up, using a post-hoc Mann-Whitney U test, it was found that both the First team and Under 18s were able to create considerably more final third entries than their younger, Under 16 counterparts (*z=-2.560, p=0.01, z=-2.042, p=0.041 respectively)*. Across the observed matches, 37.15% of attacks resulted in a shooting opportunity, with Under 16s converting 41.67% of final third entries into a shot at goal. This conversion rate was followed by the Under 18s and then First team who yield shots from 37.70% and 32.88% of attacks, respectively. As a result of these shooting opportunities, the First team were able to hit the target on 37.08% of all shots taken, while Under 18s achieved a shooting accuracy of 41.10% and the Under 16s achieving 46.09%. In coherence with their inferior number of shots, the First team were only able to convert 11.76% of shots into goals, meanwhile the Under 18s and Under 16s were able to achieve goal scoring rates of 13.75% and 18.54% respectively. Finally, from all observed matches only 5.47% of successful attacks resulted in a goal.

	Games	Final Third Entries	Number of Shots	Number of On-Target Shots	Number of Off-Target Shots	Number of Goals
First team	15	**1189**$^{\dagger ab}$	391	145	246	46
Under 18s	15	1138	429	176	253	59
Under 16s	15	984	410	189	222	76
Total	45	3311	1230	510	721	181

Table 6. Frequency count of incidents observed.

†= significant difference across all groups (*p<0.05)*, ^{a} = significant difference with U18 (*p<0.05)*, ^{b} = significant difference with U16 (*p<0.05)*.

5.2 Build-up Play

From the games observed, it was discovered that some aspects of build-up play differed across ages groups. As displayed in Table 6, using a Krustal-Wallis H test there was no significant differences found across groups regarding the duration of attack ($H_2=0.890, p>0.05$), total distance ($H_2=3.792, p>0.05$) and average distance per action ($H_2= 2.059, p>0.05$). In addition, it was identified that the number of actions between age groups were not statistically significant ($H_2=5.684, p=0.058$) despite the First team performing significantly more actions that the Under 18s ($z=-2.337, p=0.019$) as observed following a Mann-Whitney U post-hoc test. The initial Krustal-Wallis H test did however identify that the number of passes ($H_2=7.371, p=0.025$), dribbles ($H_2=11.221, p<0.01$) and crosses ($H_2=18.880, p<0.01$), were all statistically significant across age groups. Succeeding this, post-hoc tests identified that the First team displayed significantly more passes and crosses compared to both the Under 18 ($z=-2.472, p=0.013, z=-3.352, p<0.01$ *respectively*) and Under 16 ($z=-2.196, p=0.28, z=-4.251, p<0.01$ *respectively*) age groups. Furthermore, the number of dribbles performed by the Under 16s were found to be significantly greater than the First team ($z=-2.653, p<0.01$) and Under 18s ($z=-2.510, p=0.012$).

Table 7. Build-up play variables (mean ± sd) across age groups.

Variable	First team	Under 18	Under 16
Duration (s)	15.25 ± 4.09	14.06 ± 2.64	14.38 ± 4.30
Total Distance (m)	9.00 ± 2.49	7.73 ± 1.62	8.12 ± 2.70
Average Distance (m)	1.94 ± 0.16	2.00 ± 0.19	2.00 ± 0.20
Number of Action	**5.53 ± 1.57**[a]	4.57 ± 1.17	4.83 ± 1.58
Number of Passes	**4.03 ± 1.45**[†ab]	3.10 ± 0.96	3.17 ± 1.21
Number of Dribbles	**1.00 ± 0.26**[†b]	**1.03 ± 0.18**[b]	1.27 ± 0.45
Number of Crosses	**0.90 ± 0.31**[†ab]	0.50 ± 0.52	0.37 ± 0.49

[†]= significant difference across all groups ($p<0.05$), [a] = significant difference with U18 ($p<0.05$), [b] = significant difference with U16 ($p<0.05$).

As displayed in Table 7, the usage of direction in build-up actions was found to significantly differ across ages. In particular, it was found that backwards ($H_2=8.172, p=0.017$), forward-diagonal ($H_2=6.392, p=0.041$) and forward ($H_2=6.576, p=0.037$) directions were considerably different. After

carrying out post-hoc tests, is was identified that Under 16s performed significantly more backwards (*z=-2.714, p<0.01*) and forward (*z=-2.380 p=0.017*) actions compared to the First team. There was also, a greater percentage of forward passes used by Under 18s compared to the First team; however, it was not found to be statistically significant (*z=-1.935 p=0.053*). Finally, it was identified that the First team utilised significantly more forward diagonal (*z=-2.644 p=<0.01*) passes than the Under 16s.

Table 8. Direction of build-up actions displayed as a percentage (mean ± sd) across age groups.

Variable	First team	Under 18	Under 16
Backward (%)	**6.73 ± 2.46**$^{\dagger b}$	7.27 ± 3.17	9.03 ± 3.49
Backward Diagonal (%)	8.73 ±3.87	8.10 ± 3.64	8.60 ± 4.15
Sideways (%)	33.10 ± 7.99	34.00 ± 16.71	30.07 ± 10.08
Forward Diagonal (%)	**28.40 ± 5.86**$^{\dagger b}$	25.10 ± 10.27	25.17 ± 7.62
Forward (%)	**23.13 ± 5.28**$^{\dagger b}$	25.40 ± 6.63	27.30 ± 7.42

†= significant difference across all groups (*p<0.05)*, ^{a} = significant difference with U18 (*p<0.05)*, ^{b} = significant difference with U16 (*p<0.05)*.

The utilisation of the pitch during build-up play, was only observed to display differences at the defensive zone (H_2*=8.416, p=0.015*) and in wide zones (H_2*=16.475, p<0.00*). In more detail, it was found that the First team executed considerably less actions in the defensive zone (*z=-2.988, p<0.01*) than compared to the Under 16s. Similarly, it was found that both the First team and Under 18s performed significantly more actions in wide zones (*z=-3.913, p<0.00*, *z=-2.387, p=0.017* respectively) than the Under 16s. Although not significant, the First team did display a greater percentage than the Under 18s in regard to usage of wide zones (*z=-1.906, p=0.057*).

Table 9. Pitch utilisation during build-up play displayed as a percentage (mean ± SD) across age groups.

Group	Defensive Zone (%)	Defensive-Midfield Zone (%)	Midfield Zone (%)	Attacking-Midfield Zone (%)	Attacking Zone (%)	Wide Zones (%)
First team	**0.50 ± 0.51**[†b]	6.20 ± 2.67	11.73 ± 4.10	34.50 ± 5.58	47.20 ± 8.77	**30.10 ± 4.06**[†b]
Under 18	1.00 ± 1.15	6.60 ± 3.43	10.93 ± 3.55	33.97 ± 5.37	47.57 ± 8.77	**27.77 ± 4.65**[b]
Under 16	1.40 ± 1.40	6.90 ± 3.55	10.17 ± 3.60	34.43 ± 6.52	47.20 ± 9.99	24.20 ± 5.73

[†]= significant difference across all groups (*p<0.05)*, [a] = significant difference with U18 (*p<0.05)*, [b] = significant difference with U16 (*p<0.05)*.

5.3 Ball Recovery

The method used to recover the ball was observed to display that there were substantial differences in the percentage of tackles (H_2*=9.420, p<0.01*) and loose-ball (H_2*=9.906, p<0.01*) regains completed across all teams. It was found that Under 16s performed a significantly higher percentage of tackles to recover the ball, opposed to First team (*z=-2.947, p<0.01*) and Under 18 (*z=-2.185, p=0.029*) squads. Conversely, the Under 16 team were found to regain the ball via loose-balls considerably less than the First team (*z=-3.031, p<0.01*). This can also be seen with the Under 18 team, however post-hoc tests did not identify the difference to be a statistically significant (*z=-1.918, p=0.55*).

Table 10. Percentage of Ball recovery methods (mean ± SD) used across age groups.

Variable	First team	Under 18	Under 16
Tackle (%)	**9.90 ± 5.39**[†b]	**11.47 ± 7.13**[b]	16.37 ± 10.09
Duel (%)	9.17 ± 4.69	9.80 ± 3.88	10.03 ± 4.78
Interception (%)	11.50 ± 5.51	13.33 ± 7.38	11.03 ± 6.45
Loose Ball (%)	**20.87 ± 6.42**[†b]	18.13 ± 6.35	14.97 ±7.45
Defensive Error (%)	2.30 ± 3.46	2.07 ± 2.18	3.00 ± 2.72
Goal Keeper (%)	5.10 ± 3.66	4.43 ± 3.77	4.77 ± 3.78
Set Play (%)	37.23 ± 8.55	38.47 ± 8.37	36.13 ±11.83
Other (%)	3.97 ± 4.44	2.43 ± 3.08	3.80 ± 4.04

[†]= significant difference across all groups (*p<0.05)*, [a] = significant difference with U18 (*p<0.05)*, [b] = significant difference with U16 (*p<0.05)*.

On the other hand, ball recovery location, as seen in Table 10, was only found to be considerably different in the midfield zone ($H_2=11.512, p<0.01$), with the width of ball recoveries displaying no statistical difference ($H_2=3.567, p>0.05$). Mann-Whitney U tests identified that Under 18s displayed significantly more regains in the midfield zone compared to First team ($z=-2.839, p<0.01$) and Under 16 ($z=-2.968, p<0.01$) teams. Interestingly, it can be noted that the First team and Under 16s performed more regains in the attacking zone, although it was not found to be statistically significant ($z=-1.896, p=0.058, z=-1.769, p=0.077$ *respectively*).

Table 11. Ball recovery location displayed as a percentage (mean ± SD) across age groups.

Group	Defensive Zone (%)	Defensive-Midfield Zone (%)	Midfield Zone (%)	Attacking-Midfield Zone (%)	Attacking Zone (%)	Wide Zones (%)
First team	7.60 ± 5.17	14.73 ± 7.83	**17.93 ± 6.90**[†a]	33.27 ± 9.64	26.30 ± 6.25	47.43 ± 8.73
Under 18	6.83 ± 5.24	14.17 ± 7.36	**23.17 ± 6.74**[b]	32.50 ± 8.65	23.27 ± 7.80	44.47 ± 8.97
Under 16	7.93 ± 5.89	12.67 ± 9.51	16.67 ± 9.44	34.27 ± 12.95	28.63 ± 1.69	44.33 ± 9.9

[†] = significant difference across all groups ($p<0.05$), [a] = significant difference with U18 ($p<0.05$), [b] = significant difference with U16 ($p<0.05$).

5.4 Assist Actions

The penultimate action leading up to a goal was found to show clear differences in regard to the actions used to assist the goal. Krustal-Wallis H tests revealed considerable differences in crosses ($H_2=9.328, p<0.01$) and dribbles ($H_2=8.801, p=0.012$) across age groups, with post-hoc tests identifying that the First team squad performed a greater percentage of assists via a crossing action compared to both Under 18 ($z=-2.527, p=0.012$) and Under 16 squads ($z=-2.680, p<0.01$). Moreover, it found that First team squads displayed a significantly lower percentage of dribbles in order to assist a goal scoring incident, opposed to the Under 18s ($z=-2.211, p=0.027$) and Under 16s ($z=-2.976, p<0.01$) counterparts.

Table 12. Assist method displayed as a percentage (mean ± SD) across age groups.

