

1 **Football coaches' perceptions of the introduction, delivery and evaluation of visual exploratory**  
2 **activity**

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10

## 1 **Abstract**

2 The purpose of the study was to examine how visual exploratory activity (VEA) is introduced,  
3 delivered, and evaluated by football coaches. Further, this study aimed to explore whether distinct  
4 groups of football coaches existed who differed in their approach to the delivery of VEA training and,  
5 if so, whether there were differences in the demographics of the coaches across these differentiated  
6 groups. The participants in the study consisted of 303 current football coaches who completed an online  
7 survey comprised of three sections and 12 items. Cluster analysis identified three clusters of coaches,  
8 which were distinguished by the extent to which they engaged in the delivery of VEA training: Low  
9 delivery of VEA training (n = 68), Moderate delivery of VEA training (n = 153) and High delivery of  
10 VEA training (n = 82). The High delivery of VEA training cluster were likely to provide more  
11 feedback/instruction on VEA; they designed an activity or part of a session to focus on VEA more often;  
12 and the percentage of sessions they would primarily focus on VEA was higher compared to the  
13 Moderate delivery of VEA training and Low delivery of VEA training clusters. It appears that a higher  
14 coaching qualification and experience (years coached and number of hours coached per week) leads to  
15 a positive attitude of coaching VEA. Future research regarding VEA should involve direct observations  
16 of coaching behaviour in relation to VEA, as well as interviewing the coaches on the delivery of VEA  
17 training. From a practical perspective, there is a need for further research to explore practice design and  
18 how this can be developed to enhance the use of VEA by performers.

19 **Keywords:** visual exploratory activity; decision-making; perceptual-cognitive skill; coaching.

20

## 1 **1. Introduction**

2 Successful perceptual-cognitive skill in team-sports such as football requires players to pick up task-  
3 relevant information during the control of action in complex and dynamic situations (Araújo, Davids,  
4 & Hristovski, 2006; Pocock, Dicks, Chapman, Barker & Thelwell, 2017). At the elite level, football  
5 players may only hold possession of the ball 40 to 60 times in an entire match (Dellal et al., 2011) and  
6 the average duration of a single possession for outfield players is only 1.1 seconds (Carling, 2010).  
7 Thus, the majority of movements when not in possession - to support a team-member, for instance -  
8 require that the player reads the game in order to ensure that they act successfully when in possession.  
9 Researchers have proposed that an ability to read the game is developed through sport-specific  
10 adaptations to perceptual-cognitive skills that include recognising and recalling patterns of play  
11 (Williams, Hodges, North, & Barton, 2006), anticipating an opponents' actions (Williams & Davids,  
12 1998), and showing greater situational awareness (Ward & Williams, 2003).

13 In the perceptual skills literature, one factor which has been the subject of considerable research is  
14 visual search behaviours (Roca, Ford, McRobert, & Williams, 2011; Vaeyens, Lenoir, Williams, &  
15 Philippaerts, 2007); that is, the sequence, location and duration of visual fixations by a performer. For  
16 example, using video sequences of 11 v 11 scenarios in football, Roca et al. (2011) identified that  
17 professional and semi-professional players performed more fixations of shorter duration to more  
18 locations in the display compared to amateur players. However, the generalisation of video-based tests  
19 of visual search behaviours underpinning perceptual-cognitive skill have been questioned (Dicks,  
20 Button, & Davids, 2010; Jordet, 2005a). In a recent study, van Maarseveen, Oudejans, Mann and  
21 Savelsbergh (2016) examined the performance of skilled football players on video tests of perceptual-  
22 cognitive skill (pattern recognition, decision-making and anticipation) and compared the results of these  
23 tests to on-field performance during small-sided games. Results revealed non-significant correlations  
24 between the level of performance on the different video-based perceptual-cognitive tests. Analysis of  
25 visual search behaviours revealed differences in gaze patterns when participants completed the video  
26 test of pattern recall in comparison with the anticipation and decision-making tests, suggesting that  
27 pattern recall skill, in particular, may be driven by different processes to those used for anticipation and  
28 decision-making. Furthermore, the on-field performance was not predicted by any of the video-based  
29 tests, suggesting possible difference between current laboratory and field-based measures of perceptual-  
30 cognitive skill that have been used in studies of expert performance (McGuckian, Cole & Pepping,  
31 2018).

32 The findings considered above indicate that although the research on video-based measures of visual  
33 search behaviour and perceptual-cognitive skill has offered insight into the factors which may  
34 distinguish less-skilled from skilled footballers (Williams et al., 2011), there may be a need to move  
35 towards the development of better on-field measures (Dicks, Button & Davids, 2010; McGuckian et al.,

1 2018). In the sport expertise literature, theoretical perspectives in ecological psychology (Gibson,  
2 1979), which place emphasis on the reciprocal role of perception-action in skilful decision-making  
3 (Araújo et al., 2006) and anticipation (van der Kamp et al., 2008), has been used as a framework for  
4 recent research (McGuckian et al., 2018). From this perspective, visual search is conceptualised as an  
5 active process, which encompasses the body, head and eyes (van der Kamp & Dicks, 2017). Exemplary  
6 of such an approach to perceptual expertise, Jordet (2005a, 2005b) proposed that researchers (and  
7 coaches) should consider the study of visual exploratory activity (VEA), defined as:

8 “A body and/or head movement in which the player’s face is actively and temporarily  
9 directed away from the ball, seemingly with the intention of looking for teammates,  
10 opponents or other environmental objects or events, relevant to perform a subsequent  
11 action with the ball” (Jordet, 2005b, p.143).

12 If VEA is a reliable indicator of a performer’s perceptual skill, then observation of the timing and  
13 frequency of a player’s VEA could become an accessible skill development measure for scientists and  
14 applied practitioners, particularly for those working within talent development environments (see  
15 Pocock et al., 2017). Initial research into VEA examining close-up footage of players during live games  
16 indicated a positive relationship between visual exploration frequency and performance with the ball  
17 (Jordet, 2008). Specifically, English Premier League midfield players demonstrated higher frequency  
18 VEA than a sample of Dutch amateur players. Furthermore, Premier League players who had won  
19 international awards demonstrated a higher frequency of VEA than the players who had not won awards  
20 and there was a significant positive relationship between the frequency of VEA and pass completion  
21 rate (Jordet, Bloomfield, & Heijmerikx, 2013). Subsequent research by Eldridge, Pulling, and Robins  
22 (2013) further demonstrated a relationship between the occurrence of VEA and the accuracy of  
23 performance in a youth football context. Although VEA appears to be an important indicator of  
24 performance accuracy in youth and elite footballers, there is a lack of understanding on how coaching  
25 practices can impact upon the development of this aspect of skill (McGuckian et al., 2018; Pocock et  
26 al., 2017).

