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Visual exploratory activity and resultant behavioural analysis of youth midfield soccer players

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ABSTRACT

Eldridge D, Pulling C, Robins M. Visual exploratory activity and resultant behavioural analysis of youth midfield soccer players. *J. Hum. Sport Exerc.* Vol. 8, No. Proc3, pp. S560-S577, 2013. The purpose of this study was to examine the effects of visual exploratory activity, prior to receiving the ball in the middle third of the pitch, on the actions of youth midfield soccer players. The visual exploratory activity of three youth central midfield players was examined using a player cam approach, which in turn, was related to each player's actions, after receiving the ball, through the use of a wide angle perspective. SportsCode Elite software was used to analyse all player actions post-event. Players participated in five training games, each 20 minutes in duration. The player's actions were divided into five themes: (1) maintaining possession, (2) loss of possession, (3) field location of maintained possessions (4) defensive pressure, and, (5) turning. Associations between visual exploratory activity and each of the resultant behavioural themes were examined using a chi-squared test ($p<0.05$). The findings of the study revealed that the players performed more forward passes, executed more passes into the attacking half, performed more turns when opportunities arose, and experienced less defensive pressure when performing visual exploratory activity prior to receiving the ball ($p<0.01$). There is evidence to suggest that coaches should encourage players to perform visual exploratory activity prior to receiving possession of the football. Moreover, coaches should be acutely aware that visual exploratory activity can influence the technical and tactical aspects of performance, and, consequently, this aspect should be considered an important facet to aid player development. **Key words**: PERFORMANCE ANALYSIS, MOTOR CONTROL, PLAYER DEVELOPMENT.

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INTRODUCTION

Sports performance analysis is the scientific sub-discipline of sport and exercise science whose primary goal is to enhance individual or team performance through the collection of objective, valid and reliable data. This data could be garnered during either training or competition. The one sport that has, perhaps, been most extensively researched by the domain of sports performance analysis is soccer (for a review, see Mackenzie & Cushion, 2012). Moreover, soccer is also the sport where most applied performance analysts operate, with roles within professional clubs including, amongst others, 1st team analyst, opposition analyst, recruitment analyst, and academy analyst. The main areas of scientific research within soccer include examination of the physiological aspects (Stolen et al., 2005), technical actions (Taylor et al., 2004), and tactical demands (Taylor et al., 2005). Despite an abundance of studies pertaining to soccer, performance analysis research typically focuses on quantifying the frequencies and relative success of discrete on-the-ball events such as tackles, passes, crosses and shots, a sentiment that is supported by both Taylor et al. (2004) and Williams et al. (2003). The quantification of on-the-ball actions is exemplified by the positional demands research, whereby the specific roles and responsibilities of different playing positions are identified. The positional demands within sports such as rugby union (e.g. James et al., 2005) and football (e.g. Taylor et al., 2004, 2005) have thus far been examined. For instance, Taylor et al. (2004) reported that the most common action for outfield players in football was passing and that; (1) fullbacks attempted the most throw-ins and crosses, (2) centre backs performed the most clearances and aerial challenges, (3) midfielders completed the most tackles, dribbles and corners, and, (4) forwards performed the most shots.

However, concentrating on solely on-the-ball events provides only a rudimentary understanding of performance and does not elucidate the causative mechanisms behind such performance. As a result, performance analysis research has, arguably, routinely dealt with the “what” but rarely with the “why”. Subsequently, qualitative variables have been advocated to support traditional quantitative action variables (see Tenga et al., 2009, 2010), and calls have been made for a more comprehensive assessment of performance, using off-the-ball actions to provide greater explanatory power (McGarry, 2009). One such factor that could be quantified to help explain soccer player’s actions is visual exploratory activity. Investigating visual exploratory behavior does not only have important implications for applied coaching practice, but also brings together the fields of motor control and notational analysis, often presented together within schematics of sports performance analysis (see Hughes, 2004), within an inter-disciplinary framework to better answer applied research questions. The need for, and benefits of, inter-disciplinary research is surmised nicely by Elliott (1999, pp.307) who stated that:

“Seldom is a complex question answered by research based in a single science discipline. Hence, the biomechanist must combine with exercise physiologist, and biochemist, the sport psychologist and the movement development specialist to structure appropriate research design.”

It is crucial in soccer that through observation and visual skills, performers have knowledge of where teammates and opposition are situated within the playing environment (Critchell et al., 2010). Developing this awareness can support a midfield player in their decision making process to select the correct actions when linking attack and defence (James et al., 2002). A process that can aid players taking in such information from the environment is known as visual exploratory activity. Jordet et al. (2013, pp.2) defines this as:

"...movements of the body and/or head during which the player's face is actively and temporarily directed away from the ball, seemingly with the intention of looking for team-members, opponents or other environmental objects or events, relevant to performing a subsequent action with the ball".