Variable	First team	Under 18	Under 16
Pass (%)	32.26 ± 39.13	36.59 ± 38.20	44.62 ± 38.48
Cross (%)	**40.57 ± 35.03**$^{\dagger ab}$	19.07 ± 33.16	16.79 ± 29.32
Dribble/*Self Assist* (%)	**4.35 ± 14.41**$^{\dagger ab}$	18.67 ± 29.84	26.04 ± 33.22
No Assist Action (%)	22.83 ± 29.56	25.56 ± 34.76	12.5 ± 17.85

†= significant difference across all groups (*p<0.05)*, ^{a} = significant difference with U18 (*p<0.05)*, ^{b} = significant difference with U16 (*p<0.05)*.

The pitch location of a team's assists (Figure 5) did not find many differences across age groups within the individual zones. Regardless, a difference can be seen in the zone label 'B3', although it was not found to be significant (H_2*=5.943, p=0.051*). After post-hoc tests, it was found that the First team exhibited a considerably smaller percentage of assists from this zone (*z=-2.236, p=0.*025), while a similar difference can be seen with the Under 18s it was not found to be statistically significant (*z=-1.927, p= 0.054)*. In addition to this, the First team can be seen to display an inferior percentage of assists from 'C1' in relation to the Under 18s. Again, after using a Mann-Whitney U post-hoc test this difference was not found to be statistically significant (*z=-1.937, p=0.053*). Once assists were categorised into wide and central areas, a significant difference was observed across all ages (H_2*=7.701, p=0.021*). This difference is displayed by the substantially superior percentage exhibited by the First team, relative to the percentage displayed by the Under 16s (*z=-2.729, p<0.01*).

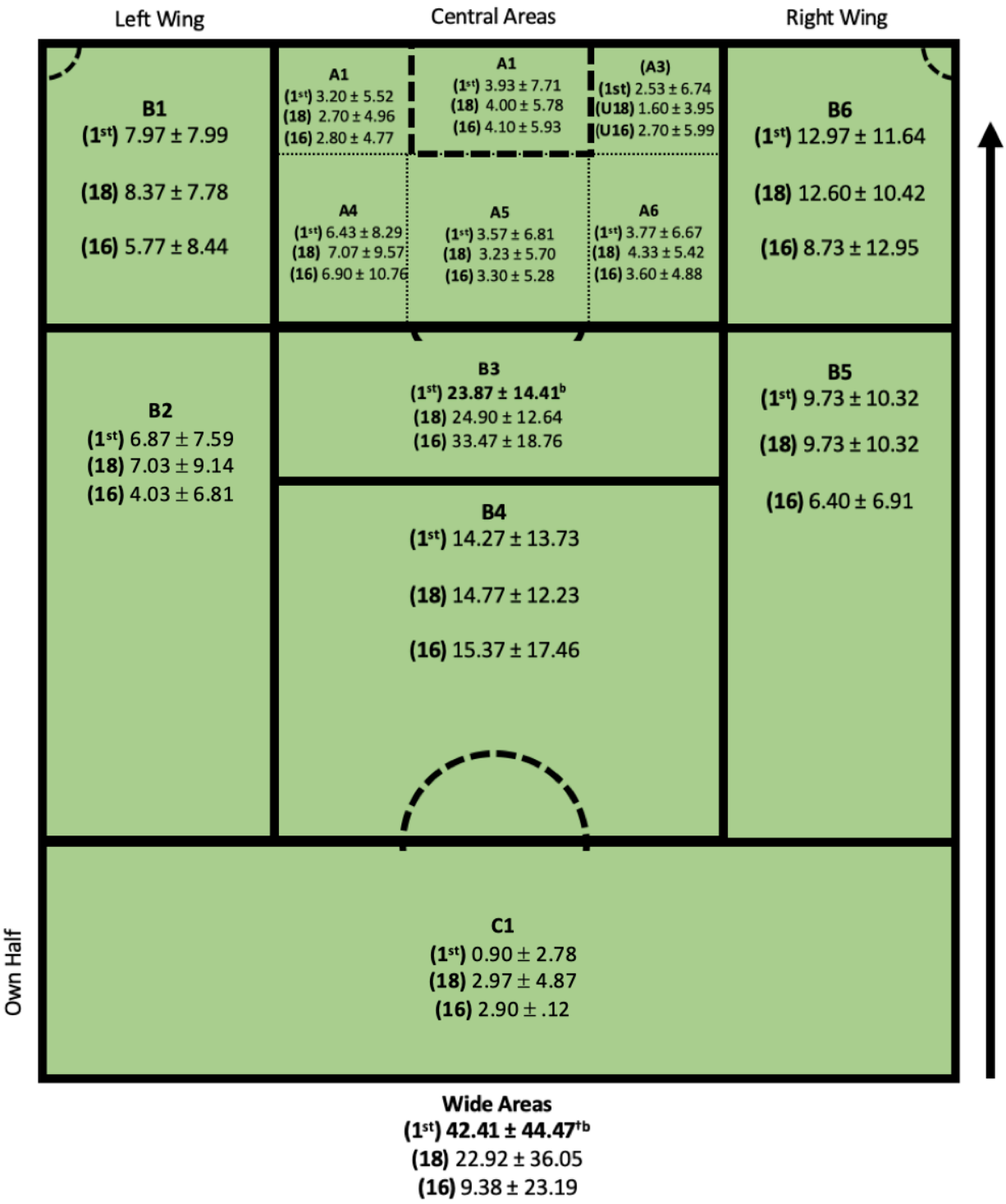


Figure 5. Assist location displayed as a percentage (mean ± SD) per zone across age groups, whereby [†]= significant difference across all groups (p<0.05), [a] = significant difference with U18 (p<0.05), [b] = significant difference with U16 (p<0.05).

5.5 Possession Outcomes & Shooting Opportunities

The outcome from all successful attacks were observed to display significant differences in the percentage of possessions that resulted in possession being lost or interrupted ($H_2=10.025$, $p<0.01$) and those ending in a shooting opportunity ($H_2=10.232$, $p<0.01$). As seen in Table 12, the First team had a significantly higher percentage of attacks that were lost or interrupted compared to both the Under 18s ($z=-2.050$, $p=0.40$) and Under 16s ($z=-3.168$, $p<0.01$). In contrast to this, the First team were found to generate a significantly smaller percentage of shooting opportunities than both of the younger counter parts ($z=-2.198$, $p=0.028$, $z=-3.079$, $p<0.01$ *respectively*). As for the outcome of shots, there were seen to be no significant differences across ages, or between age groups.

Table 13. Possession outcome displayed as a percentage (mean ± SD) across age groups.

Variable	First team	Under 18	Under 16
Interrupted/Lost (%)	**67.36 ± 6.06**$^{\dagger ab}$	62.03 ± 9.70	58.97 ± 12.34
Shooting Opportunity (%)	**31.24 ± 5.88**$^{\dagger ab}$	36.80 ± 9.46	39.63 ± 12.11
Rebound Created (%)	1.27 ± 1.98	1.17 ± 2.07	1.37 ± 2.17
Own-Goal (%)	0.07 ± 0.37	0.00 ± 0.00	0.07 ± 0.37

†= significant difference across all groups ($p<0.05$), ^{a} = significant difference with U18 ($p<0.05$), ^{b} = significant difference with U16 ($p<0.05$).

Table 14. Shot outcome displayed as a percentage (mean ± SD) across age groups.

	Variable	First team	Under 18	Under 16
	On-Target (%)	37.80 ± 16.04	39.60 ± 15.41	44.63 ± 12.42
	Off-Target (%)	62.20 ± 16.04	60.40 ± 15.41	55.37 ± 12.42
On-Target	Scored (%)	31.17 ± 24.99	40.63 ± 26.58	35.57 ± 28.63
	Saved (%)	68.93 ± 25.04	59.41 ± 26.58	64.43 ± 28.63
Off-Target	Missed (%)	61.00 ± 21.75	63.63 ± 16.30	60.30 ± 20.32
	Blocked (%)	36.93 ± 20.60	33.70 ± 16.53	37.37 ± 19.53
	Post (%)	2.17 ± 4.82	2.70 ± 7.46	2.47 ± 6.12

†= significant difference across all groups ($p<0.05$), ^{a} = significant difference with U18 ($p<0.05$), ^{b} = significant difference with U16 ($p<0.05$).

Shooting location was seen to display differences across groups, however only in the B4 zone ($H_2=13.228, p<0.01$) of the pitch (as seen in Figure 6). In more detail, post-hoc tests identified that the Under 16s performed a significantly greater percentage of their shots from this zone compared to both First team ($z=-2.202, p=0.28$) and Under 18s ($z=-3.213, p<0.01$). In addition to this, it was noted that the First team performed fewer shots from zone 'B3' however post-hoc tests found it to be an insignificant difference ($z=-1.901, p=0.057$). No differences were found in the percentage of shots taken from either inside, or outside the penalty area ($H_2=2.908, p>0.05$).

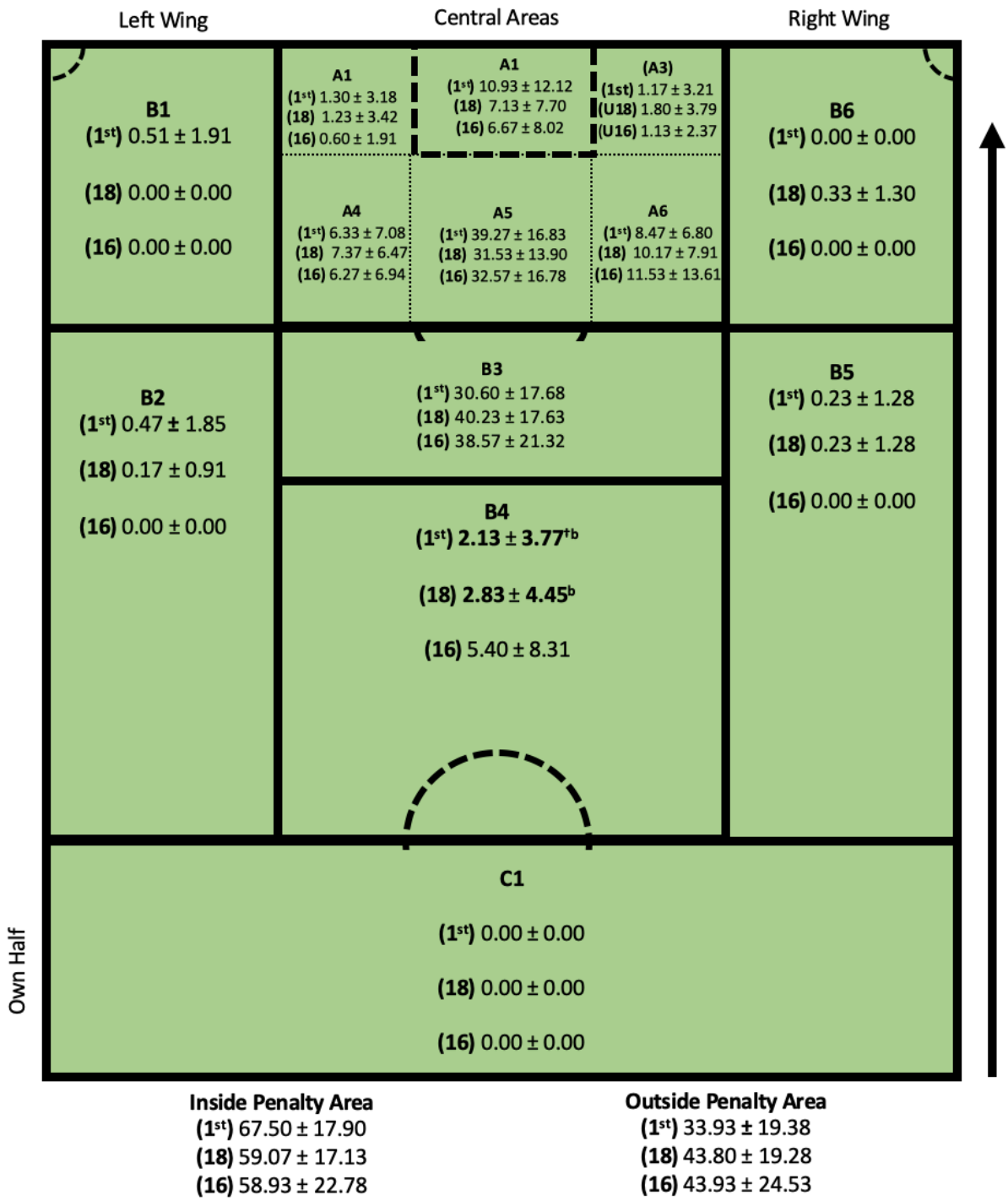


Figure 6. Shot location displayed as a percentage (mean ± SD) per zone across age groups, whereby †= significant difference across all groups (p<0.05), a = significant difference with U18 (p<0.05), b = significant difference with U16 (p<0.05)