27 Developing an understanding of current coach knowledge and practice provides the possibility to  
28 identify developments and interventions to support the coaching process (Abraham & Collins, 1998).  
29 There has been much progress in understanding the knowledge and practices of sports coaches in  
30 relation to key principles of biomechanics and skill acquisition (e.g., Smith, Roberts, Wallace, Kong,  
31 & Forrester, 2015; Whelan, Kenny, & Harrison, 2016). Specific to the application of skill acquisition  
32 in coaching, observation of UEFA A and B Licensed youth football coaches has identified the potential  
33 need to bridge the gap between the applied recommendations that stem from research evidence and  
34 actual coaching behaviours (Ford, Yates, & Williams, 2010). This research suggested that coaches spent  
35 more time developing players in training form (e.g., drill-based coaching with minimal decision

1 making) than playing form (e.g., variable, game-based coaching) practice despite research evidence  
 2 advocating more support for the latter mode of practice (see also, Partington & Cushion, 2013).  
 3 O'Connor, Larkin and Williams (2017) found that football coaches generally apply more playing form  
 4 than training form activities, however, coaches demonstrated high amounts of instruction and tended to  
 5 'over-coach'. This coaching practice has the potential to reduce the problem-solving and decision-  
 6 making demands on players. An investigation of coach perceptions of youth rugby revealed that many  
 7 coaches highlighted the need for lots of structure in competitive match-play rather than unstructured  
 8 youth rugby (Thomas, Coles & Wilson, 2017). However, not all coaches shared this opinion;  
 9 specifically, elite coaches (Thomas & Wilson, 2014) and youth coaches who had played at a high level  
 10 (Thomas et al., 2017), supported a less structured youth game, with a coaching emphasis on decision-  
 11 making and skill development, which is a view commensurate with research evidence (Côté &  
 12 Abernethy, 2012).

13 In summary, research has suggested that VEA is an important facet of skilled performance in youth  
 14 (Eldridge et al., 2013; Pocock et al., 2017) and adult (Jordet et al., 2013) football. However, it is  
 15 currently unknown whether such evidence is commensurate with the views of coaches and whether  
 16 coaching practices are utilised to develop VEA in training. Research has revealed differences between  
 17 the opinions of youth coaches and the type of practices utilised in the development of perceptual skill  
 18 in team sports (Ford et al., 2010; Thomas & Wilson, 2014; Thomas et al., 2017). In order to further  
 19 current understanding on VEA and coaching practices, the present study developed an online survey to  
 20 examine: (i) when VEA should be introduced in coaching; (ii) how VEA is delivered by coaches and  
 21 (iii) how coaches evaluate VEA. Further, this study aimed to explore whether distinct groups of football  
 22 coaches existed who differed in their approach to the delivery of VEA training and, if so, whether there  
 23 were differences in the demographics of the coaches across these differentiated groups.

## 24 **2. Method**

### 25 *2.1 Participants*

26 The participants in the study consisted of 303 current football coaches. Table 1 provides an overview  
 27 of the demographic details of the coaches.

28 Table 1. Demographic details of the coaches.

	Number of coaches
Highest qualification obtained	
No qualification	24
FA Level 1 (first formal level of qualification)	83
FA Level 2	87
UEFA B Licence	70
UEFA A Licence	16
UEFA Pro Licence (highest formal level of qualification)	1
Other	22

Number of years coaching experience (Stoszkowski & Collins, 2016)

<1-2 years	39
3-5 years	75
6-9 years	67
10-14 years	68
15 years or more	54

Hours of coaching per week

<1-2 hours	57
2-3 hours	55
3-5 hours	75
5-10 hours	53
10 hours or more	63

Age group of players the coaches work with (adapted from Partington, Cushion & Harvey, 2014)

Under 9 years and below	57
Under 10 years and under 11 years	53
Under 12 years and under 13 years	69
Under 14 years, under 15 years and under 16 years	68
16 years and over	56

Level of players the coaches work with

Grassroots/Club/School	180
District/Representative team	21
Development centre	30
Academy	58
Semi-professional	11
Professional	3

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2 *2.2 Instrument*

3 The instrument was developed following procedures in existing research (Stoszkowski & Collins,  
 4 2016). The four authors, who each have a background in sports coaching, developed an initial survey.  
 5 As there was limited previous research and coaching literature on VEA, an inductive approach was  
 6 adopted. A pilot test was conducted on the survey, which involved three qualified football coaches  
 7 (mean  $\pm$ SD: age = 23.0  $\pm$  5.2 years); one UEFA B Licence holder with seven years coaching experience  
 8 and two FA Level 2 coaches each with three years coaching experience) completing the survey and  
 9 providing comments. The coaches were also interviewed following the pilot test so they could suggest  
 10 any improvements to the structure, format and wording of the survey. The main adjustment made was  
 11 the use of the word ‘scanning’ rather than ‘VEA’, as the coaches suggested that this term was more  
 12 universally known across team sports<sup>1</sup>. The final version of the survey comprised of three sections and

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<sup>1</sup> This article will use the term VEA rather than scanning apart from when providing example questions from the questionnaire and when applying quotations from participants.

1 12 items. Section one comprised of five questions based on the coaches' demographics. Questions were  
2 related to the coaching qualifications they possessed; their years of coaching experience; the number of  
3 hours per week they coached; and, the age group and playing level of the players that the coaches  
4 predominantly worked with (see Table 1). Section two provided a definition of VEA (Jordet, 2005b)  
5 and a video clip of a youth player performing VEA within a small-sided training game. This section  
6 was included so that the participants were aware of how VEA had been defined in the literature to date.  
7 Section three comprised of seven questions based on the coaches' perceptions of VEA. Of the seven  
8 questions, three were closed (e.g. On a scale of 0 to 10, how important is it for a player to develop the  
9 skill of scanning?); three were closed with the option to provide a reason for the response (e.g. Within  
10 your coaching, how often would you give your players instruction/feedback on scanning? Please  
11 provide a reason for your response); and one open question was asked (How would you recognise if a  
12 player is using scanning effectively?). A copy of the survey is available from the first named author.