Jordet (2005) stated that an important presumption for this definition is that performers in team ball sport games are not able to perceive all task relevant information without engaging in active looking behaviour i.e. performers will need to move their heads and/or bodies. Performers will need to conduct visual exploratory activity to recognise team-members, opponents and other vital environmental cues that are located behind their backs, as peripheral vision will only allow performers to see what is happening in the ca. 180 degrees of visual field in front of them. Consequently, exploratory visual activity allows key constraining information to be obtained, helping to guide player's actions within the performance environment.

Ford (2009) stated that visual skills are important within the game of soccer and that expert players have superior visual skills compared to lesser-skilled players. Furthermore, Ward & Williams (2003) stated that skilled players are better able to recall and recognise patterns of play, exhibit more effective visual search strategies and are more adept at utilising advanced cue information. In addition, expert players use their vision to scan the playing environment in a systematically different manner to lesser-skilled players by looking at the correct source of information (for example, movement of a supporting team-member) at the correct time (Williams & Davids, 1998). Ford (2009) uses the example of an expert central midfield player, who regularly moves their head to look around the playing environment. This suggests that the player is conducting visual exploratory activity.

Most previous studies that have investigated player vision within team sports have focused on visual search strategy. Williams (2002, pp.169) defined visual search strategy as:

"...the way that the eyes move around the display in an attempt to direct visual attention towards relevant sources of information".

Visual search refers to the movement of the eyes to gain relevant information from the playing environment. The majority of research conducted on visual search strategy has explored differences between expert and lesser-skilled performers. Differences in visual search strategies between expert and novice sports performers have been observed in soccer (Savelsbergh et al., 2002; Canal-Bruland et al., 2011; Roca et al., 2011), basketball (Vickers, 1996), golf (Vickers, 1992), gymnastics (Vickers, 1988), and tennis (Singer et al., 1996). Research has shown that higher skilled performers within soccer conduct more pertinent visual search strategies, which involve fewer but longer fixations, and that these performers are able to fixate on the more informative areas of the display than less skilled performers (Savelsbergh et al., 2002; Canal-Bruland et al., 2011). Roca et al. (2011) found the opposite and stated that skilled soccer players employed a visual search strategy that involved more fixations of shorter duration, although differences between studies could be attributed to the differing constraints on action. The aforementioned soccer-based perceptual expertise studies were all conducted within a laboratory setting and therefore the representative design of these studies is questioned. These investigations required participants to view still images (Canal-Bruland et al., 2011) or films (Savelsbergh et al., 2002; Roca et al., 2011) and to then respond to what they had observed. As a result, research has tended to de-couple perception and action, and instead, research designs need to be constructed to couple perception and action together within a representative performance environment. In support of this contention, Jordet et al. (2013) stated that studies exploring visual search behaviour using still images and films that are projected onto large viewing

screens, fail to involve tasks and conditions that logically would seem critical to visual perception and subsequent player actions in real games. By using large viewing screens, only display information that is positioned in front of the participants is investigated. These viewing screens do not display the full amount of information that is found in real world games i.e. information from vital events that are happening behind a player's back (Jordet et al., 2013). It appears that there is a need to investigate visual exploratory activity, and its effect on resultant behaviour, within game-like situations.

In one such study of this nature, Jordet (2005) investigated the effect of an imagery intervention study on three elite soccer players' visual exploratory activity and performance with the ball. The imagery intervention optimised the frequency and timing of visual exploratory activity, which enabled the players to search for and perceive relevant information in real games. Even though visual exploratory frequency and timing was optimised, only one of the three participants improved their performance with the ball. This may have been due to the scale that was used to measure performance with the ball. This scale had no scientific basis and performance with the ball was graded subjectively by two soccer analysts from 1 to 7, with 1 considered the lowest performance and 7 the best performance. It could be suggested that documenting the frequency and success of player actions with the ball may be a better, more objective way of assessing performance change in response to visual exploratory activity. The use of computerised performance analysis systems, such as SportsCode, offers a suitable vehicle by which to do this. For example, passing could be measured via retained possession (successful) or lost possession (unsuccessful). This could then be developed by recording which type of pass retained possession, for example, a forward pass (a pass when the ball is played towards the opponent's goal). A further explanation for the lack of improvement for performance with the ball could be that the study used elite performers and therefore any enhancement in performance may have been minimal and difficult to recognise. Jordet (2005) concluded it is still not known exactly if, or how, visual exploratory activity affects prospective control of future actions and performance with the ball.

Jordet et al. (2013) investigated the visual exploratory activity of English Premier League soccer players. The aim of this study was to explore the visual exploratory activity of professional soccer players in real-world games and to test the relationship between visual exploratory activity and performance. The sample consisted of 118 players (midfielders and forwards) participating in 1279 game situations. The results showed that the players who engaged in extensive visual exploratory activity (moving their bodies and heads to perceive what is going on behind their backs), in the period prior to receiving the ball, are more successful with the ball than players who conducted less visual exploratory activity. These results largely remained significant across positional roles (midfielders and forwards), under different contextual conditions (defensive half and attacking half), and with different types of performances (pass completion and forward pass completion). The most noticeable effect though is found with midfielders and forward pass completion. This study suggested that offensive players (both midfielders and forwards) would benefit from conducting visual exploratory activity before receiving the ball. Within this study, player performance with the ball was evaluated through pass completion and forward pass completion rates. This is a more objective system for evaluating performance than the scale used previously by Jordet (2005). However, only two variables have actually been recorded. Therefore, other player actions e.g. finding space when receiving the ball, could be investigated to provide a more comprehensive assessment of player performance.