5.6 Principle Component Analysis

Following the same process as Fernandez-Navarro et al. (2016), the Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the Principle Component Analysis, KMO = 0.334. In which, communalities of 0.6 or greater were observed in 20 of 21 variables and the Batlett's test of sphericity indicated that the correlations between indices were statistically significant for principle component analysis (X^2=3417.30, df=210, p<0.01). As seen in the scree plot (Figure 4) it can be seen that 7 components displayed eigenvalues of 1.0 or greater, accounting for 79.21% of the variance found within the dataset. The data was extracted and Varimax rotation was applied (O'Donoghue 2012), whereby it was seen that the initial component decreased in correlation size, while the remaining six increased. The relationship between the extracted rotated components and the original performance indicators can be seen in Table 15, where absolute correlations of 0.7 or greater were highlighted in order to assist interpretation of the PCs.

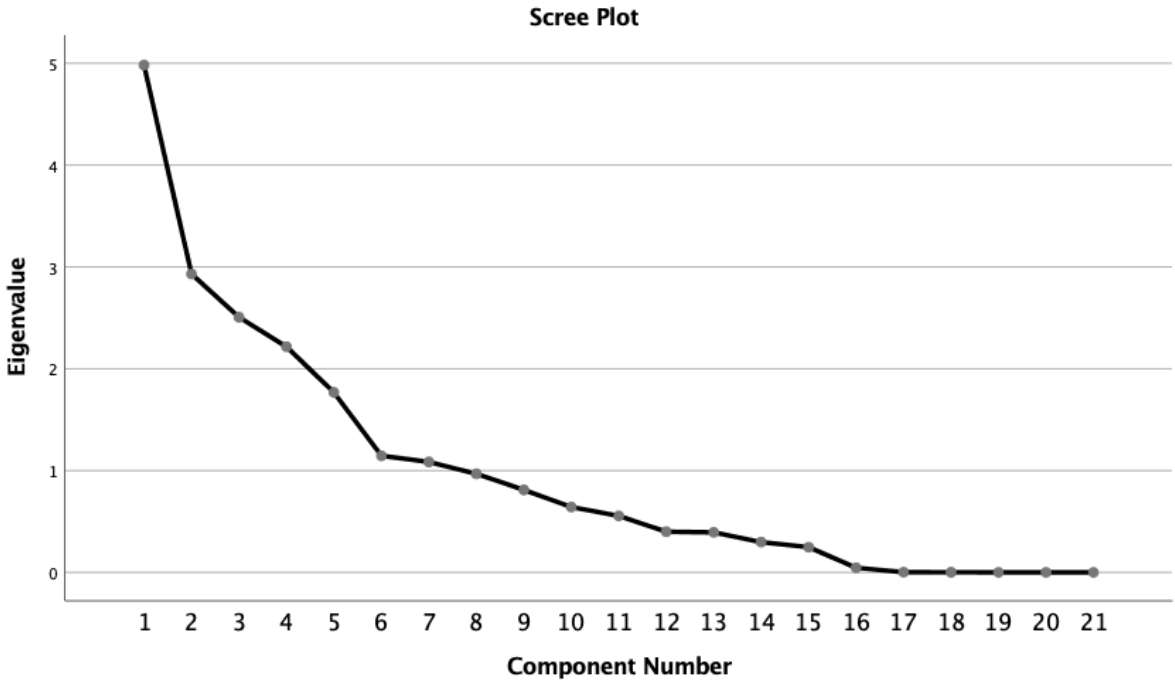


Figure 7. Scree plot displaying the Eigenvalues of each principal component.

Table 15. Rotated Component Matrix

Variables	Component						
	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Duration Percentage	**.894**	.091	-.030	.157	.199	.030	.028
Pass Percentage	**.880**	.087	-.060	.216	.123	-.003	.059
Build-Up (AZ)	**-.860**	.002	-.165	.069	-.250	.309	.127
Build-Up (MZ)	**.767**	.026	.061	.063	.077	.227	-.218
Build-Up (DMZ)	.676	-.112	.133	-.088	.438	.252	.097
Build-Up (Sideways)	.050	**-.957**	-.181	.083	-.051	-.010	.064
Build-Up (Backward Diagonal)	.182	**.767**	.039	.196	-.038	-.075	.113
Build-Up (Forward Diagonal)	-.052	**.727**	-.178	.001	-.301	-.059	-.131
Build-Up (Backward)	.041	.617	.012	.158	.380	.015	.245
Ball Recovery (Central)	.103	.002	**.965**	-.027	-.014	.013	-.059
Ball Recovery (Wide)	-.104	-.003	**-.964**	.027	.015	-.014	.058
Build-Up (Forward)	-.157	.139	.527	-.319	.311	.122	-.135
Build-Up (Central)	-.098	-.095	.074	**-.957**	.060	-.026	.055
Build-Up (Wide)	.097	.095	-.076	**.957**	-.063	.027	-.053
Ball Recovery (DZ)	.334	-.121	.023	-.132	**.726**	.089	-.075
Build-Up (DZ)	.281	.057	.010	-.042	**.725**	-.025	.168
Build-Up (AMZ)	.433	.026	.161	-.092	-.045	**-.750**	-.160
Ball Recovery (AMZ)	-.321	.068	-.138	-.083	-.420	-.680	-.031
Ball Recovery (DMZ)	.447	-.066	.216	-.124	-.186	.676	.067
Ball Recovery (MZ)	-.045	-.008	.067	.193	.049	-.028	**-.867**
Ball Recovery (AZ)	-.185	.057	-.107	.108	.187	.143	**.806**

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Bold demonstrates those within the Factor (PC). Grey shows other correlation values for completeness.

The description of each component was interpreted based on the combination of performance indicators, as carried out by Fernandez-Navarro (2016). Making up for 23.72% of variance, Component 1 (PC1) defines a team's possession type, with positive values representing an elaborate possession-based approach opposed to negative values that signify more direct attacks. Component 2 (PC2), describes the direction of a team's performance, accounting for 13.96% of variance, whereby lateral attacks are displayed by negative values and vertically-diagonal approaches are seen as positive. With 11.94% of variance, ball recovery width forms Component 3 (PC3). Central ball recoveries are reflected by positive scores, while wide regains are represented by negative. Component 4 (PC4) explains 10.56% of variance and describes the width of the build-up play, with wide possessions of play exhibiting positive values and narrow build-up displaying

negative values. Defensive build-up is defined by Component 5 (PC5), with 8.42% of variance, the variables are observed to correlate highly and consequently a team's positive values on this factor have an increased percentage possession being regained in the defensive zone and subsequent possession in this area. Penultimately, component 6 (PC6) displays reduced values for teams that perform actions in the attacking-midfield zone and can therefore be labelled as reduced attacking-midfield build-up. The final component reflects ball recovery pressure, whereby component 7 (PC7) exhibits negative scores for teams that recover possession in the midfield zone, with a higher press displayed by a positive score where balls are recovered in the attacking zone. These components account for 5.45% and 5.17% of variance respectively.

Using these components, visual representations of a team's playing style can be produced (Fernandez-Navarro et al. 2016). The location of each team's average match performance was plotted on an axis to describe the approach in relation each of the components. Figures 8 to 13 display the average attack of each age group in relation to possession type (PC1) and the remainder components. PC1 was plotted against the other factors as it explained the greatest variance (23.72%), with centroids and 95% confidence intervals implemented to display the differences in performance across each age group.

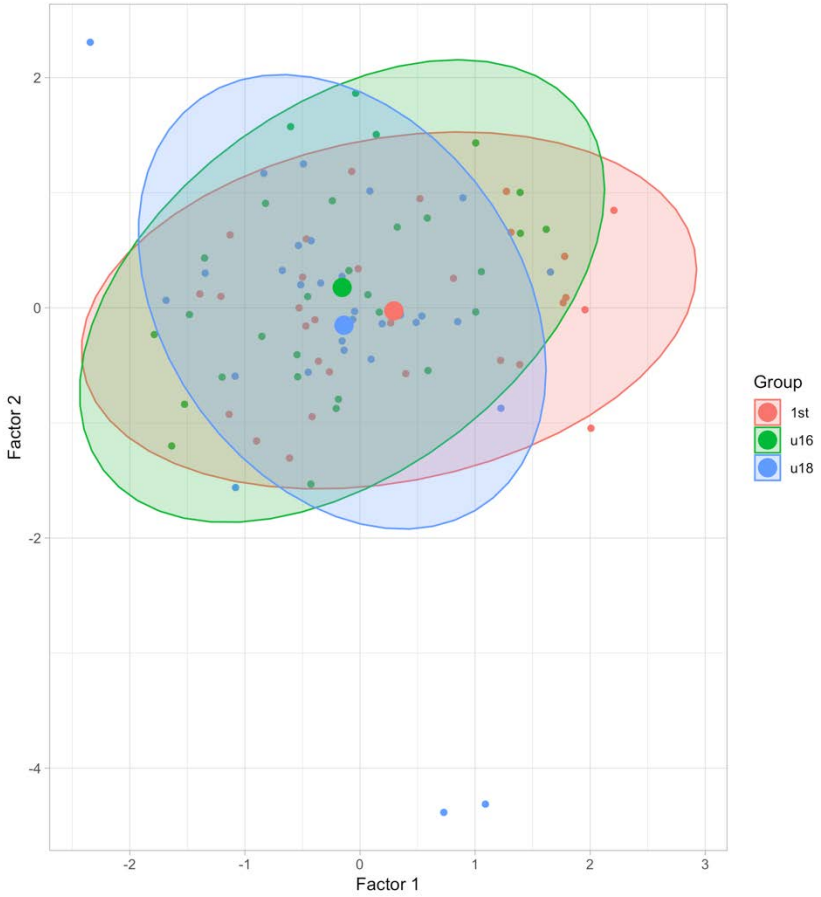


Figure 8. Style of play of different age groups of football teams according to Possession Type (PC1) and Direction of Attack (PC2).