### 13 *2.3 Procedure*

14 Prior to data collection, the local institution's research ethics committee granted ethical approval. An  
15 online survey tool (Bristol Online Survey, [www.onlinesurveys.ac.uk](http://www.onlinesurveys.ac.uk)) hosted the survey. The web link  
16 for the survey was distributed to personal contacts of the researchers by email; these contacts included  
17 football coaches, FA coach educators, university lecturers, club secretaries, league secretaries and  
18 physical education teachers. Social media (Twitter and Facebook) was also used by three of the  
19 researchers to distribute the survey. When participants clicked on the web link for the survey, they were  
20 presented with a title page, followed by a participant information sheet. The participants were then taken  
21 to the next page where they were asked to provide informed consent. The participants completed  
22 sections one to three of the survey (as detailed in the instrument section). The survey was active for  
23 seven months and three weeks.

### 24 *2.4 Data Analysis*

#### 25 *2.4.1 Qualitative analysis*

26 The responses to the open-ended questions were subjected to inductive content analysis (Patton, 2015)  
27 following a two-step process (Côté, Salmela, Baria, & Russell, 1993). In the first step, meaning units  
28 were identified within the responses supplied by coaches, and each meaning unit was coded with a  
29 provisional name describing the topic. Each author took primary responsibility for coding one of the  
30 questions. Once all answers had been coded, the codes were reviewed and refined for consistency (i.e.,  
31 each item within a code refers to the same concept) and exclusivity (i.e., no overlap between codes). In  
32 the second step, codes with similar meanings were grouped together, and a new label generated which  
33 summarised the identity of that group of codes. A collaborative coding process was adopted in both  
34 step one and step two of the coding process, whereby one of the authors, who had not been involved in  
35 the analysis of that question, reviewed and queried both the initial coding, and the clustering of codes.

1 In order to further enhance the trustworthiness of the analysis, the authors independently familiarised  
2 themselves with all of the data by reading through the lists of meaning units. Discussions continued  
3 until the research team were satisfied that a workable structure had emerged from the qualitative data  
4 collected (Sparkes, 1998).

#### 5 2.4.2 *Quantitative analysis*

6 The responses from the closed questions were entered into SPSS v22 and descriptive statistics  
7 calculated. As the data was not normally distributed, medians and inter-quartile ranges are reported.  
8 Cluster analysis was applied to determine whether groups of football coaches existed who differed in  
9 their approach to the delivery of VEA training (Thomas et al., 2017). Cluster analysis allows natural  
10 groupings to emerge from the data, and is an appropriate method to adopt when there are no clear  
11 theoretical or empirical reasons for grouping coaches (Hair, Anderson, Tatham, & Black, 2010). The  
12 first stage of the cluster analysis was to decide which responses from the survey to explore. The  
13 responses that were selected for the cluster analysis were chosen in relation to conceptual and practical  
14 considerations. The conceptual considerations were that VEA will or will not form part of a coach's  
15 regular practice and that coaches will vary in terms of the frequency that they deliver VEA. The practical  
16 consideration was that there were three questions from the survey based on how coaches deliver VEA  
17 and therefore the responses to the following three questions were used for the cluster analysis: (i) Within  
18 your coaching, how often would you give your players instruction/feedback on VEA?; (ii) Within your  
19 coaching, how often would you design an activity or part of a session to develop VEA?; and (iii) Within  
20 your coaching, approximately what percentage of sessions would primarily focus on VEA? The  
21 responses to questions (i) and (ii) were recorded on a scale from 0 (never) to 10 (very often). The  
22 response to question (iii) was a percentage and therefore the response to question (iii) was adjusted to  
23 a scale of 0 to 10 before the cluster analysis (Mooi & Sarstedt, 2011).

24 The responses were examined to assess the impact of multicollinearity and it was judged to be at an  
25 acceptable level (correlation coefficients  $< 0.57$ ) (Hutcheson & Sofroniou, 1999). Hierarchical cluster  
26 analysis was conducted using Ward's agglomerative method with squared Euclidean distance. This  
27 method has been previously used for exploring groups of rugby union coaches based on their beliefs  
28 and attitudes (Thomas et al., 2017). It has also been suggested that Ward's agglomerative method is  
29 appropriate for ordinal data that has been standardised to a specific range (Everitt, Landau, Leese &  
30 Stahl, 2011). The agglomerative hierarchical technique, as used in this study, ultimately reduced the  
31 data to a single cluster containing all the participants, requiring the researchers to decide on the number  
32 of clusters present (Everitt et al., 2011). In the current study, cluster analysis indicated two, three and  
33 five cluster solutions that warranted further investigation. Examination of the dendrogram, the average  
34 within cluster distance, and the descriptive statistics for each cluster, suggested that the three cluster  
35 solution was the most promising. In order to ensure rigour, a Professor of statistics, with no knowledge

1 of the study's aims, independently inspected the data output and concurred with the selection of the  
2 three cluster solution. Cluster 1 (C1) had a total of 68 coaches, cluster 2 (C2) contained 153 coaches  
3 and cluster 3 (C3) had 82 coaches. The Kruskal-Wallis one-way analysis of variance was utilised to  
4 verify the differences between the three clusters. Mann-Whitney U tests were then used to complete the  
5 pairwise comparisons. Based on the descriptive statistics, the clusters were classified as; *Low delivery*  
6 *of VEA training (C1)*, *Moderate delivery of VEA training (C2)* and *High delivery of VEA training (C3)*  
7 to reflect the extent to which coaches implemented VEA in the design and delivery of their sessions.

8 The three clusters were then investigated with the use of chi-squared tests according to the demographic  
9 data (highest qualification obtained; number of years coaching experience; hours of coaching per week;  
10 age group of players the coaches work with; and level of players that the coaches work with). When the  
11 chi-squared tests were analysed with all possible outcomes, the highest qualification obtained and the  
12 level of players the coaches worked with contained cells that had an expected value less than five,  
13 thereby violating the assumption underpinning the use of chi-squared tests (see Thomas & Nelson,  
14 1996). To negate this violation, the coaches who had the UEFA A Licence and the UEFA Pro Licence  
15 were collapsed into one category. Further, three collapsed categories were also developed for the level  
16 of players the coaches worked with: (i) Grassroots/club/school; (ii) District/Representative team and  
17 Development centre; and, (iii) Academy, semi-professional and professional. The following  
18 associations were then tested statistically using the chi-squared ( $\chi^2$ ) test of independence; (i) the highest  
19 coaching qualification obtained and the cluster classification; (ii) the number of years coaching  
20 experience and the cluster classification; (iii) the amount of hours coached per week and the cluster  
21 classification; (iv) the age group of the players that the coach works with and the cluster classification;  
22 and, (v) the level of the players that the coach works with and the cluster classification. Cramer's V was  
23 used to calculate the effect sizes. When significant chi-square results with a small effect size were found,  
24 standardized residuals (SR) provided a *post-hoc* test to identify where there were significant deviations  
25 from the expected frequencies (Hancock, Young, & Ste-Marie, 2011). SRs  $\geq \pm 1.96$  were deemed  
26 noteworthy.