Previous research has highlighted the need to examine the impact of visual exploratory activity on soccer player actions (e.g. Ward & Williams, 2003; Jordet, 2005). Jordet et al. (2013) have attempted to address this but only pass completion and forward pass completion were explored. Therefore, more actions still need to be investigated. Visual exploratory activity in game-like situations has not been explored in youth

soccer players, a population where coaching and instruction about the use of visual exploratory activity would be particularly potent to aid player development. In addition, there are no previous studies that have compared players who performed visual exploratory activity prior to receiving possession of the ball to those who did not perform visual exploratory activity. Consequently, the aim of this study was to examine the effects of visual exploratory activity on the actions of youth midfield soccer players when receiving the ball in the middle third of the pitch.

MATERIAL AND METHODS

Participants

The participants were three male youth midfield soccer players. The mean (± SD) age of the participants was 14.3 ± 0.6 years. The participants had all been invited to attend a training centre in the South of England. Each player trained twice per week at the centre, and played in games against professional soccer club academies at least once a month. Within the past year, two of the players have had trials at professional soccer club academies. Informed consent was obtained from parents of the participants prior to data collection. Ethical approval was also granted by the local institution's research ethics committee.

Measures and Procedures

Data was collected in training games using video based filming; this method of performance analysis data collection is essential for capturing player actions (Court, 2004). The computerised analysis software package SportsCode Elite Version 8.4.0 (Sportstec, Warriewood, NSW, Australia) was used for lapsed-time analysis. A code window (Figure 1) was developed consisting of action variables that were essential to obtaining the relevant information for the study (Hughes, 2004). To enable a logical recording of information, the code window was structured to record events in the following sequence: 1. visual exploratory activity. 2. defensive pressure. 3. turning opportunity. 4. maintained / lost possession. 5. field location where possession was maintained.

Figure 1. *SportsCode Elite code window.*

The analyst (UEFA 'A' Licence coach) with the support of prior studies (Jordet, 2005; Tenga et al., 2010; and Shafizadeh et al., 2012) devised clear and replicable operational definitions (see Table 1). O'Donoghue (2007) argues that the analyst's knowledge of the sport and understanding of behaviours are more important than the agreement of the wording of operational definitions. The definitions were therefore, validated and contextualised by a fellow UEFA 'A' License coach with 15 years of experience coaching soccer and a university senior lecturer who had recently conducted a study on visual exploratory activity in youth soccer players.

Table 1. *Action variables and operational definitions*

Category	Action Variables	Operational definition
Visual exploratory activity	Visual exploratory activity	A movement of the body and/or head prior to receiving the ball, during which the players face was actively and temporarily directed away from the ball, seemingly with the aim of searching for teammates, opponents or other environmental events, relevant to performing a subsequent action.
	No visual exploratory activity	An insignificant movement of the body and/or head where the players face was not actively and temporarily directed away from the ball.
Defensive pressure	Loose	A player receives the ball in space with very little pressure from the opposition.
	Tight	A member of the opposing team is in close proximity to exert pressure on the player receiving the ball.
Turning opportunity	Turn	Using the foot to change the direction of the ball in an attempt to exploit an opportunity in another area of the pitch.
	No turn	A player does not change the direction of the ball even when there is an opportunity to turn.
Maintain possession	Pass forwards	A pass when the ball is played towards the opponent's goal.
	Pass backwards	A pass when the ball is played towards the goal that the player was defending.
	Pass sideways	A pass when the ball was neither played towards the goal that the player is defending or towards the opponent's goal.
	Penetrating pass	A forward pass that breaks the last line of defence.
	Running with the ball	A forward touch into space after the initial control of the ball.
Loss of possession	Ball control	Losing possession due to lack of trap/ receiving ability or passer's bad pass.
	Delay	Losing possession when the ball holder has delay in sending.

Passing to a marked player	Losing possession due to passing to a marked player rather than an unmarked player.
Ball manipulation	Losing possession due to inappropriate distance, trajectory, etc.
Teamwork	Losing possession due to misunderstanding among players.

Pilot testing was conducted and this enabled the researcher to determine the crucial technical and tactical performance indicators that were fundamental to the study (Hughes & Bartlett, 2002). It was also used to check the operational definitions against pilot footage (Teijlingen & Hundley, 2001). The analyst and three assistants were responsible for filming; each assistant was given 30 minutes of training in the most important procedures. The filming team simultaneously operated up to four cameras (Casio Exilim EX-FH25) at each training game, one for each of the three participants and one for the ball. Each camera was set up on the half way line to collect footage from the game. The participants were filmed via a player cam setup. A player cam setup is where the camera only follows an individual player, common within time-motion analysis research (e.g. Gabbett & Mulvey, 2008), and enables all the player's actions within a game or training environment to be recorded. A high zoom was used to record each participant and a regular zoom followed the ball. The separate video files were then stacked within the SportsCode Elite software to enable the players visual exploratory activity behavior to be observed in relation to the location of the ball (see Figure 2).