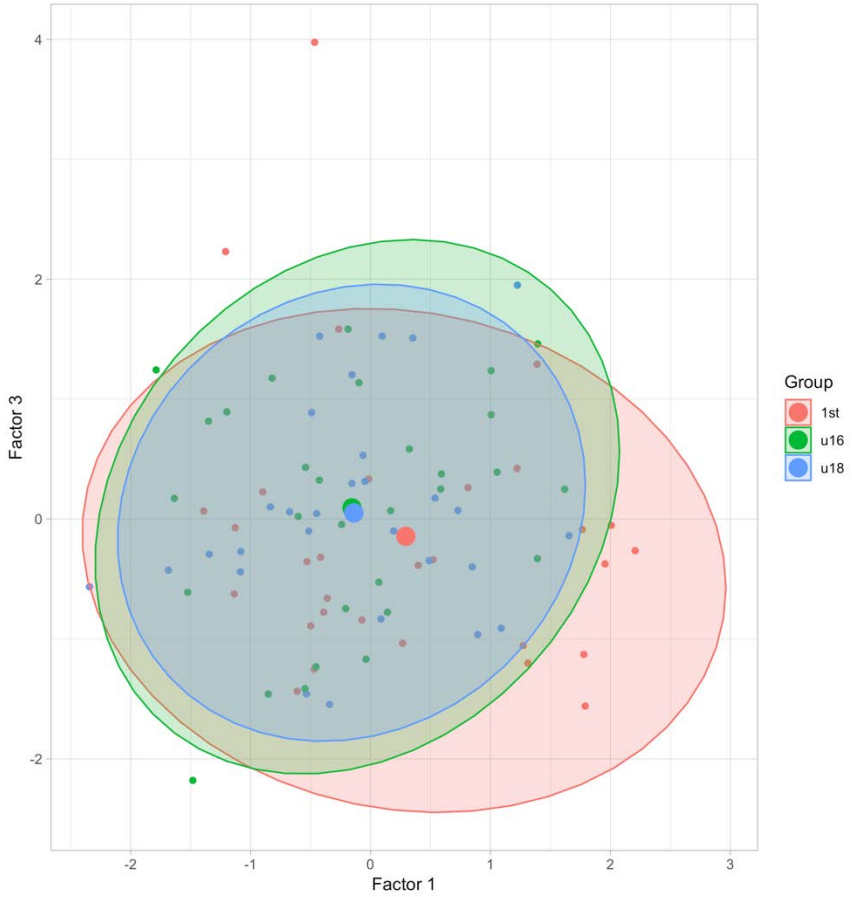


Figure 9. Style of play of different age groups of football teams according to Possession Type (PC1) and Ball Recovery Width (PC3).

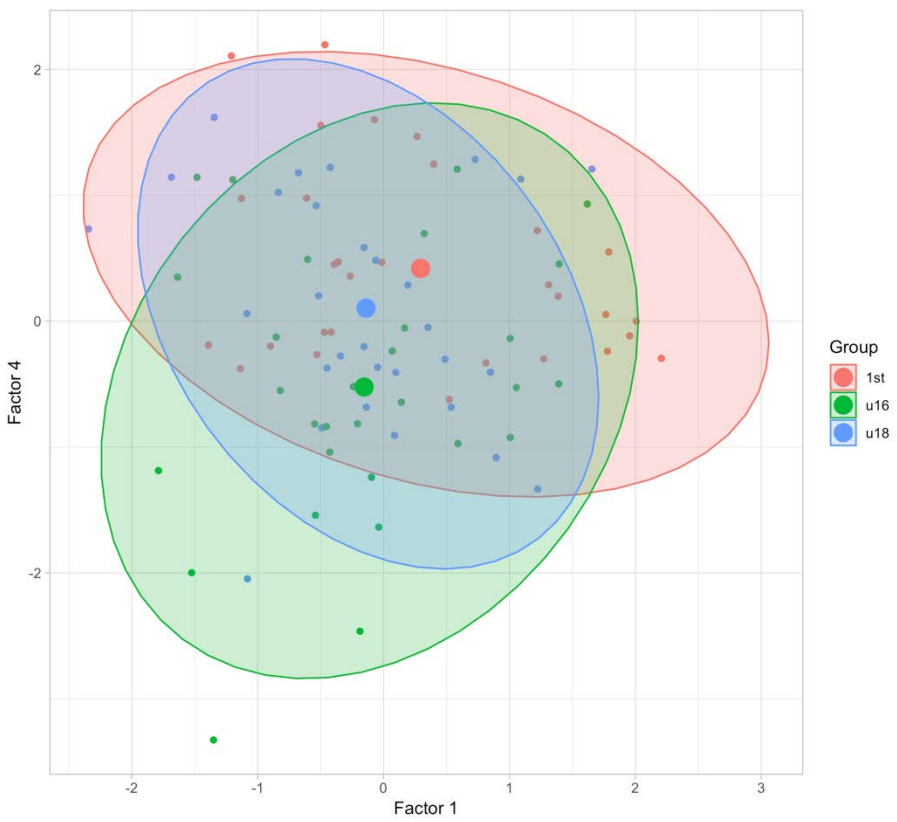


Figure 10. Style of play of different age groups of football teams according to Possession Type (PC1) and Build-Up Width (PC4).

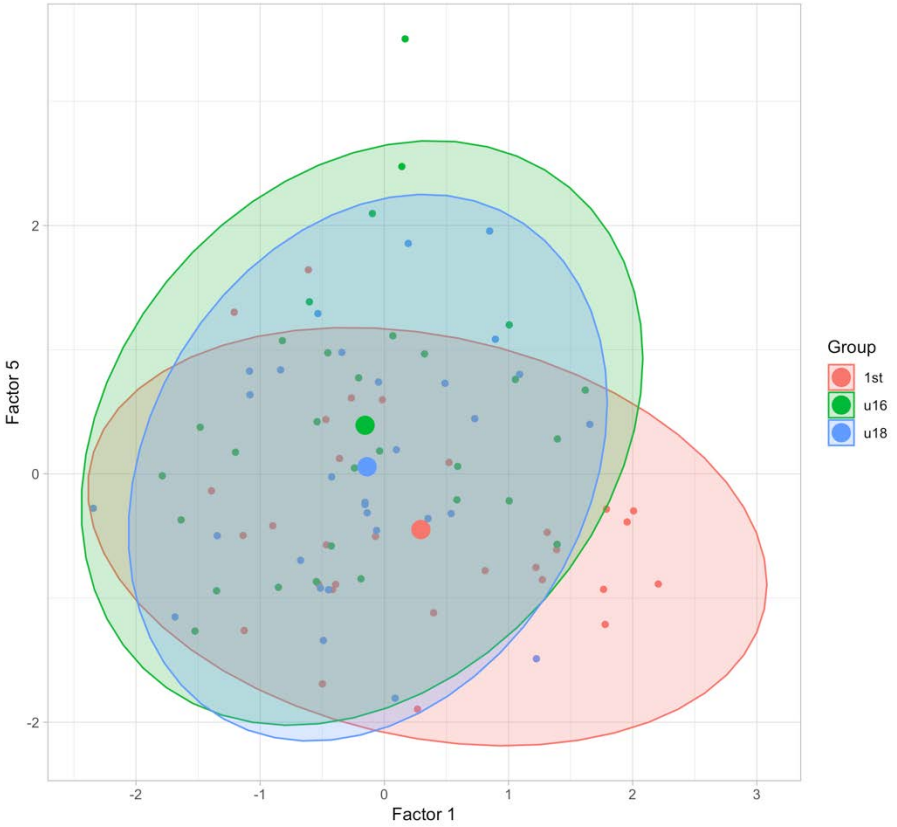


Figure 11. Style of play of different age groups of football teams according to Possession Type (PC1) and Defensive Build-up (PC5).

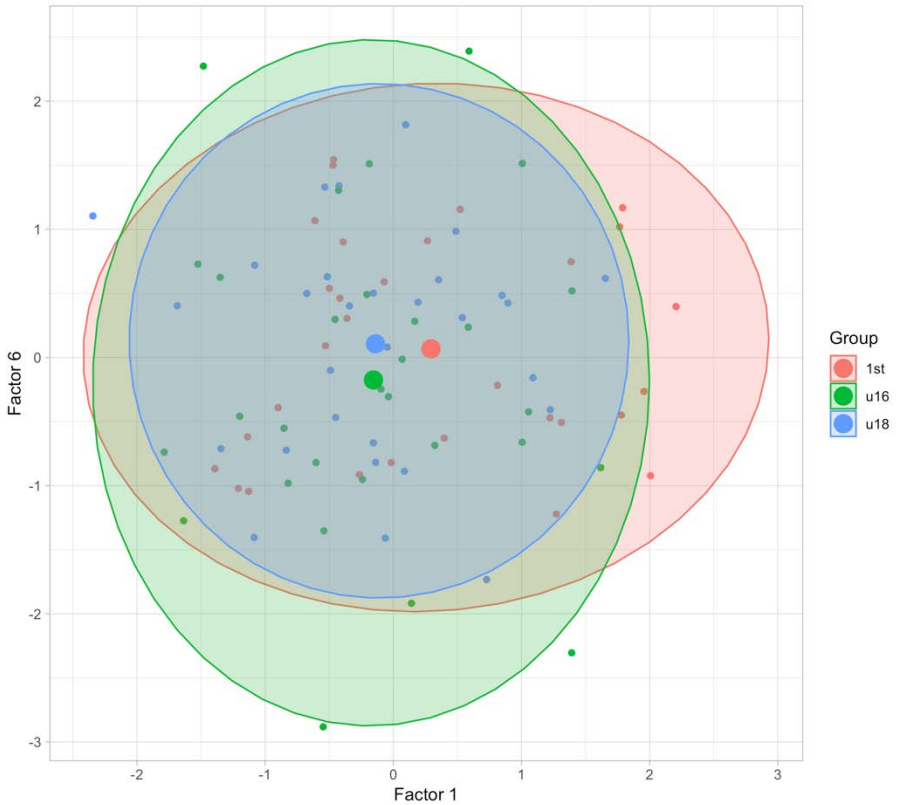


Figure 12. Style of play of different age groups of football teams according to Possession Type (PC1) and Attacking Build-up play (PC6).

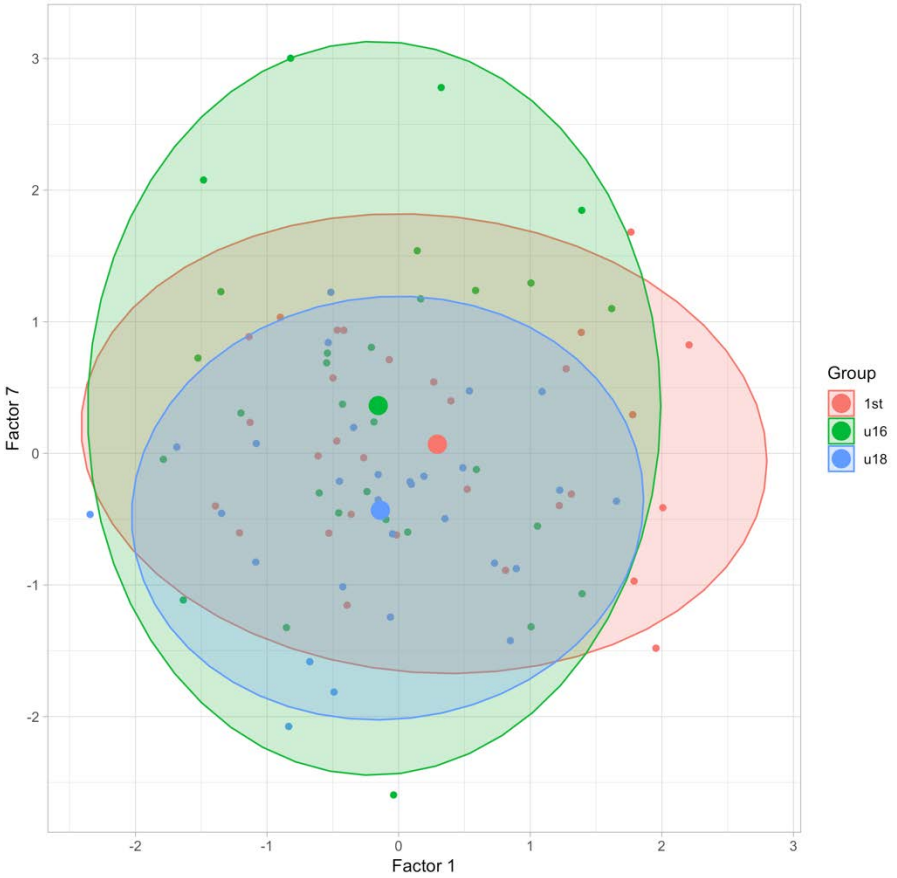


Figure 13. Style of play of different age groups of football teams according to Possession Type (PC1) and Defensive Pressure (PC7).