### 27 **3. Results**

#### 28 *3.1 Confirmation of the cluster analysis classification*

29 As described in the data analysis section, a cluster analysis was used to determine whether groups of  
30 football coaches existed who differed in their approach to the delivery of VEA training. Three clusters  
31 emerged, which were distinguished by the extent to which coaches engaged in the delivery of VEA  
32 training: Low delivery of VEA training (n = 68), Moderate delivery of VEA training (n = 153) and High  
33 delivery of VEA training (n = 82). There was a significant association between the highest coaching  
34 qualification obtained and the cluster classification ( $\chi^2_{10} = 27.51$ ,  $p = 0.002$ ,  $V = 0.213$ ). In the Low  
35 delivery of VEA training cluster there was an over-representation of coaches with no qualification (SR

1 = 2.4) or a highest qualification of FA level 1 (SR = 2.4). Within this cluster, there was also an under-  
 2 representation of coaches whose highest qualification was the UEFA B (SR = -2.4). There was a  
 3 significant association between the number of years coaching experience and the cluster classification  
 4 ( $\chi^2_8 = 21.53$ ,  $p = 0.006$ ,  $V = 0.188$ ). In the Low delivery of VEA training cluster there was an over-  
 5 representation of coaches who had been coaching for <1-2 years (SR = 3.5). There was a significant  
 6 association between the number of hours coached per week and the cluster classification ( $\chi^2_8 = 26.17$ ,  
 7  $p < 0.001$ ,  $V = 0.208$ ). In the Low delivery of VEA training cluster there was an over-representation of  
 8 coaches who coach for <1-2 hours per week (SR = 3.7). There was a non-significant association between  
 9 the age group of the players that the coach worked with and the cluster classification ( $\chi^2_8 = 4.42$ ,  $p =$   
 10  $0.818$ ,  $V = 0.085$ ). There was a non-significant association between the level of the players the coach  
 11 works with and the cluster classification ( $\chi^2_4 = 3.227$ ,  $p = 0.521$ ,  $V = 0.073$ ).

12 The three clusters were significantly different from each other based on how often the coaches gave  
 13 players instruction/feedback on VEA ( $H_{(2)} = 82.31$ ,  $p < 0.001$ ). All of the pairwise comparisons were  
 14 significantly different: low – moderate ( $U = -66.94$ ,  $p < 0.001$ ,  $r = -0.37$ ); low – high ( $U = -125.66$ ,  $p <$   
 15  $0.001$ ,  $r = -0.74$ ); and moderate – high ( $U = -58.71$ ,  $p < 0.001$ ,  $r = -0.33$ ) (see Figure 1).

16 INSERT FIGURE 1 ABOUT HERE

17 Figure 1. Frequencies with which the coaches provided players with instruction/feedback on VEA.  
 18 Error bars represent median absolute deviation.

19 The three clusters were significantly different from each other for how often the coaches designed an  
 20 activity or part of a session to develop VEA ( $H_{(2)} = 181.42$ ,  $p < 0.001$ ). The pairwise comparisons were  
 21 all significantly different: low – moderate ( $U = -131.86$ ,  $p < 0.001$ ,  $r = -0.70$ ); low – high ( $U = -185.75$ ,  
 22  $p < 0.001$ ,  $r = -1.07$ ); and moderate – high ( $U = -53.89$ ,  $p < 0.001$ ,  $r = -0.30$ ) (see Figure 2).

23 INSERT FIGURE 2 ABOUT HERE

24 Figure 2. Frequencies with which the coaches designed an activity or part of a session to develop VEA.  
 25 Error bars represent median absolute deviation.

26 The three clusters were significantly different for the percentage of sessions that the coaches would  
 27 primarily focus on VEA ( $H_{(2)} = 194.88$ ,  $p < 0.001$ ). All of the pairwise comparisons were significantly  
 28 different: low – moderate ( $U = -53.38$ ,  $p = 0.01$ ,  $r = -0.28$ ); low – high ( $U = -186.09$ ,  $p < 0.001$ ,  $r = -$   
 29  $1.07$ ); and moderate – high ( $U = -132.71$ ,  $p < 0.001$ ,  $r = -0.73$ ) (see Figure 3).

30 INSERT FIGURE 3 ABOUT HERE

31 Figure 3. Percentage of sessions in which the coaches would predominantly focus on VEA. Error bars  
 32 represent median absolute deviation.

### 1 3.2 Introducing VEA

2 Within all three clusters, coaches predominantly suggested that VEA should be introduced at under 8  
3 years or earlier (Low delivery of VEA training cluster 52% of coaches, Moderate delivery of VEA  
4 training cluster 56% of coaches, High delivery of VEA training cluster 66% of coaches). A chi-squared  
5 test of independence revealed broad similarity across the clusters, with the exception that coaches in the  
6 Low delivery of VEA training cluster (27%; SR = 2.6), who were more likely to introduce VEA at age  
7 11 years or above than coaches in either the Moderate delivery of VEA training cluster (12%) or High  
8 delivery of VEA training cluster (10%) ( $\chi^2_4 = 12.727$ ,  $p = 0.013$ ,  $V = 0.145$ ). Irrespective of cluster, the  
9 primary reason provided by coaches for their choice of when VEA should be introduced was the  
10 importance/advantage of starting early (Table 2). The majority of coaches emphasised the need for  
11 players to start developing this skill as early as possible, often making a connection to the benefit of  
12 forming skills that are "instinctive", for example "It should be embedded as young as possible so it is a  
13 natural reaction, just the same as kicking the ball" (P272, High delivery of VEA training cluster). A  
14 small number of coaches ( $n = 11$ , 3.6% of the total number of coaches) provided reasons for starting  
15 early, including the suggestion that players learn more quickly when they are younger, for instance "it  
16 is more difficult to teach to players once in their teens" (P33, Moderate delivery of VEA training  
17 cluster). A further suggestion was provided that earlier introduction allows for more practice to be  
18 accumulated ( $n = 3$ , 1.0% of the total number of coaches), for instance "the earlier they become aware  
19 of it as a desirable skill, the longer time they have to develop it and the less pressure there will be to  
20 develop it quickly" (P191, Moderate delivery of VEA training cluster).