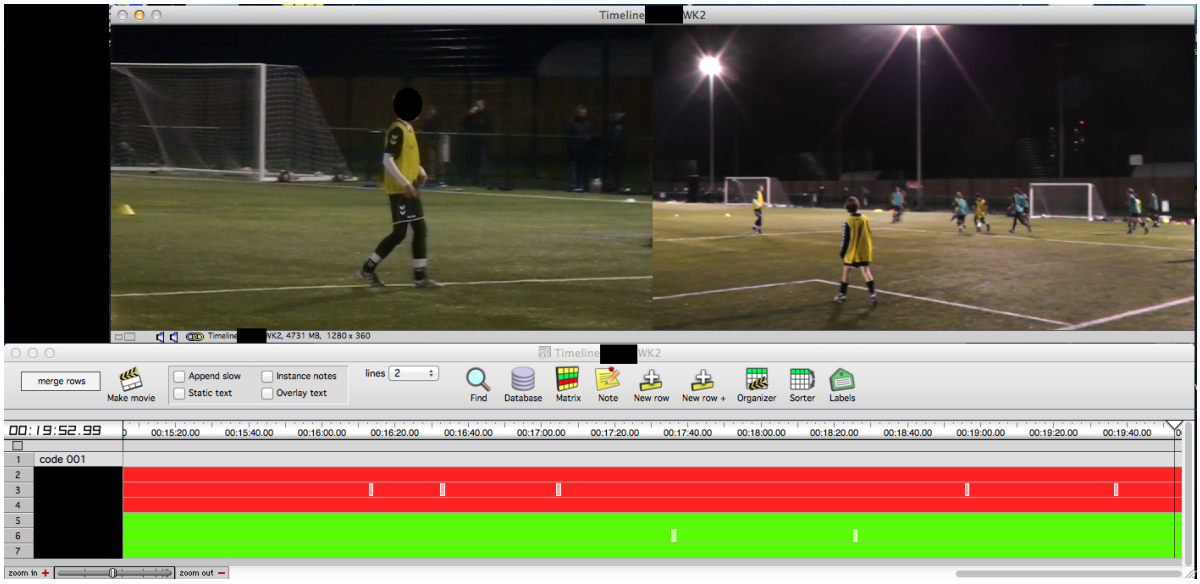

***Figure 2**. Example stacked timeline.*

The participants were filmed for 20 minutes during five 9 v 9 training games. The games were played on a 60 yard by 40 yard pitch with cones on the outside to indicate the middle third (20 yard section in the middle of the pitch). For a situation to be coded the participant had to receive a pass from a teammate when located in the middle third of the pitch. The middle third was selected as Taylor et al. (2008) found that large frequencies of actions were performed in the middle third of the pitch. This is also the area of the pitch that midfield players were most to operate.

A crucial aspect of the study was the analysis of the areas of the soccer pitch in which the players retained possession. Figure 3 illustrates the 12 key areas that the soccer pitch was divided into. The basis of this grid was adapted from James et al. (2002), and permits a suitable compromise between precision and accuracy.