6.0 Discussion

6.1 Descriptive Statistics

The initial aim of this study was to identify the differences between several age groups at different stages of footballing development. Using a univariate approach, it was intended to isolate key performance indicators in order to establish their significance between teams. This was followed up using a multivariate methodology, in which related key performance indicators were catalogued into components of correlating variables that reflect aspects of a team's playing style. Ultimately allowing the differentiation between the three squads.

The initial findings from the descriptive statistics identified that First team performances exhibited significantly more possessions resulting in a final third entry (1,189), compared to the younger squads (Under 18 = 1138; Under 16 = 984). This equates to an average of 79.3 final third entries per match, compared to 75.7 and 65.6 per match for the Under 18s and Under 16s respectively. As a descriptive statistic, this provides an interesting foundation to build; with First team demonstrating an enhanced ability to create penetrating attacks that enter the opposition's defensive third. This supports previous research, in which Sevil Serrano et al. (2017) reported that decision-making and successful execution of both passing and dribbling actions are observed to increase progressively with age. In continuation of this, the reduced number of analysed attacks for the Under 16s could signify an inept ability to maintain or create possessions that penetrate into the final third.

With this in mind, a study by Bradley et al. (2013) examined the physical and technical profiles of English Premier League teams depending on the team's ball possession percentage. The study found that high-possession based teams, with possession ranging from 51-66%, displayed a significantly greater number of final third entries per player (6.2 ± 3.8) than those categorised into low-possession teams (5.6 ± 3.5). In this case, the initial findings of the present study could indicate the use of a high-possession based playing style by the First team, while the younger teams were more likely to utilise a low-possession style of play. Although, as previously noted, ball-possession provides a descriptive overview of performance and given the highly complex

nature of football, other factors should be examined to enhance the understanding of a team's patterns of play (Machado et al. 2014).

6.2 Build-Up Play

6.2.1 Duration of Attack

The speed of an attack is believed to be an important element of a team's playing style, facilitating either a quick transition from defence into attack, or a slower and more patient approach in which players try to manipulate space in order to expose defences. The current study however, did not find any significant differences between age groups. This is surprising given that Shafizadeh et al. (2014) reported that the time taken to transition from attack into defence, and vice versa, is discriminating variable between Youth and Senior teams. On average, the First team exhibited slower attacks (15.25 seconds $\pm$ 4.09), which was closely followed by the Under 18s and Under 16s (14.06 seconds $\pm$ 2.64, 14.38 seconds $\pm$ 4.30 respectively).

Previous literature states that longer durations of attack have been associated with successful teams. For example, Tenga and Sigmundstad (2017) observed that the top three teams in the Norwegian top league displayed significantly more attacks that lasted 12 seconds or more (19.2 ± 5.9). This was also seen to be a distinguishing factor that differentiated the bottom three teams and those in between the two limits; where bottom teams displayed attacks lasting 10.8 seconds (± 3.7), while the in-between teams executed 15.0 seconds (± 3.8). Jones et al. (2004) proposes that this is accounted for by the ability to avoid tackles, complete harder passes and anticipate both player and ball movements.

In relation to the differences between ages, Ortega et al. (2006a) reported that Under 16s Basketball players displayed a higher tempo when in possession of the ball, compared to their older counterparts, Under 18s and First team. In addition to this, Smith et al. (2013) reported 39% of Under 16s goal-scoring attacks were a product of an offensive sequence lasting 12 seconds or more, while Under 18s and First team performed 32% and 31.2% respectively. Unlike the current research study, Smith et al. (2013) utilised a case study methodology, utilising performance data extracted from ages across one club. When compared with the present study, results are conflicting and this may be due to the limited scope of the Smith et al. (2013) study. By solely

focusing on one team, it is not representative of the overall population of academy teams at these ages. Contradictory to both Smith et al. (2013) and Ortega et al. (2006a), the present study did not identify differences between ages in duration of attack, and could therefore suggest that the teams utilised a similar tempo in their attacks in order to displace and exploit the opposition's defensive frailties. Alternatively, it could explain the make-up of the attack, which is the important aspect, and that the time it takes to attack is a fairly standard duration perhaps linked to cognition processing times and awareness of situations within the game.

6.2.3 Number of Actions

The number of actions has been identified to reflect a team's playing style with a greater number of actions replicating a possession-based style of play (Lago & Dellal 2010). The current findings revealed that the number of actions in the build-up to a final third entry were not significantly different across the three groups (p=0.058). It was however found that there was a considerable difference between two of the teams. Specifically, the First team were seen to execute a significantly greater number of actions in the build-up to an attack, compared to the Under 18s (5.53 ± 1.57 vs 4.57 ± 1.17 respectively). As highlighted by Smith et al. (2013), by accounting for all actions, opposed to isolating just passes, the analysis process is able to accurately reflect offensive sequences and prevents the distortion of shorter build-up sequences. Smith and co-workers also documented that the frequency of actions for both First team and the Under 16s were significantly greater when compared with the Under 18s. Similar to this study, it suggests that First team have an enhanced ability and mastery of the ball, allowing them to maintain attacks. This could be expected after Teoldo da Costa et al. (2010) identified that U20's, of whom are likely to transfer into the First team, displayed a significant superiority in regards to the efficiency of their actions. In which, the biggest difference was observed in the quantified tactical performance indices between the U17's and U20's group.

This difference in the number of actions between age groups, can be seen in more detail when categorised into the individual actions including passes, crosses and dribbles. In line with the findings of Sevil Serrano et al. (2017), each were found to be statistically significant when compared across the age groups. Specifically, it was found that the First teams produced significantly more passes, displaying an average of 4.03 ± 1.45 passes per attack; compared to the Under 18s who produced 3.10 ± 0.96 and Under 16s who achieved 3.17 ± 1.21 per final third

entry. In line with aforementioned literature, the number of passes performed by each team during an offensive sequence gives an insight into their playing style. Widely recognised by academics and professionals, a higher frequency of passes, is considered to reflecting a possession-based patterns of play (Lago & Dellal 2010), while conversely, fewer passes are representative of a more direct method of attack (Tenga & Larsen 2003). In this respect, it can be noted that the First team used a more possession-based approach when in the offensive phase compared to both the Under 18s and Under 16s.

The number of dribbles supports this notion, with the Under 16s performing significantly more dribbles (1.27 ± 0.45) than both the First team and Under 18s (1.00 ± 0.26, 1.03 ± 0.18 respectively). This suggests that the Under 16s have a more direct and individualised approach, with players encouraged to master the ball and encounter 1v1 situations. This was observed by Ortega et al. (2006) within Basketball, in which it was noted that younger players are more reliant on individual actions, opposed to team-play. This would a line with the findings of (Smith et al. 2013), whom found the Under 16 age group performed a higher frequency of dribble assists (37.5%) than old age groups (First team = 21.1%, Under 18 = 28.4%). It should be noted that the English Football Association (The FA 2019b) encourage Youth coaches, especially those coaching age ranges between Under 13 through to Under 16, to prioritise ball mastery and creativity when on the ball. This could partially explain the increased number of dribbles at this age; accompanied by the increase demand for positive results at First team and Under 18 levels. By creating a pressurised environment, players may perform safer actions in order to minimalize mistakes. Other studies have not noted the use of dribbles at a Youth level, although Bradley (et al. 2013) documented that lower possession teams performed a fewer dribbles than higher-possession teams (0.3 ± 0.8, 0.5 ± 1.2 respectively). In this case, the number of dribbles suggests that the Under 16s utilized patterns of play similar to high-possession based teams, which is contradictory to the proposed playing style based on a team's number of actions and passes. It could therefore be suggested that the Under 16s compensated for their lack of passes by using more dribbles in order to maintain possession and exploit space, which may be influenced by the principles of coaching at this age group.

As for the number of crosses, it was identified that there was a significant difference across the groups, with the First team displaying significantly more crosses (0.90 ± 0.31) per attack than both Under 18s (0.50 ± 0.52) and Under 16s (0.37 ± 0.49). Crosses are judged to be an important

tactical approach used by teams to penetrate defensive blocks where it has been identified to reflect a team's ability to use wide spaces in order to generate an attack (Hughes 1980; Pulling et al. 2018). In a study by Pulling et al. (2018) it was observed that teams during the 2014 World Cup performed a total of 1332 crosses where 3.2% resulted in a goal. The location of crosses were seen to be predominantly from wing positions with over 78% of crosses originating from this channel. Supporting previous coaching literature, that crosses mirror a team's ability to utilise the spaces found in wide positions. Similar to Smith et al. (2013), First team were able to score 42.2% of goals from a crossed assist, with 42.7% of all assists originating from wide positions. The findings from the present study can therefore be suggested to display the First team's use of the wide channels. Applying a more tactically aware approach, by adding variation into their attacks and using an elaborate build-up accompanied with a more direct approach once wide by using crosses in an attempt to disrupt the defensive line (Lapresa et al. 2018).

6.2.3 Build-Up Location

The notion that increased possession in wide areas is representative of a more successful and tactically aware team is supported by James et al. (2002), of whom found wing usage to be at 39.7% for an elite English 2001/2002 team that competed in the UEFA Champions League that same season. With this in mind, the percentage of actions in the defensive and wide zones were the only areas in which statistical differences were observed. The defensive zone saw significantly more actions performed by the Under 16s (1.40% ± 1.40) compared to the First team (0.50% ± 0.51). As suggested above by the number of crosses, it was also observed that the First team utilised the wide channels significantly more (30.10% ± 4.06) than the Under 16s (24.20% ± 5.73), while Under 18s were also seen to utilise wide zones more (27.77% ± 4.65) compared to the Under 16s too. Interestingly, Folgado et al. (2014) identified that in small sided games, younger players are more reliant on using the length of the space available and resultingly neglect the width of the pitch. Olthof et al. (2015) reinforces these findings, in which the lateral dispersion of players in an Under 19 age group displayed significantly higher scores (5.24 ± 0.08) than the Under 17 age group (5.03 ± 0.07). These studies are coherent with the present findings, in which significantly more possession was observed in the defensive zone and considerably less possession in the wide areas. This could be as a result of the physical, technical and psychological ability of the players, with old players further developed than those at younger ages and therefore have an increased capability to recognise and exploit these positions (Olthof et al. 2015).

6.2.4 Build-Up Direction

The direction of build-up actions has been identified to display a team's ability of penetration and their directness of attack. The study incorporated diagonal passes with the intention of enhancing the insight provided by the data, with the majority of prior research using either just forward (Smith et al. 2013), or backward, forward and sideways variables (Fernandez-Navarro et al. 2016). Results display that Under 16s performed statistically more backward and forward actions (9.03% ± 3.49, 27.30% ± 7.42 respectively) than the First team (6.73% ± 2.46, 23.13% ± 5.28 respectively), while First team executed more forward diagonal actions (28.40% ± 5.86) than the Under 16s (25.17% ± 7.62). As previously mentioned, both Folgado et al. (2014) and Olthof et al. (2015) identified that younger players have a higher value towards utilising the length of the pitch, when compared with the utilisation of the width. These increased percentages in forward and backward actions for Under 16s could be representative of this same concept, with actions being in a vertical direction rather than lateral and vertical. Comparably, Smith et al. (2013) reported that 58.8% of First team attacks utilised at least 75% of forward action. This was observed to be statistically less than both Under 18 and Under 16 age groups who demonstrated 74.7% and 73.7% respectively. The similar results between the current study and Smith et al. (2013) reinforces the notion that younger teams have inferior perceptual abilities and decision-making qualities that limit their capacity to utilise alternative options and neglect the use of lateral actions, while First team use a varied approach in which practises both vertical and lateral actions.