21 The second theme to emerge related to introducing VEA at an age-appropriate point (Table 2).  
22 Differences between the clusters were evident on a single sub-theme only: 15% of coaches in both the  
23 Low delivery of VEA training and Moderate delivery of VEA training clusters, compared to only 2%  
24 of coaches in the High delivery of VEA training cluster, commented upon the need to master more basic  
25 elements (often specified as ball mastery) of the game first, for example "at this age they should have  
26 the basic skills to be able to control the ball and position it where they want for the next pass/shot etc.  
27 They can then move on to develop this more advanced skill." (P54, Moderate delivery of VEA training  
28 cluster). Rather than age, 11 coaches (3.6% of the total number of coaches) made specific reference to  
29 a player's level of skill or willingness to learn as the determining factor when introducing VEA, for  
30 instance "if the players you coach are good listeners progressing well teaching them at a younger age  
31 can only help in their development to become a rounded footballer" (P85, Moderate delivery of VEA  
32 training cluster). Rather than focusing on the individual, 26 coaches (8.6% of the total number coaches)  
33 emphasised that the structure of the age-grade game dictated when VEA should be introduced, as an  
34 example "scanning is linked to passing and receiving, at U7/U8 the player needs to be aware of 'traffic'  
35 so he can receive cleanly and perform the next action" (P45, Moderate delivery of VEA training cluster).

### 1 3.3 Delivery of VEA

2 Coaches reported that VEA was delivered using a variety of methods (Table 2). The most common  
 3 method that coaches reported that they used to deliver VEA was direct instruction (n = 88, 29.0% of  
 4 the total number of coaches). The use of direct instruction such as “ always saying ‘look up’, ‘check  
 5 your shoulder’ during training and matches” (P195, Low delivery of VEA training cluster) was more  
 6 common for coaches within the Low delivery of VEA training cluster (32.4%) and the Moderate  
 7 delivery of VEA training cluster (32.0%) compared to coaches within the High delivery of VEA training  
 8 cluster (20.7%). A second method that coaches used to relay information through verbal communication  
 9 was via questioning (n = 17, 5.6% of the total number of coaches). Coaches from the Moderate delivery  
 10 of VEA training cluster (7.2%) and High delivery of VEA training cluster (6.1%) were more likely to  
 11 apply questioning than coaches from the Low delivery of VEA training cluster (1.5%), for instance “I  
 12 ask questions and provide feedback as to how to improve the effectiveness of their scanning” (P123,  
 13 Moderate delivery of VEA training cluster). Finally, rather than instructional modes, a common method  
 14 that coaches reported using to develop VEA was through the modification of task constraints that were  
 15 designed to encourage the use of VEA (n = 59, 19.5% of the total number of coaches). Coaches from  
 16 the High delivery of VEA training cluster (23.3%) and Moderate delivery of VEA training cluster  
 17 (22.2%) were more likely to apply constraints to encourage VEA compared to coaches in the Low  
 18 delivery of VEA training cluster (8.8%), for example “the constraints placed upon practices often lead  
 19 players to scan more often” (P14, High delivery of VEA training cluster).

20 A total of 93 coaches (30.7% of the total number of coaches) reported that the delivery of VEA training  
 21 was not a priority (Table 2). Comments on why VEA was not a priority included: not enough time for  
 22 everything; other skills need to be developed; players had already mastered VEA. The Low delivery of  
 23 VEA training cluster (47.1%) and the Moderate delivery of VEA training cluster (35.3%) were much  
 24 more likely to report that VEA was not a priority compared to the High delivery of VEA training cluster  
 25 (8.5%), for example “most players have different and more pressing needs” (P169, Low delivery of  
 26 VEA training cluster). Furthermore, some of the coaches (n = 40, 13.2% of the total number of coaches)  
 27 made comments referring to the barriers of delivering VEA. The following barriers were reported: VEA  
 28 was difficult to coach; the coach perceived that they had a lack of knowledge regarding VEA; and that  
 29 there was a lack of resources regarding VEA. The Low delivery of VEA training cluster (20.6%) and  
 30 the Moderate delivery of VEA training cluster (13.1%) were more likely to report a barrier to delivering  
 31 VEA than the High delivery of VEA training cluster (7.3%), for instance “It is a hard skill to put into a  
 32 drill and practice” (P155, Low delivery of VEA training cluster).

33 Table 2. Analysis of the responses to the open-ended questions.

<b>Higher Order Theme</b>	<b>Lower Order Theme</b>	<b>Sub-themes</b>
Delivery of VEA training	Coach VEA using a variety of methods	Direct instruction Applying constraints

		Questioning
	Coaching of VEA not a priority	Not enough time for everything Other skills need to be developed Players had already mastered VEA
	Barriers to delivery of VEA training	VEA was difficult to coach Lack of knowledge regarding VEA Lack of resources regarding VEA
When to introduce VEA	Start early	Helps to make the skill instinctive Younger players learn more quickly Allows players to accumulate more practice
	Start at age-appropriate point	Master more basic elements first When to introduce depends upon the player When to introduce depends upon the game structure at that age grade
Evaluating VEA	Subsequent player behaviour	Awareness of surroundings Decision making Quality and/or speed of the technical action
	Direct observation	General observation Specific observation of head and/or body movement
	Assessing player understanding	Questioning

1

2 

### 3.4 Evaluating VEA

3 Coaches reported three main ways of evaluating players' use of VEA (Table 2). A total of 175 coaches  
4 (48.6% of the total number of coaches) referred to the subsequent player behaviour following a VEA,  
5 with many coaches referring to multiple behaviours. Coaches from the High delivery of VEA training  
6 cluster (47.6%) and the Moderate delivery of VEA training cluster (44.4%) were more likely to provide  
7 an example of subsequent player behaviour than coaches from the Low delivery of VEA training cluster  
8 (31%). Comments frequently referred to a player evidencing an awareness of his/her surroundings, for  
9 example "if a player knows where he is, knows what's going on around him and moves accordingly  
10 (P76, High delivery of VEA training cluster). Alternatively, the coach might reference a player's  
11 decision-making, for instance "the decision that they attempt to make once they receive the ball in  
12 relation to the picture that is in front of them" (P201, High delivery of VEA training cluster). Other  
13 comments referred to assessing the quality and/or speed of the technical action carried out by a player  
14 following a VEA, for instance "they are able to turn and make passes quickly as they know the general  
15 shape of the field (P61, Moderate delivery of VEA training cluster). A total of 143 coaches (47.2% of

1 the total number of coaches) reported using a direct observation to evaluate VEA, this could involve a  
2 general “visual observation of each player” (P86, Low delivery of VEA training cluster) or a specific  
3 observation of “a head up and looking around” (P303, Low delivery of VEA training cluster). In contrast  
4 to the finding with player behaviours, coaches from the Low delivery of VEA training cluster (47.1%)  
5 were more likely to refer to direct observation than coaches in the Moderate delivery of VEA training  
6 (43.1%) or High delivery of VEA training (35.4%) clusters. Finally, a small number of coaches (n =  
7 20, 6.6% of the total number of coaches) that were evenly distributed between the clusters mentioned  
8 verbally assessing a player’s understanding of a situation as a result of “asking questions about what  
9 they have seen” (P250, Moderate delivery of VEA training cluster).