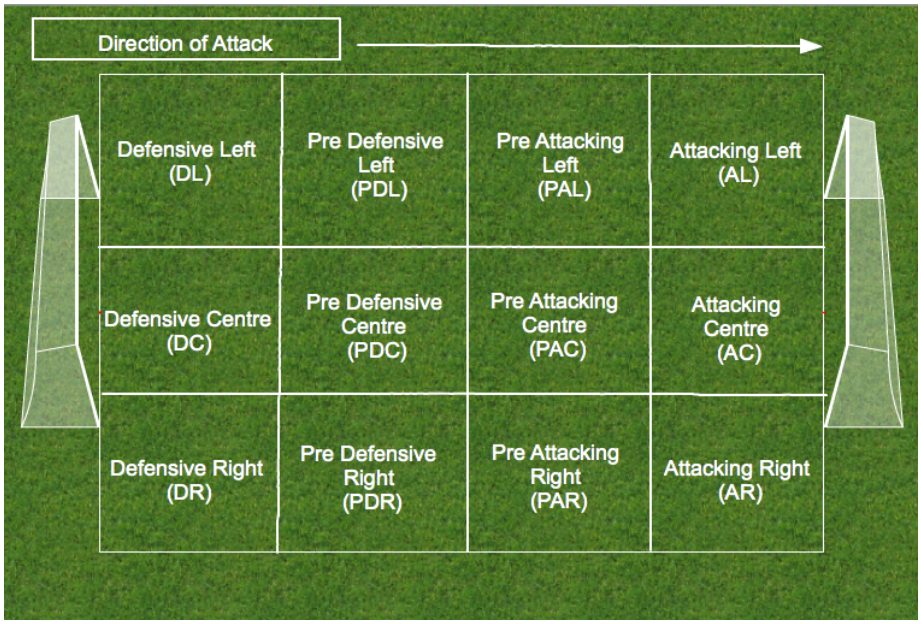

Figure 3. *Areas of the soccer pitch where the players maintained possession.*

Reliability

It is vital that data derived from performance analysis studies are both reliable and objective, as inconsistencies in measurements can have a major effect on the value of the data derived (Cooper et al., 2007). In order to assess the reliability of the study, inter-observer and intra-operator reliability analyses were conducted at the same level of analysis as the primary study. In the current study, both inter-observer and intra-observer reliability tests were conducted on the designed notation system for two random 20 minutes games. This equated to 13.3% of the total video footage recorded. The intra-observer reliability test was carried out with the researcher, either side of a six-week gap to alleviate the possibility of learning effects (Taylor et al., 2008). The inter-observer reliability test involved an accredited International Society of Performance Analysis of Sport (ISPAS) level five analyst analysing the selected footage. Prior to analysis, the analyst was given a training session on how to use the observer system and given a visual aid outlining the action variables and operational definitions that were used in the data collection process. Reliability was calculated using the percentage error for the following areas: defensive pressure (loose and tight), turning opportunity, possession maintained through passing and possession maintained through running with the ball.

Table 2*. Percentage error for intra-observer and inter-observer reliability*

Reliability test	Percentage error
Inter-observer	17,7%
Intra-observer	15,9%

Data Analysis

All data were presented as absolute frequencies and supported by percentage occurrence (stated in brackets). Not all outcomes could be analysed using Chi-squared (χ^2) tests of independence, as some cells had an expected value less than 5, thus violating the assumption underpinning the use of chi-squared tests (Fallowfield et al., 2005). To negate this violation for the field location of passes that maintained possession, the data were collapsed in the following way. Passes that maintained possession in the six attacking areas (PAL, PAC, PAR, AL, AC and AR) were regarded as attacking-half passes and passes that maintained possession in the six defensive areas (DL, DC, DR, PDL, PDC and PDR) were regarded as defending-half passes. Therefore, the following associations were tested statistically using the chi-squared (χ^2) test of independence; (1) visual exploratory activity behaviour and retention of possession, (2) visual exploratory activity behaviour and the direction of the pass that maintained possession (forwards, sideways and backwards), (3) visual exploratory activity behaviour and the location of passes that maintained possession (4) visual exploratory activity behaviour and defensive pressure, and, (5) visual exploratory activity behaviour and turning opportunity. The alpha level was set at 0.05. Further pairwise analyses were conducted to explore the association between visual exploratory activity behaviour and the different directions of passes that maintained possession. A Bonferroni adjustment was applied to these analyses and the alpha level was set at 0.017.

RESULTS

All players had 70 or more possessions within the middle third of the pitch over the course of the five training games, with player 1 having the most possessions (90). Players 1 and 2 were more likely to conduct visual exploratory activity before receiving possession than not performing visual exploratory activity. Player 3 was more likely to not conduct visual exploratory activity prior to receiving possession of the ball (Table 3).

Maintaining possession

All three players were able to maintain possession of the football for the majority of possessions, whether they had performed visual exploratory activity or not prior to receiving the ball. There was no significant association between the visual exploratory activity and whether possession was maintained or lost (χ^2 = 1.90, p = 0.168). However, there was a significant association between visual exploratory activity and the direction of the pass that maintained possession (χ^2 = 28.53, p = 0.001). Specifically, there was a significant association between visual exploratory activity and the application of forward and backwards passes that maintained possession (χ^2 =27.96, p = 0.001) and visual exploratory activity and the application of forwards and sideways passes that maintained possession (χ^2 = 13.97, p = 0.001). These statistical differences are exemplified by the fact that when all three players conducted visual exploratory activity prior to receiving possession of the ball, they regularly maintained possession through the application of forward passes. Player 1 and Player 3 were most likely to maintain possession through a forward pass when they had performed visual exploratory activity rather than passing backwards, whilst Player 2 was most likely to maintain possession through either a forward or sideways pass rather than passing backwards. Player 1 and Player 2 were most likely to maintain possession with a backwards pass when they had not conducted visual exploratory activity, whilst player 3 was most likely to maintain possession with a sideways pass (Table 3).