6.3 Ball Recovery

6.3.1 Ball Recovery Action

Regaining possession of the ball is just as important as maintaining it (Almeida et al. 2014) and as a result, ball recoveries have been used to decipher a team's defensive approach. The study found that Under 16s performed statistically more regains through the action of a tackle (16.37% ± 10.09) compared to both Under 18s (11.47% ± 7.13) and First team (9.90% ± 5.39). While the First team were able to obtain possession via loose balls (20.87 ± 6.42) more readily than the Under 16s (14.97 ±7.45). To date, literature has not looked at the different ball recovery methods used across age groups, however the findings do display that open-play regains are more frequent than those

from set-pieces at all ages (First team=37.23% ± 8.55, U18=38.47% ± 8.37, U16=36.13% ±11.83), similar to Barreira et al. (2013) who reported 77.3% of recoveries to occur via open-play versus 22.3% through set-pieces. The increased use of tackles by the Under 16s correlates to the findings found regarding the number of dribbles. With a higher dependency on individual actions such as dribbling, the number of 1v1 situations is likely to increase the number of tackles performed. While older age groups limit their reliance on individual actions, the percentage of loose ball regains are seen to increase at each age. Loose balls are defined to be when the ball in not contested or is played directly to the player regaining the ball. As a consequence, it can be suggested that loose balls are a result of superior defensive positioning by First teams, when compared to the Under 16s. This is coherent with the findings of Almeida et al. (2016) of whom identified that as players increase in age, teams evolve structurally to flattened shapes, opposed to the elongated shapes displayed at younger ages.

6.3.2 Ball Recovery Location

The location of ball recovery has been well documented to reflect the pressure applied by a team (Fernandez-Navarro et al. 2016). Results found that Under 18s displayed a significantly greater percentage of ball recoveries in the midfield zone (23.17% ± 6.74) compared to the First team (17.93% ± 6.90) and Under 16s (16.67% ± 9.44). This difference, although found to be statistically insignificant (*p=0.058, p=0.077*), can be seen to be accounted for by the increase rate of ball recoveries made in the attacking zone. In which, Under 16s performed 28.63% (± 1.69) of ball recoveries, followed by First team with 26.30% (± 6.25) and Under 18s with 23.27% (± 7.80). These findings indicate the different defensive styles used to regain possession, with First team and Under 16s utilising a higher press, whereas Under 18s use a defensive block that is likely to engage at the halfway line. The Under 18s ball recoveries can be explained by the competitive nature of the league, with performances being results orientated and therefore more likely to utilise a deeper block in order to reduce space for opposition to exploit and limit oppositions ability to penetrate. Whereas Under 16s displayed an aggressive approach, which is in line with Partridge et al. (1993) of whom suggests that younger teams use an aggressive approach when out of possession, specifically stating that younger players did not tend to fall back into their own half in order to defend. This is clearly represented by the findings of the Under 16s with the highest percentage of attacking zone regains, while results from the Under 18s is significantly greater in the midfield zone. Similarly, to the Under 16s, the First team were likely to have exhibited a higher

press than the Under 18s in an attempt to take advantage of the notion that ball regains higher up the pitch are more likely to result in a goal (Tenga et al. 2010a).

6.3 Assist Actions

6.3.1 Assist Method

The penultimate action leading up to a shot at goal is a valuable variable that enables the differentiation of how goals are scored. The current study identified that there were significant differences in both crossing and dribbling assist actions. In consistency with previously mentioned findings, Under 16s (26.04% ± 33.22) and Under 18s (18.67% ± 29.84) performed statistically more self-assisted goals via the use of dribbling with the ball. While First team achieve significantly less dribbled assists (4.35% ± 14.41), they accounted for the difference by achieving significantly more crossed assists (40.57% ± 35.03) than both Under 18s (19.07% ± 33.16) and Under 16s (16.79% ± 29.32). These findings are extremely similar to the findings of Smith et al. (2013), who reported that the First team age group achieved 42.2% of goals via crosses, with Under 18s achieving 16.4% and Under 16s 20.8%. This vast disparity in goal scoring methods suggests that First team are more likely to use a team-play approach when attacking, utilising a combination of passing and crossing to interlink and score a goal. This is highlighted by the staggering 72.83% of goals scored by either a pass and cross, meanwhile Under 18s completed 55.66%, and Under 16s obtaining 61.41% of goals via combining with team mates in the penultimate action. These findings are consistent with Carling et al.'s (2006) proposal, stating that the majority of goals are scored through passing or crossing. While also reinforcing previously mentioned Ortega et al. (2006b), in which it was reported that younger players are reliant on individual actions such as dribbling opposed to the team approach of passing and crossing.

6.3.2 Assist Location

As for the location of assists made by each team, there were only seen to be significant differences in the central zone outside of the penalty area, labelled 'B3'. This zone displayed the First team to assist significantly fewer goals (23.87% ± 14.41) compared to the Under 16s (33.47% ±18.76). It can also be seen that this area shows the First team to perform fewer assists from this location compared to the Under 18s (24.90% ± 12.64) however, not statistically significant (*p=0.054*). In

addition, differences can be seen between First team (0.90% ± 2.78) and both Youth squads (Under 18 = 2.97% ± 4.87, Under 16 = 2.90% ± 0.12) in the percentage of assists from their own half, suggesting a possible tendency to use long balls to score, however again it was found to be statistically insignificant (*p>0.05*). Finally, once grouped into wide (left and right wings) and central zones, it was found to be a substantial difference across groups. In more detail, Senior teams produced 42.41% (± 44.47) of assists from wide areas, while Under 18s and Under 16s achieved far more from central positions, with wide assist percentages of 22.92% (± 36.05) and 9.38% (± 23.19) respectively. The Under 16 results reflect similar to that found by Smith et al. (2013), whereby it was recorded that 57.8% of goals were assisted from positions central. The present study found that Under 16s achieved 48.84% of goals from central areas outside the box (zones B3 and B4). This was not the case with First team, as 42.41% (± 44.47) assists coming from wide positions. This supports the previously mentioned findings, regarding assist action, with First team utilising wide areas more frequently in order to cross the ball. 38.14% of the First team chances were from central areas outside the penalty area further reinforcing the notion that they used a varied approach in order to penetrate the oppositions defensive line. Furthermore, with the assist method in mind, the findings of the current study are concurrent with Ortega et al. (2006b) and Olthof et al. (2015), whereby it can be suggested that as players age, their physical, technical and psychological abilities improve, and their aptitude for utilising team mates becomes a priority in which their tactical and spatial awareness are superior.

6.4 Possession Outcomes & Shooting Opportunities

6.4.1 Possession Outcome

The outcome of an attack has not been reported in performance analysis literature as the majority of studies focus solely on goal scoring opportunities. The present study established criteria that observed incidents resulted in a final third entry, with the intention of obtaining a comprehensive insight into a team's playing style throughout a match rather than isolating sequences leading up to a goal. The results found that First team's attacks were more frequently interrupted by the opposition (67.36% ± 6.06) than the Under 18s (62.03% ± 9.70) and Under 16s (58.97% ± 12.34). As a result, significantly more shooting opportunities were created by the Under 16s and Under 18s, with a shooting percentage of 39.63% (± 12.11) and 36.80% (± 9.46) respectively, while First teams managed to create a shooting opportunity in 31.24% (± 5.88) of their final third entries. This

can be explained by the defensive abilities of the age groups, with younger ages displaying a less structured defensive block and inferior tactical awareness to older ages (Folgado et al. 2014; Olthof et al. 2015). Following a video-based test and post-match analysis where components of performance, decision making and skill execution were examined. Blomqvist et al. (2005) reported that Youth players exhibit a better understanding and performance of the game when in the offensive phase of the game, rather than the defensive phase. This can therefore justify the increased number of shots created as the ages decrease. In addition to this, Under 16s are not exposed to a results orientated environment compared to older age groups, this therefore may encourage players to take shots from unlikely positions.

6.4.2 Shot Outcome

Interestingly, the outcome of shots at goal were not seen to display any statistical differences across the groups. Although insignificant, shooting accuracy was seen to decrease with age. It was observed that First teams achieved the lowest percentage of on-target shots with 37.80% (± 16.04), with Under 18s managing to score 39.60% (± 15.41) and Under 16s leading the way with 44.63% (± 12.42). This is contradictory to the expected outcome, given that technical ability is seen to improve with age (Teoldo da Costa et al. 2010). Thus forth, it would be expected that the percentage of shots on-target would rise, as the age increases. Initially, it was be predicted that Senior teams would achieve a higher percentage of shots that resulted on-target, especially given the superior skill level and experience (Partridge et al. 1993). Despite this, Sevil Serrano et al. (2017) noted that older age groups, specifically Under 19s in this case, displayed a higher decision-making ability and successful execution of said actions. Therefore, it could be suggested that the improved skill level of First team players is counteracted by the enhanced defensive capacity of their opposition (Folgado et al. 2014; Olthof et al. 2015), in which restricts the opportunities for Senior teams to generate a shot at goal. Given that it has been identified that decision-making and successful execution of shooting opportunities gradually decreased with age (Sevil Serrano et al. 2017), it is comparable with Blomqvist et al. (2005) who reports that younger players have a better understanding of offensive responsibilities than the defensive aspects of performance. This is consistent with the present findings in which older ages are exposed to greater defensive pressure (Blomqvist et al. 2005) and in turn reduces the time available to make decisions, ultimately inhibiting the execution of shooting performance.

6.4.3 Shot Location

The location of shots were not found to be significant across the majority of zones. This was also identified when shots were categorised into either 'inside' or 'outside' of the penalty area. It was however observed that shots taken from inside the penalty area were more frequent, with 67.50%, 59.07% and 58.93% of shots taken from within this zone (First team, Under 18, Under 16 respectively). Between groups, there was one zone that was seen to show statistically significant disparities. This zone was located centrally following the entry into the opposition's half, 'B4' on Figure 6. It was discovered that both the First team (2.13% $\pm$ 3.77) and Under 18s (2.83% $\pm$ 4.45) performed fewer shots from the 'B4' zone than the Under 16s (5.40% $\pm$ 8.31). The results suggest that Under 16s are more likely to shoot from further out, which may exemplify their decision-making by performing shots from unlikely or distant positions opposed to generating opportunities closer to goal. It has been documented that successful teams achieve the majority of their goals from shots taken inside the penalty area (Clemente 2012) and in a study by Dufour (1993) it was reported that shots from 30 meters or more have a scoring rate of almost 0%, opposed to closer range shots the achieve a scoring rate of 10% and 15% when executed from 16.5 meters and 5.5 meters respectively. Ultimately, shot location between teams does not significantly differ across most zones, with long distance shots potentially displaying Under 16s direct approach to scoring goals.