#### 10 **4. Discussion**

11 Research has begun to highlight that VEA is an important facet of skilled performance in football  
12 (Jordet et al., 2013). However, there is a lack of research on the knowledge of youth coaches and the  
13 type of practices utilised in the development of VEA. In order to address these gaps in the literature,  
14 the current study aimed to identify: (i) when VEA should be introduced; (ii) how VEA is delivered by  
15 coaches and; (iii) how coaches evaluate VEA. Further, this study explored whether groups of football  
16 coaches existed who differed in their approach to the delivery of VEA training and whether there were  
17 differences in the demographics of the coaches across these groups. Three clusters (groups) emerged,  
18 which were distinguished by the extent to which coaches engaged in the delivery of VEA training: Low  
19 VEA, Moderate VEA and High VEA. Within the Low delivery of VEA training cluster there was an  
20 over-representation of coaches with no qualification or a highest qualification of FA level 1; an over-  
21 representation of coaches who had been coaching for <1-2 years; and an over-representation of coaches  
22 who coach for <1-2 hours per week. It appears that a higher coaching qualification and experience  
23 (years coached and number of hours coached per week) leads to a positive attitude of coaching VEA  
24 (see also, Thomas & Wilson, 2014). However, this positive attitude to coaching VEA was not influenced  
25 by the ability and the age of players that are being coached. The critical factors that determine the use  
26 of coaching practices to develop VEA appear to be the qualification and experience of the coach. For  
27 football associations, this indicates that they would benefit from helping coaches to progress through  
28 the coaching qualification pathways and to provide appropriate opportunities for coaches to develop  
29 coaching experiences (Watts & Cushion, 2017). Moreover, it may be worthwhile for inexperienced  
30 coaches to work alongside experienced coaches who can act as mentors to help them develop their  
31 coaching practice (Jones, Harris & Miles, 2009).

#### 32 *4.1 Introducing VEA*

33 Coaches predominantly suggested that training of VEA should be introduced at Under 8 or earlier.  
34 However, coaches in the Low delivery of VEA training cluster were more likely to delay introducing  
35 VEA coaching practices until age 11 or above than coaches in either the Moderate delivery of VEA

1 training cluster or High delivery of VEA training cluster. One reason for this difference may lie in the  
2 perceived priority of developing technical aspects of skill prior to tactical or perceptual-cognitive skills  
3 (for a discussion, see Chow et al., 2007). Further to such distinction, in the current study, approximately  
4 15% of coaches in both the Low delivery of VEA training and Moderate delivery of VEA training  
5 clusters specifically commented upon the need to master more basic elements (often specified as ball  
6 mastery) of the game first, compared to only 2% of coaches in the High delivery of VEA training cluster.  
7 It appears that some coaches are adopting a traditional coaching approach where technique needs to be  
8 mastered before game play (Evans, 2006) and it has been suggested that this approach could lead to a  
9 detachment between technique and tactical understanding (Light & Harvey, 2015). Alternatively, the  
10 later introduction of VEA may be associated with the greater use of direct instruction rather than a  
11 constraints-led approach by coaches in the Low delivery of VEA training cluster. As coaching for U8  
12 and below is believed to be optimized through game-based and non-prescriptive coaching (Davids,  
13 Araújo, Correia, & Vilar, 2013) these findings in relation to the introduction of VEA reinforce the need  
14 to develop and promote evidence-based coaching interventions specifically targeting early years  
15 coaches.

#### 16 *4.2 Delivery of VEA training*

17 The High delivery of VEA training cluster were likely to provide more feedback/instruction on VEA;  
18 they designed an activity or part of a session to focus on VEA more often; and the percentage of sessions  
19 they would primarily focus on VEA was higher compared to the Moderate delivery of VEA training  
20 and Low delivery of VEA training clusters. The most common method that coaches reported that they  
21 used to deliver VEA was direct instruction (e.g. “always saying ‘look up’, ‘check your shoulder’ during  
22 training and matches” P195, Low delivery of VEA training cluster). Instruction is a behaviour  
23 frequently used by football coaches (O’Connor, Larkin & Williams, 2018; Partington & Cushion,  
24 2013), and previous research has suggested that an overly prescriptive approach to instruction can be  
25 detrimental for learning (Ford et al., 2010; Gabbett & Masters, 2011). Questioning is an alternative  
26 method by which VEA might be promoted (e.g. “I ask questions and provide feedback as to how to  
27 improve the effectiveness of their scanning” P123, Moderate delivery of VEA training cluster).  
28 Questioning was reported by a relatively small proportion of coaches and this is consistent with previous  
29 research that has revealed coaches rarely ask players questions (Cope, Partington, Cushion & Harvey,  
30 2016). However, questioning is important for the development of desirable learner outcomes (i.e.  
31 enabling performers to critically reflect on their performance) (Cope et al., 2016). It would also be  
32 important for coaches to move beyond simplistic questioning (low order and convergent questions) and  
33 attempt to apply higher order and divergent questions to enhance performer learning of VEA in football  
34 practices (Harvey & Light, 2015).

1 Rather than direct interactions such as instruction or questioning, the modification of task constraints  
2 was an approach commonly reported by coaches in the High and Moderate delivery of VEA training  
3 clusters. Common modifications include altering the dimensions of the playing area, the number of  
4 players, the position of the goals, or the means of identifying teammates (e.g. bibs versus headbands).  
5 Previous literature and studies have demonstrated how such modifications can promote specific  
6 adaptations in game play (Davids, Button & Bennett, 2008; Buszard, Reid, Masters, & Farrow, 2016;  
7 Timmerman, Farrow, & Savelsbergh, 2017). However, research on constrained games has primarily  
8 focused on the number of technical actions performed (e.g., tackles, passes, shots on goal, etc;  
9 Capranica, Tessitore, Guidetti, & Figura, 2001; Katis & Kellis, 2009) rather than on VEA. McGuckian  
10 et al. (2017) conducted the only previous study that has explored the impact of modifying task  
11 constraints on the VEA of football players. This study highlighted that football players conducted more  
12 VEA when playing on a pitch with less space per player compared to playing on a pitch with the same  
13 amount of space as a full-size, 11 versus 11 match. Thus, further research is required to determine the  
14 particular task constraint manipulations which best support the development of VEA.