Table 3. *Maintaining possession*

Player	Visual exploratory activity	Possessions	Possessions maintained	Pass backwards	Pass forwards	Penetrating pass	Pass sideways	Run with the ball
1	No visual exploratory activity	27	24 (88.9)	17 (70.8)	3 (12.5)	0 (0)	4 (16.7)	0 (0)
	Visual exploratory activity	63	53 (84.1)	11 (20.7)	25 (47.2)	1 (1.9)	14 (26.4)	2 (3.8)
2	No visual exploratory activity	29	23 (79.3)	10 (43.5)	4 (17.4)	0 (0)	8 (34.8)	1 (4.3)
	Visual exploratory activity	41	39 (95.1)	10 (25.6)	12 (30.8)	2 (5.1)	12 (30.8)	3 (7.7)
3	No visual exploratory activity	55	46 (83.6)	17 (37.0)	4 (8.7)	6 (13.0)	18 (39.1)	1 (2.2)
	Visual exploratory activity	32	30 (93.7)	6 (20.0)	16 (53.3)	2 (6.7)	6 (20.0)	0 (0)
Total	No visual exploratory activity	111	93 (83.8)	44 (47.3)	11 (11.8)	6 (6.5)	30 (32.3)	2 (2.2)
	Visual exploratory activity	136	122 (89.7)	27 (22.1)	53(43.4)	5 (4.1)	32 (26.2)	5 (4.1)

Loss of possession

The players were most likely to lose possession through ball control or ball manipulation. However, due to the low frequency of lost possessions it is difficult to suggest any further findings, and readers should view these findings with caution (Table 4).

***Table 4**. Loss of possession*

Player	Visual exploratory activity	Possessions	Lost possessions	Ball Control	Delay	Passing to a marked player	Ball manipulation	Teamwork
1	No visual exploratory activity	27	3 (11.1)	1 (33.3)	1 (33.3)	1 (33.3)	0 (0)	0 (0)
	Visual exploratory activity	63	10 (15.9)	5 (50.0)	0 (0)	0 (0)	5 (50.0)	0 (0)
2	No visual exploratory activity	29	6 (20.7)	3 (50.0)	0 (0)	0 (0)	3 (50.0)	0 (0)
	Visual exploratory activity	41	2 (4.9)	0 (0)	0 (0)	1 (50.0)	1 (50.0)	0 (0)
3	No visual exploratory activity	55	9 (16.4)	5 (55.6)	0 (0)	2 (22.2)	2 (22.2)	0 (0)
	Visual exploratory activity	32	2 (6.3)	0 (0)	0 (0)	0 (0)	2 (100.0)	0 (0)
Total	No visual exploratory activity	111	18 (16.2)	9 (50.0)	1 (5.6)	3 (16.7)	5 (27.8)	0 (0)
	Visual exploratory activity	136	14 (10.3)	5 (35.7)	0 (0)	1 (7.1)	8 (57.1)	0 (0)

Field location of maintained possessions

There was a significant association between visual exploratory activity and the field location (attacking-half or defensive-half) of passes and runs with the ball that maintained possession (χ^2 =23.34, p = 0.001). All three players were more likely to pass or run with the ball into the six attacking areas when they had performed visual exploratory activity compared to when they had not conducted visual exploratory activity. The total data highlights that the players passed the ball or run with the ball into the attacking half to maintain possession for only 20.4% of their maintained possessions when they had not performed visual exploratory activity. However, when they had performed visual exploratory activity, the players passed the ball or run with the ball into the attacking half to maintain possession for 53.3% of their maintained possessions.

Table 5. *Field locations of maintained possessions*

Player	Visual exploratory activity	Total	DL	DC	DR	PDL	PDC	PDR	Defensive half total	PAL	PAC	PAR	AL	AC	AR	Attacking half total
1	No visual exploratory activity	24	7 (29.2)	3 (12.5)	2 (8.3)	2 (8.3)	5 (20.8)	0 (0)	19 (79.2)	2 (8.3)	1 (4.2)	1 (4.2)	1 (4.2)	0 (0)	0 (0)	5 (20.8)
	Visual exploratory activity	53	3 (5.7)	5 (9.4)	3 (5.7)	11 (20.8)	4 (7.5)	1 (1.9)	27 (50.9)	11 (20.8)	13 (24.5)	2 (3.8)	0 (0)	0 (0)	0 (0)	26 (49.1)
2	No visual exploratory activity	23	3 (13.0)	3 (13.0)	3 (13.0)	3 (13.0)	6 (26.1)	2 (8.7)	20 (87.0)	1 (4.3)	2 (8.7)	0 (0)	0 (0)	0 (0)	0 (0)	3 (13.0)
	Visual exploratory activity	39	3 (7.7)	2 (5.1)	5 (12.8)	2 (5.1)	3 (7.7)	6 (15.4)	21 (53.8)	1 (2.6)	8 (20.5)	5 (12.8)	2 (5.1)	1 (2.6)	1 (2.6)	18 (46.2)
3	No visual exploratory activity	46	6 (13.0)	5 (10.9)	4 (8.7)	4 (8.7)	13 (28.3)	3 (6.5)	35 (76.1)	1 (2.2)	3 (6.5)	1 (2.2)	0 (0)	2 (4.3)	4 (8.7)	11 (23.9)
	Visual exploratory activity	30	1 (3.3)	2 (6.7)	1 (3.3)	1 (3.3)	3 (10.0)	1 (3.3)	9 (30.0)	9 (30.0)	6 (20.0)	2 (6.7)	2 (6.7)	1 (3.3)	1 (3.3)	21 (70.0)
Total	No visual exploratory activity	93	16 (17.2)	11 (11.8)	9 (9.7)	9 (9.7)	24 (25.8)	5 (5.4)	74 (79.6)	4 (4.3)	6 (6.5)	2 (2.2)	1 (1.1)	2 (2.2)	4 (4.3)	19 (20.4)
	Visual exploratory activity	122	7 (5.7)	9 (7.4)	9 (7.4)	14 (11.5)	10 (8.2)	8 (6.6)	57 (46.7)	21 (17.2)	27 (22.1)	9 (7.4)	4 (3.3)	2 (1.6)	2 (1.6)	65 (53.3)