6.5 Principle Component Analysis

The multivariate data analysis approach known as Principle Component Analysis (PCA) is a method of reducing data in order to identify the dimensions of a set of performance indicators where those that are correlate, are grouped together (Manly 2005). Fernandez-Navarro et al. (2016) used this technique as an exploratory method into defining different styles of play. Observing seven principle components with eigenvalues of 1.0 or greater, of which explained for twelve different styles of play. The study provides an interesting insight into the playing styles of teams at the top level, specifically in the English Premier League and Spanish La Liga, however by using scale values ranging as both a percentage and frequency the analysis process using PCA is easily dominated by the larger values (Abdi and Williams 2010). For example, Fernandez-Navarro et al. (2016) used a scoring system in order to interpret the direction of passes; in which. 1 point was given to backwards passes, 2 for sideways and 3 points for forward and the mean value was calculated

from the passes. This indicates that scores would range anywhere between 1.0 and 3.0. In the same dataset inputted into PCA, percentages were used where values would lie within the range of either 0.0 and 1.0, or 0.0 and 100.0. The use of varying scales can lead to larger values dominating the data and consequently biasing the data (Abdi and Williams 2010), therefore it should be noted that all variables are in the same format to prevent this limitation of PCA.

The present study used similar variables as Fernandez-Navarro and et al. (2016) in the PCA process with the intention of comparing age groups across similar aspects of performance. Identifying 7 principle components, comprised of 5 offensive and 2 defensive factors of performance. Comparably, the initial component (PC1) that is responsible for the highest percentage of variance (23.72%), was reported to describe possession type. Previous literature has identified possession type to be an influencing factor on performance (Michailidis et al. 2018), with 'elaborate' and 'direct' styles being well documented in relation to the frequency of passes prior to a goal (Bate 1988; Hughes and Franks 2005; Tenga et al. 2010a; Tenga et al. 2010b) or percentage of time on the ball (Bloomfield et al. 2005; Lago-Ballesteros and Lago-Penas 2010; Castellano et al. 2012; Collet 2013).

Based on previous research, elaborate playing styles tends to exhibit higher duration times and an increased number of passes and therefore PC1 can be used to describe possession type. Correlating positively with performance indicators such as; duration percentage, pass percentage and build-up play in both the midfield zone and defensive-midfield zone, while negatively associating with build-up play in the attacking zone. PC1 can therefore be employed to identify a team's performances based on this metric; in which higher score on this factor display elaborate patterns of play, while negative values signify a direct approach. With this in mind, the centroids found on Figure 8 display the overarching playing styles of each age group in regards to PC1 across the x-axis, from which it can be addressed that First team performances tend to utilise an elaborate approach. Attacks are therefore observed to utilise an enhanced number of passes and longer periods of offensive pressure, reinforcing previous findings at a univariate level (Table 6). Similarly, it can be expected that First teams utilised less condensed areas of the pitch (midfield zone and defensive-midfield zone) in order to draw out defensive players. Meanwhile, the negative value of possession in the attacking zone suggests that First teams are less likely to use build-up play in the final fifth of the pitch which could be associated with direct patterns of play. The younger teams on the other hand, displayed similar performances to one another in regards

to possession type (PC1). This is representative of a more direct playing style, where build-up play is limited in terms of passing frequency and attack duration; supplemented by the preferred use of the ball in offensive areas of the pitch. Similar results between the two ages were found at a univariate level, in which all performance indicators incorporated into PC1 are almost identical.

Explaining 13.96% of the variance in the dataset, the y-axis of Figure 8 displays the usage of lateral passes (PC2); specifically presenting negative scores to exhibit a prominence towards lateral passes (sideways), compared to diagonally-vertical passes (forward-diagonal and backward-diagonal) that are represented by positive values. Both of ends of this scale, between square and diagonal passes have been identified to be determinants of success in the sport of indoor hockey (Hasnor et al. 2018). However, literature on these variables in football is restricted, with Moyls (1990) identifying that diagonal passes are an effective method of attack when utilising offensive sequences longer than 2 passes (Moyls 1990), in contrast to vertical downfield passes. This can be explained by the sideways movement of the ball into wide areas, maximising the utilisation of space by the offensive team while simultaneously causing the defensive team to reposition themselves in relation to the ball, potentially creating space for attackers and causing errors defensively. In more detail, PC2 displays a small difference between teams, with First team and Under 18 both employing a slightly more horizontal approach, while Under 16s were seen to perform more slanted passes utilising a vertical element to their attacks. This is coherent with aforementioned studies such as Folgado et al. (2014) and Olthof et al. (2015), where it was documented that younger players tend to have a more direct approach and their actions in the direction of the opposition's goal are found to be more favourable.

Principle component 3 (PC3) defines a team's playing styles in terms of width of ball recoveries and accounts for 11.94% of variance. The variables linked with this component of performance are central and wide regains of possession. Positive values are connected to the former and negative values to the latter. This aspect of a team's playing style had not been documented in previous research, until Fernandez-Navarro et al. (2016) identified that these variables are distinguishable factors between teams. It has been proposed by Wright et al. (2011) that ball recoveries from central areas, initiated by pressure from two or three attackers may provide a greater chance of establishing a counter-attack. Similarly, Barreira et al. (2013) identified that ball recoveries from the central areas of the defensive-midfield zone were directly associated with improved offensive efficacy. Interestingly, differences between age groups within the current study were not seen to

be massively different (Figure 9); reinforcing findings at a univariate level where First team, Under 18s and Under 16s are all observed to display similar characteristics (Table 10). In line with previous research, the current study exhibits the average performance at a Youth level to be describes as a more direct strategy, pursuing the ball in central areas in order to turnover possession. Alternatively, First team performances tended to utilise a slightly wider percentage of ball recoveries. This small difference could be justified by the improved tactical awareness of Senior players (Teoldo da Costa et al. 2010; Sevil Serrano et al. 2017), forcing players into wide areas by condensing central areas and resultingly reducing the passing options of opposition players (Smith et al. 2013). Although, the differences between ages are minimal and are closely positioned to the intersecting line (0) suggesting teams do not prioritise the width that the ball is recovered.

Following on from this, principle component 4 (PC4) displays the percentage of build-up possession in wide or central areas. With 10.56% of the variance, PC4 illustrates wide build-up play with positive values, characterising central build-up play as negative values. Width of possession has been described as a distinctive feature of performance at the elite level (James et al. 2002; Wright et al. 2011), with the likes of Hughes and Franks (2004) highlighting the significance of strategies that exploit these positions. Lapresa et al. (2018) supports this notion, where it was identified that the frequent use of wide positions is utilised to expand the area of play, allowing the offensive team to penetrate in a forward direction in the aim of piercing the last line of defence. Figure 10reveals an interesting development of increased usage of width (PC4) parallel to the increase in age and possession type (PC1), where a large void can be seen between the Under 16s and both the Under 18s and First team. The negative value appointed to Under 16 performances is representative of their narrow build-up play, which again reinforcing univariate findings (Table 8). While Under 18s demonstrate an almost neutral score suggesting their build-up play varies between the two strategies of attack; and finally, First team performances were seen to use predominantly more wing play creating space and stretching defensive blocks. These findings correspond with the aforementioned study by Teolado da Costa (2010), in which it stated that older teams have a reliance on the maximising of playing space, utilising wings more readily than their younger. Contradictory to these findings, it should be noted that La Liga's FC Barcelona have been reported to perform similar characteristic of play across ages groups, with Lapressa et al. (2018) recording the use of lateral corridors when building attacking sequences at Youth level, similar to finds at a Senior level of the club (Camerino et al. 2012). This may however be as a result

of utilising a case study approach, focusing on a single team, whereas the present study provides an inclusive dataset that displays the playing styles of age groups as a whole.

Defensive build-up play is depicted by principle component 5 (PC5), in which 8.42% of variance was accounted for. Defensive ball recovery and build-up play both responsible for the construction of this component of play, where positive values indicate a higher percentage of ball recoveries and build-up play in the defensive zone. This corresponds with FC Barcelona's Under 12 age group, as documented by Lapressa et al. (2018). In which it was found that players would regularly launch possession from this area, in an attempt to try to build attacks. This finding was suggested to represent Under 12's ability to retain the ball while manipulating the ball the length of the pitch. Figure 8 displays the interaction between defensive build-up (PC5) and possession type (PC1), where defensive build-up it can be seen to be counter-intuitive of age. In more detail, Under 16s have the highest value in relation to PC5, displaying their increased use of recoveries and build-up play in their defensive zone. Under 18s are again seen to have an almost neutral value bridging the gap with First team performances that were observed to utilise these variables considerably less than. Travelling the length of the pitch is considered a difficult task (Sarmento et al. 2014a), therefore it could be suggested that this difference exemplifies the defensive abilities of each age; where Seniority encourages more structured and organised defences preventing First teams to generate attacks from their own defensive zone, meanwhile younger teams are defensively unstable and display greater offensive qualities (Blomqvist et al. 2005; Teoldo da Costa et al. 2010), resulting in an enhanced ability to create a final third entry from attacks that are initiated from this area.

Responsible for 5.45% of variance, the penultimate principle component characterises a team's ability to perform actions in the attacking-midfield zone (PC6), specifically the reduced ability to perform build-up actions in this zone. As a result, positive scores are seen to display a reduced ability to utilise possession in this area, while negative scores disclose an improved use of possession in this zone. This zone has been reported to be responsible for the majority of assists (Carling et al. 2006; Andrade et al. 2015), with Smith et al. (2013) stating that 57.8% of goals were assisted from central parts of this zone. With this said, possession in this area can be expected to be hard to maintain, given the expected increase in player density closer to the oppositions goal. Figure 12 displays the small differences in PC6 between the teams, with both Under 18s and First team performances displaying close to neutral scores suggesting that their build-up play does not

significantly rely on this zone to build an attack. Under 16s however, have a more negative score, indicating their higher percentage of 'Attacking Midfield' build-up play. It can be proposed that this increased use of build-up play in this action is responsible for the univariate results regarding assist location (Figure 5), in which Under 16s are seen to display significantly more assists from this area. The assessment of this area by previous studies, reinforced with the findings from the present study, suggests that the attacking midfield zone is particularly influential in the creation of goal scoring opportunities. For this reason, it can be justified that teams with better defensive capabilities and are results driven, specifically the Under 18s and First team, will therefore limit build-up play in this area to prevent opponents from creating goal scoring opportunities. While less tactically and technically developed teams, Under 16s in this case, may be able to enter this area of the pitch with less resistance (Folgado 2010; Folgado et al. 2014; Olthof et al. 2015).

Finally, principle component 7 (PC7) reflects the defensive pressure applied by a team, specifically between high-pressure and midfield-block strategies. With 5.17% of variance, negative values are representative of ball recoveries in the midfield zone, which signifies a deeper defensive set-up where teams remain compact within their own half in order increase player density, limiting and stifling attacks around the halfway line (Claudio Alberto et al. 2016). Contrastingly, positive scores are a characteristic of ball recoveries in the attacking zone which has previously been associated with high-pressing tactics where teams apply pressure using their strikers in an attempt to force errors or regain the ball. Interestingly, Claudio Alberto et al. (2016), Smith & Lyons (2017) and Barreira et al. (2013), all identified that midfield areas of pitch observed an increased percentage of possessions lost, while also noting that high-pressure tactics were seen to significantly increase the chances of scoring (Tenga et al. 2010a). The present study explains Under 16s aggressive approach when out of possession, making a higher proportion of recoveries in the attacking zone compared to the other groups. This assertive high-press by Under 16s reflects findings by Partridge et al. (1993), whom states that younger players do not tend to drop-off in order to defend. In other words, they are unlikely to utilise a midfield block to defend and consequently, are seen to be aggressive in their pursuit of the ball, which is displayed by the number of regains in the attacking zone. Interestingly, Under 18s display a conflicting approach, whereby recoveries are more frequent in the midfield zone suggesting a mid-block strategy. This approach is similar to that found in previous studies and could signify the passive defensive approach in order to maintain a compact and structured defensive shape. This reserved defensive approach can be justified as a result of the match-outcome orientated nature of their environment, where they are

more conscious about the result of the match. As a consequence of this mindset, Under 18s are seen to drop-off, reducing the oppositional threat by remain compact and forcing attackers wide or into compact areas (Smith et al. 2013). First teams on the other hand, display a neutral value in relation to defensive pressure used, which suggests that Senior teams tend to vary their approach. Utilising both high-press and mid-block tactics in order to achieve a successful match outcome, which could be as a result of situation variables forcing the team to adjust their defensive pressure accordingly (O'Donoghue and Tenga 2001).