15 Some of the coaches made comments referring to the barriers of delivering VEA. The following barriers  
16 were reported: VEA was difficult to coach; the coach perceived that they had a lack of knowledge  
17 regarding VEA; and that there was a lack of resources regarding VEA. The Low delivery of VEA  
18 training cluster and the Moderate delivery of VEA training cluster were more likely to report a barrier  
19 to delivering VEA than the High delivery of VEA training cluster. For football associations, this would  
20 highlight that coaches require support in developing their understanding of VEA, with formal coach  
21 education courses being one possible way of achieving this (Stoszkowski & Collins, 2016). The  
22 production of resources for the delivery of VEA training is a key area for coach education provision to  
23 consider (Nelson, Cushion & Potrac, 2013). However, a first-phase of research is required to identify  
24 systematically how coaching practices can be designed to enhance VEA, before appropriate evidence-  
25 based interventions can be implemented.

#### 26 *4.3 Evaluating VEA*

27 As considered, a contemporary question in the perceptual-cognitive skill literature concerns the  
28 optimisation of methods for the measurement and development of this aspect of expertise. A particular  
29 requirement has been the need to further develop on-field measures of perceptual-cognitive skill (van  
30 Maarseveen et al., 2016). In the current study, coaches offered some examples of how they evaluate  
31 and coach VEA. Coaches reported three main ways of evaluating players' use of VEA: subsequent  
32 player behaviour, direct observation and assessing player understanding. Comparable to extant  
33 measures used in the VEA literature (Eldridge et al., 2013; Jordet, 2005b), a large number of coaches  
34 stated that they observed a player's subsequent behaviour following VEA. These behaviours were  
35 divided across three areas of performance: awareness, decision-making and quality and/or speed of

1 technical action. Previous studies have examined outcome measures including forward pass completion  
2 rates (Jordet et al., 2013) and coach determined decision-making (Pocock et al., 2017) in relation to  
3 VEA. Based on the current findings, a combined measure of awareness, decision-making and quality  
4 and/or speed of technical action may provide an appropriate candidate variable of VEA. Future studies  
5 would benefit from the further development of field-based measures of perceptual-cognitive expertise  
6 in order to develop understanding on the processes that underpin this aspect of skill.

7 Evaluating VEA by questioning players was only reported by a minority of coaches. Questioning could  
8 be implemented by stopping one player within a small-sided game, and asking him/her to provide an  
9 account of his/her thoughts over the previous 15-30 seconds (Eccles, 2012). By implementing  
10 questioning in this way, it is possible that players could be encouraged to use VEA to exploit sources  
11 of information that will support prospective actions. Although chiefly utilised in the context of closed  
12 motor skills such as golf strokes (Whitehead, Taylor, & Polman, 2016) or with coaches (Whitehead et  
13 al., 2016), such retrospective accounts have provided insight into the awareness and cognition of  
14 football players when responding to video footage under laboratory conditions (Roca et al., 2011).  
15 Future research should consider whether verbal reports could be fruitfully implemented within the more  
16 dynamic context of small-sided games.

17 The current article has only explored the perceptions of coaches regarding the introduction, delivery  
18 and evaluation of VEA. Future research should consider direct observations of coaching behaviour in  
19 regards to VEA. For example, a sizable proportion of the coaches in the current study have described  
20 applying a constraints-led approach (Davids et al., 2008). However, previous research has identified an  
21 epistemological gap between what football coaches want to achieve and the practices that they are  
22 implementing to bring about that result (O'Connor, Larkin & Williams, 2017; Partington & Cushion,  
23 2013). Direct observation of coaching practice, coupled with retrospective interviews to establish the  
24 rationale behind selected behaviours (e.g., Collins & Collins, 2016; O'Connor, Larkin & Williams,  
25 2017; Partington & Cushion, 2013), would provide a richer description of how VEA is developed as  
26 well as unearthing any relevant epistemological gaps.

27 In summary, the current study aimed to identify: (i) how VEA is delivered by coaches; (ii) when VEA  
28 should be introduced and; (iii) how coaches evaluate VEA. Further, this study explored whether groups  
29 of football coaches existed who differed in their approach to the delivery of VEA training and whether  
30 there were differences in the demographics of the coaches across these groups. Cluster analysis  
31 identified three clusters of coaches, which were distinguished by the extent to which coaches engaged  
32 in the delivery of VEA training: Low VEA, Moderate VEA and High VEA. The High delivery of VEA  
33 training cluster were likely to provide more feedback/instruction on VEA; they designed an activity or  
34 part of a session to focus on VEA more often; and the percentage of sessions they would primarily focus  
35 on VEA was higher compared to the Moderate delivery of VEA training and Low delivery of VEA

1 training clusters. It appears that a higher coaching qualification and experience (years coached and  
2 number of hours coached per week) leads to a positive attitude of coaching VEA. Future research  
3 regarding VEA should consider direct observations of coaching behaviour in relation to VEA, as well  
4 as interviewing the coaches on the delivery of VEA training. From a practical perspective, further  
5 research should explore practice design and how this can be developed to enhance the use of VEA by  
6 performers.

## 7 **References**

- 8 Abraham, A., & Collins, D. (1998). Examining and extending research in coach development. *Quest*,  
9 50, 59-79.
- 10 Araújo D., Davids K., & Hristovski R. (2006). The ecological dynamics of decision making in sport.  
11 *Psychology of Sport and Exercise*, 7(6), 653–676.
- 12 Buszard, T., Reid, M., Masters, R., & Farrow, D. (2016). Scaling the equipment and play area in  
13 children’s sport to improve motor skill acquisition: A systematic review. *Sports Medicine*, 46(6), 829-  
14 843.
- 15 Capranica, L., Tessitore, A., Guidetti, L., & Figura, F. (2001). Heart rate and match analysis in pre-  
16 pubescent soccer players. *Journal of Sports Sciences*, 19(6), 379-384.
- 17 Carling, C. (2010). Analysis of physical activity profiles when running with the ball in a professional  
18 soccer team. *Journal of Sports Sciences*, 28(3), 319-326, DOI:10.1080/02640410903473851.
- 19 Chow, J. Y., Davids, K., Button, C., Shuttleworth, R., Renshaw, I., & Araujo, D. (2007). The Role of  
20 Nonlinear Pedagogy in Physical Education. *Review of Educational Research*, 77(3), 251-278.
- 21 Collins, L., & Collins, D. (2016). Professional judgement and decision-making in the planning process  
22 of high-level adventure sports coaching practice. *Journal of Adventure Education and Outdoor*  
23 *Learning*, 16(3), 256-268.
- 24 Cope, E., Partington, M., Cushion, C. J., & Harvey, S. (2016). An investigation of professional top-  
25 level youth football coaches’ questioning practice. *Qualitative Research in Sport, Exercise and Health*,  
26 8(4), 380-393.
- 27 Côté, J., & Abernethy, B. (2012). A developmental approach to sport expertise. In S. Murphy (Ed.),  
28 *The Oxford handbook of sport and performance psychology* (pp. 435–447). New York, NY: Oxford  
29 University Press.