Defensive pressure

There was a significant association between visual exploratory activity and the defensive pressure that the players were under when they received the ball (χ^2 =13.70, p = 0.001). All three players were more likely to receive the ball under loose defensive pressure when they had performed visual exploratory activity compared to when they did not conduct visual exploratory activity. There was a substantial difference in receiving the ball under loose defensive pressure for Players 2 and 3 when they performed visual exploratory activity compared to when they did not perform visual exploratory activity (Table 6). For example, Player 2 received the ball under loose pressure 82.9% of the time when visual exploratory activity was undertaken. In contrast, Player 2 only received the ball with loose pressure 55.2% of the time when no visual exploratory activity was performed.

Table 6. *Defensive pressure*

Player	Visual exploratory activity	Loose	Tight
1	No visual exploratory activity	19 (70.4)	8 (29.6)
	Visual exploratory activity	48 (76.2)	15 (23.8)
2	No visual exploratory activity	16 (55.2)	13 (44.8)
	Visual exploratory activity	34 (82.9)	7 (17.1)
3	No visual exploratory activity	27 (49.1)	28 (50.9)
	Visual exploratory activity	24 (75.0)	8 (25.0)
Total	No visual exploratory activity	62 (55.9)	49 (44.1)
	Visual exploratory activity	106 (77.9)	30 (22.1)

Turning opportunity

There was a significant association between visual exploratory activity and whether players turned when they had the opportunity (χ^2 =22.47, p = 0.001). All three players were more likely to turn when they had performed visual exploratory activity prior to receiving possession of the ball compared to if they had not performed visual exploratory activity. When the three players did not conduct visual exploratory activity, they were more likely to not turn than turn. The difference in turning behaviour was noticeably different when the players performed visual exploratory activity compared to not performing visual exploratory activity. For example, Player 2 turned for 76.9% of possessions when they had conducted visual exploratory activity, compared to just 29.2% when they had not conducted visual exploratory activity (Table 7).

Table 7. *Turning opportunity*

Player	Visual exploratory activity	Total turning opportunities	No Turn	Turn
1	No visual exploratory activity	21	14 (66.7)	7 (33.3)
	Visual exploratory activity	28	11 (39.3)	17 (60.7)
2	No visual exploratory activity	24	17 (70.8)	7 (29.2)
	Visual exploratory activity	26	6 (23.1)	20 (76.9)
3	No visual exploratory activity	34	21 (61.8)	13 (38.2)
	Visual exploratory activity	19	3 (15.8)	16 (84.2)
Total	No visual exploratory activity	79	52 (65.8)	27 (34.2)
	Visual exploratory activity	73	20 (27.4)	53 (72.6)

DISCUSSION

The purpose of this study was to examine the effects of youth midfield players' visual exploratory activity and resultant behaviours when receiving the ball in the middle third of the pitch during soccer training games. The results do give support to the use of visual exploratory activity prior to receiving the ball and are discussed further in relation to the different themes.

Maintained possession

There was no significant association between the visual exploratory activity and whether possession was maintained or lost ($\chi^2 = 1.90$, $p = 0.168$). This study fails to support the findings of Jordet et al. (2013) who found that players who conducted a higher frequency of visual exploratory activity prior to receiving the ball, had a significantly higher pass completion rate than those who performed less visual exploratory activity. This may be due to the different levels of performers that were used within the studies. The English Premier League players may have heightened perceptual expertise, allowing them to extract key information better to constrain their actions and guide them towards successful actions. It is also important to recognise that Jordet et al. (2013) analysed data from full-sided games that were played on larger pitches.

A crucial factor of this theme was the insight into the direction that players pass the football. This is supported by research from Taylor et al. (2004) who found that each outfield position was seen to perform passes more than any other technical skill. Within this study there was a significant association between visual exploratory activity and the direction of the pass that maintained possession ($\chi^2 = 28.53$, $p = 0.001$). The findings suggest that players are more likely to pass forwards to maintain possession when they had performed visual exploratory activity prior to receiving the ball than when compared to when they had not performed visual exploratory activity prior to receiving the ball. This provides some support to Jordet et al. (2013) who found that midfield players who conducted substantial visual exploratory activity were significantly more likely to maintain possession with a forward pass compared to those who conducted little visual exploratory activity. However, an element of caution is required when comparing the results of this study to the findings of Jordet et al. (2013), as the current study compared visual exploratory activity to no visual exploratory activity, whereas Jordet et al. (2013) explored high amounts of visual exploratory activity to low amounts of visual exploratory activity.