6.6 Summary

The present study aimed to contribute to the understanding of playing styles across different stages of footballing development, utilising both univariate and multivariate approaches as recommended by Hewitt et al. (2016). The results identified apparent differences in tactical and technical abilities between the age groups. Specifically, at a univariate level age was seen to significantly influence the number of; final third entries, actions, dribbles, cross, as well as the usage of; backward, forward-diagonal and backward-diagonal actions, build-up location, ball recovery method and location, assist action and location and possession outcome. Following a multivariate analysis process, the differentiation of playing styles between age groups is evident when considering possession type, width utilisation, defensive build-up and defensive pressure.

These findings concur with notational analysis literature that examine tactical differences across age groups (Smith et al. 2013), including those investigating small sided games (Folgado et al. 2014; Olthof et al. 2015). As a result, it has been suggested that the cognitive-perception, decision making and tactical understanding in young players is still to developed compared to Senior players. However, it should be noted that Schumacher et al. (2018) identified no significant differences in cognitive-perception abilities between football teams ranging from ages; Under 16 to Under 23, as well as First team subjects. As a result, these differences can be explained by the increased time practicing as illustrated Keller et al. (2018). Examining varying ability levels of Youth players with an average age of 17 years old (± 0.61). Using a 'Video-based decision-making test' it was concluded that decision making abilities across different abilities is a distinguishing factor where sub-elite players achieved significantly lower scores (45.9% $\pm$ 8.8) than their state-elite and national-elite players (56.0% $\pm$ 9.1, 65.3% $\pm$ 8.1 respectively). It has been suggested that tactical understanding and ability is a distinguishing factor across football development. In order to reduce

the gap between these ages, coaches are encouraged to provide effective education of tactical skills (Kannekens et al. 2009) once ball-mastery skills are considered sufficient (Keller et al. 2018).

7.0 Conclusion

The main objective of the study was to compare the playing styles across different stages of elite footballing development using a uni- and multi- variate approach. In order to further extend our understanding of Youth football and the utilisation of different playing styles.

At a univariate level, it was observed that playing styles are significantly different across age groups, with a variety of key performance indicators displaying discrepancies. When compared to previous literature, it was seen that First team generally used more elaborate possession-based tactics utilising varying methods to successfully penetrate the defensive line. Acquiring a greater number of actions, passes and crosses, while utilising possession in wider positions when in possession. Out of possession, First team were seen to use varying levels of pressure, while utilising the touch line to limit their opposition's options, facilitating the recovery of the ball in wide locations. Ultimately, First team were considered to demonstrate superior tactical awareness in the pursuit of creating final third entries.

Meanwhile, Under 18s were often seen to display similar patterns of play to the Under 16s in many of the measured variables, while also bridging the gap between the First team and Under 16s. Highlighted by the utilisation of width when in possession, it can be suggested that there is a progressive transition into First team playing philosophies. Interestingly, out of possession the Under 18s placed significantly greater reliance on recoveries in the midfield zone, suggesting a passive defensive approach the concentrates on condensing space in and around the halfway line. This is attributed to the introduction of result orientated performances, in which players are still developing their tactical understanding.

On the other hand, Under 16s tended to display a direct approach with an emphasise on individual ability. This was illustrated in the number of actions, passes and dribbles, with the §assist method underlining their individuality. It was also noticed that this age group were tactically inferior to their older counterparts; minimalizing space by using central areas and employing aggressive strategies, with dependence on verticality, in order to regain and create goal scoring opportunities.

Using PCA, multiple variables were associated with one another to determine different features of performance, resulting in seven principle components that explained for 14 different playing styles. After plotting each age group's performance, sizable differences were revealed in several aspects of performance. Distinctly, differences in playing style can be seen in possession width, defensive pressure and defensive build-up play, with a clear learning curve former and later component of play. These variances reinforce the findings using univariate analysis techniques, as mentioned above, illustrating differences in playing styles across the age groups.

In conclusion, the study observed that age was influential in determining the playing style of a team, presenting fundamental differences in utilisation of space and task related variables. Given the cognitive-development literature in football, the presenting findings emphasise the coach's responsibility of teaching playing styles and tactics at younger ages to aid the tactical awareness and decision-making.

7.1 Limitations

It should be noted that playing styles can change over the course of the season for various reasons. It's been noted by Lago (2012) and Wright el at. (2011) that situational variables and coaches can influence a team's patterns of play and therefore playing styles can be expected to change as the season progresses, especially in results orientated leagues. The current study obtained footage for a portion of the 2018-2019 season and future studies should aim to employ a longitudinal design, spanning the entirety of the season, in order to obtain a greater understanding of the differences in playing styles across the age groups. In addition to this, Lago (2012) suggests that research studies should include situational variables in pursuit of better understandings the changing demands throughout the durations of a match. These variables were not considered in the present study, given that the sample examined all team performances, where it was expected to observe a balanced outlook on performance. It can be suggested that future studies consider situational variables in relation to playing styles at different ages, highlighting the changes in strategies during a match, in order to better comprehend the tactical understanding of academy players.

7.2 Practical Implications

There are several practical implications as a result of the current study. Firstly, the findings display a significant difference in playing styles at varying stages of footballing development. These results are seen to highlight the deficient tactical understanding of younger players, despite previous research reporting similar levels of cognitive-perception across similar ages (Schumacher et al. 2018). In fact, these similar levels of cognitive ability, suggest that coaches should address the tactical needs of the players, educating them on various playing styles and tactics (Keller et al. 2018). Ultimately, providing an insight into the necessary training methodologies required to improve tactical and strategical ability of academy players.

In addition, the use of PCA has effectively managed to display various attributes of performance, highlighting different playing styles in relation to both offensive and defensive indices. This method of analysis, can prove useful to coaches and analysts in the differentiation of teams playing philosophies at an elite level. Facilitating the discrimination of a team's playing style, in order to predict future performances (Fernandez-Navarro et al. 2016) or compare previous behaviours to their own or with others. In turn, the distinction of a team's playing style can enable a coach to improve both offensive or tactical patterns of play in order to exploit or inhibit the opposition's tactical approach. Furthermore, teams can utilise these components of play to supervise a team's desired approach, while also allowing coaches to monitor the development when adjusting a team's playing style.

8.0 Appendices

8.2. Ethical Approval

Bournemouth University

Research Ethics Checklist

About Your Checklist	
Reference Id	24548
Date Created	10/01/2019 13:22:05
Status	Approved
Date Approved	14/05/2019 14:32:34
Date Submitted	19/04/2019 15:17:11

Researcher Details	
Name	Jacob Dayus
Faculty	Faculty of Management
Status	Postgraduate Research (MRes, MPhil, PhD, DProf, EngD, EdD)
Course	Postgraduate Research - Business
Have you received external funding to support this research project?	No
Please list any persons or institutions that you will be conducting joint research with, both internal to BU as well as external collaborators.	AFCB Bournemouth

Project Details	
Title	Performance Analysis in Football: Academy Development
Start Date of Project	17/09/2019
End Date of Project	17/09/2019
Proposed Start Date of Data Collection	22/04/2019
Original Supervisor	Andrew Callaway
Approver	Tim Rees

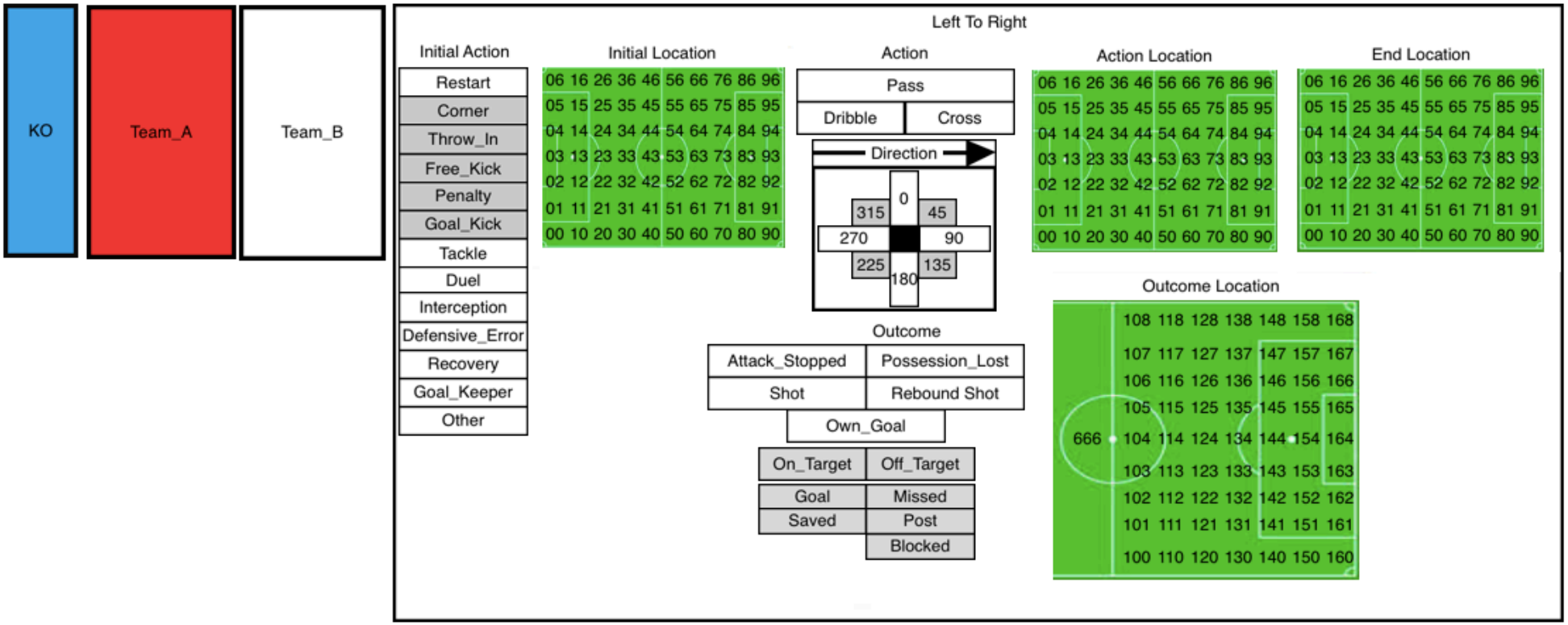
Summary - no more than 500 words (including detail on background methodology, sample, outcomes, etc.)

This research study is in collaboration with AFC Bournemouth (AFCB). AFCB have already collected videos of matches comprising of ages between 15-18 years old, and the first team. AFCB have permission to use this video from opposition teams, as well as AFCB football players and have signed an agreement form (attached) to state this as a gatekeeper to the videos.

The methodology is observational. The games will be watched to analyse how goals are scored and compare different playing styles across age groups. Data recorded will include variables such as how possession was gained, where on the pitch, number of passes and is recorded into a spreadsheet with columns of those headings, creating a row with a string of information which is anonymous of team or player, an example of an output for a game from a previous study is attached (CollectedDataExample.docx).

Using these data, differences between age groups can be analysed to better understand the learning needs of the players. There

8.3 SportsCode Tagging Panel



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