There was a significant association between visual exploratory activity and the application of forward and backwards passes that maintained possession ($\chi^2 = 27.96$, $p = 0.001$) and visual exploratory activity and the application of forwards and sideways passes that maintained possession ($\chi^2 = 13.97$, $p = 0.001$). It could be suggested that by performing visual exploratory activity prior to receiving the ball, the players were able to recognise potential team-members that were located closer to their opponent's goal. Despite the small sample size these results are still vital to the study as passing the ball forward can lead to a number of defensive players being temporarily out of the match (Beim, 1977). Generally, defensive players can be effective only if they are between the ball and their goal. Making forward passes also enables the attacking team to move closer to the opponent's goal (Eldridge et al., 2012). The closer the attacking team can get to their opponent's goal, the greater chance they have of converting an attempt at goal into a goal (Wright et al., 2011).

Field locations

In support of the directional pass data, there was a significant association between visual exploratory activity and the field location (attacking-half or defensive-half) of passes that maintained possession (χ^2

=23.34, p = 0.001). When players conducted visual exploratory activity, they were more likely to maintain possession of the ball by passing it into the attacking half of the pitch than if they had not performed visual exploratory activity. It appears that the players are able to utilise the information they have gained from visual exploratory activity to have more control over their actions, and perform more effectively once they have received the ball. This finding is also vital as the middle third action area is critical in terms of linking attack and defence (James et al., 2002). This has implications for coaches, as players are more likely to pass the ball into the attacking-half when they had performed visual exploratory activity. This should enable teams to create more opportunities to have attempts at goal.

Loss of possession

Despite a small sample size during the study, ball control, ball manipulation and passing to a marked player were the major factors for losing possession (96.9% of all lost possessions). Shafizadeh et al. (2012) stated that one of the most common ways of losing possession in soccer was due to skill execution (this included ball control, ball manipulation and passing to a marked player). The current study supports the findings of Shafizadeh et al. (2012).

Defensive pressure

The players were more likely to receive the ball under loose defensive pressure when they conducted visual exploratory activity compared to when they did not perform visual exploratory activity. There was a significant association between visual exploratory activity and the defensive pressure that the players were under when they received the ball (χ^2 =13.70, p = 0.001). This suggests that the players were able to use visual exploratory activity, to visually search the playing environment when not in possession of the ball. By regularly performing visual exploratory activity, the players had greater awareness of team-members and the movement and positions of opponents. This enables the players to receive the ball in space and under less defensive pressure (Jordet, 2005). Bruce et al. (2009) found within netball that players who received possession under low defensive pressure had a higher percentage of successful passes than players who received possession under high defensive pressure. It appears that it may be advantageous for soccer players to perform visual exploratory activity so they receive the ball under less defensive pressure, as it may help them to successfully complete subsequent passes.

Turning opportunity

The three players were more likely to turn when they had performed visual exploratory activity prior to receiving possession of the ball compared to if they had not conducted visual exploratory activity. There was a significant association between visual exploratory activity and whether players turned when they had the opportunity (χ^2 =22.47, p = 0.001). Williams et al., (2003) highlighted that one of the key technical actions of midfield players is turning. If players are able to utilise opportunities to turn then they will be facing their opponent's goal and be in a greater position to launch a penetrative attack or create a shooting opportunity (Edward, 2003). Another key finding was that when players had not performed visual exploratory activity they were more likely to not turn than turn, when a turning opportunity arose. This has implications for coaches, as players are not recognising potential opportunities to turn and are therefore likely to miss opportunities to begin attacks.

A limitation of the current study is the small sample of players that have been explored, and it would be suggested for future studies a greater number of players should be investigated. This would help to generate a greater representative profile of performance (Hughes et al., 2001). Another limitation is that the study has not investigated what the players are actually looking at when they move their body and/or heads. It could be that the players moved their body and/or heads to impress or appease the coaching staff rather than actually visually search the playing environment. In this study, visual exploratory activity was

dichotomised into "yes" or "no". Although important to build upon the extant research, this does provide only a rudimentary understanding into how visual search can support resultant behaviours. Future research should consider undertaking a more detailed analysis through the use of eyetracker technology, and more formally assessing visual search strategy by means of quantifying the number, duration and location of fixations and saccades before receiving the ball and initiating a pass (e.g. Vickers, 1996).

CONCLUSIONS

The aim of this study was to examine the effects of visual exploratory activity on midfield player's actions in soccer training games when receiving the ball in the middle third. The key findings of the study reveal that the players performed more forward passes, more attacking-half passes and performed more turns when opportunities arose; as well as experiencing less defensive pressure ($p<0.01$) when the players had performed visual exploratory activity prior to receiving the ball compared to when they did not conduct visual exploratory activity. The results suggest that visual exploratory activity prior to receiving the ball, can aid players in their next action during a game. It would be suggested that coaches should encourage players to conduct visual exploratory activity prior to receiving possession of the ball. Coaches should be aware that visual exploratory activity can influence the technical and tactical aspects of performance and could aid player development.

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