- 1 Côté, J., Salmela, J. H., Baria, A., & Russell, S. J. (1993). Organizing and interpreting unstructured  
2 qualitative data. *Sport Psychologist*, 7(2), 127-137.
- 3 Davids, K., Button, C., & Bennett, S. J. (2008). *Dynamics of skill acquisition: a constraints-led*  
4 *approach*. Champaign, IL: Human Kinetics.
- 5 Davids, K., Araújo, D., Correia, V., & Vilar, L. (2013). How small-sided and conditioned games  
6 enhance acquisition of movement and decision-making skills. *Exercise and Sport Sciences Reviews*,  
7 41(3), 154-161.
- 8 Dellal, A., Chamari, K., Wong, D., Ahmaidi, S., Keller, D., Barros, R., Biscotti, G. N., & Carling, C.  
9 (2011). Comparison of physical and technical performance in European soccer match-play: FA Premier  
10 League and La Liga. *European Journal of Sport Science*, 11(1), 51–59.
- 11 Dicks, M., Button, C., & Davids, K. (2010). Examination of gaze behaviors under in situ and video  
12 simulation task constraints reveals differences in information pickup for perception and action.  
13 *Attention, Perception, & Psychophysics*, 72(3), 706-720.
- 14 Eccles, D. W. (2012). Verbal reports of cognitive processes. In G. Tenenbaum, R. C. Eklund, & A.  
15 Kamata (Eds.), *Measurement in sport and exercise psychology* (pp. 103-117). Champaign, IL: Human  
16 Kinetics.
- 17 Eldridge, D., Pulling, C., & Robins, M. (2013). Visual exploratory activity and resultant behavioural  
18 analysis of youth midfield soccer players. *Journal of Human Sport and Exercise*, 8(3), S560-S577.
- 19 Evans, J. R. (2006). Elite level rugby coaches interpretation and use of game sense in New Zealand.  
20 *Asian Journal of Exercise & Sports Science*, 3(1), 17-24.
- 21 Everitt, B. S., Landau, S., Leese, M., & Stahl, D. (2011). *Cluster analysis* (5<sup>th</sup> Edition). Chichester:  
22 Wiley.
- 23 Ford, P. R., Yates, I., & Williams, A. M. (2010). An analysis of practice activities and instructional  
24 behaviours used by youth soccer coaches during practice: Exploring the link between science and  
25 application. *Journal of Sports Sciences*, 28(5), 483-495, DOI: 10.1080/02640410903582750.
- 26 Gabbett, T., & Masters, R. (2011). Challenges and solutions when applying implicit motor learning  
27 theory in a high performance sport environment: Examples from Rugby League. *International Journal*  
28 *of Sports Science & Coaching*, 6(4), 567-575.

- 1 Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston: Houghton Mifflin.
- 2 Hair, G., Black, B., Babin, B., Anderson, R., & Tatham, R. (2010). *Multivariate Data Analysis* (7th  
3 Edition). Upper Saddle River, New Jersey: Pearson.
- 4 Hancock, D. J., Young, B. W., & Ste-Marie, D. M. (2011). Effects of a rule change that eliminates  
5 body-checking on the relative age effect in Ontario minor ice hockey. *Journal of Sports Sciences*,  
6 29(13), 1399-406, DOI: 10.1080/02640414.2011.593040.
- 7 Harvey, S., & Light, R. (2015). Questioning for learning in game-based approaches to teaching and  
8 coaching. *Asia-Pacific Journal of Health, Sport and Physical Education*, 6(2), 175-190.
- 9 Hutcheson, G. D., & Sofroniou, N. (1999). *The Multivariate Social Scientist: Introductory statistics*  
10 *using generalized linear models*. Thousand Oaks, CA: Sage Publication.
- 11 Jones, R. L., Harris, R., & Miles, A. (2009). Mentoring in sports coaching: A review of the literature.  
12 *Physical Education and Sport Pedagogy*, 14(3), 267-284.
- 13 Jordet, G. (2005a). Applied cognitive sport psychology in ball sports: an ecological approach. In R.  
14 Stelter and K.K Roessler (Eds.), *New approaches to sport and exercise psychology* (pp.147-174).  
15 Aachen, Germany: Meyer & Meyer Sport.
- 16 Jordet, G. (2005b). Perceptual training in soccer: An imagery intervention study with elite players.  
17 *Journal of Applied Sport Psychology*, 17, 140-156.
- 18 Jordet, G. (2008). *Visual exploration in premier league footballers*. 13<sup>th</sup> Annual ECSS Congress, July  
19 9-12, 2008.
- 20 Jordet, G., Bloomfield, J., & Heijmerikx, J. (2013). *The hidden foundation of field vision in English*  
21 *Premier League soccer players*. MIT SLOAN Sports Analytics Conference Research Paper.
- 22 Katis, A., & Kellis, E. (2009). Effects of small-sided games on physical conditioning and performance  
23 in young soccer players. *Journal of Sports Science and Medicine*, 8(3), 374-380.
- 24 Light, R. L., & Harvey, S. (2015). Positive pedagogy for sport coaching. *Sport, Education and Society*,  
25 18, 407-423.
- 26 McGuckian, T. B., Cole, M. H., & Pepping, G.-J. (2018). A systematic review of the technology-based  
27 assessment of visual perception and exploration behaviour in association football. *Journal of Sports*  
28 *Sciences*, 36(8), 861-880.

- 1 McGuckian, T. B., Askew, G., Greenwood, D., Chalkley, D., Cole, M. H., & Pepping, G.-J. (2017).  
2 The impact of constraints on visual exploratory behaviour in football. In J. A. Weast-Knapp & G.-J.  
3 Pepping (Eds.), *Studies in Perception & Action XIV: Nineteenth International Conference on*  
4 *Perception and Action* (pp. 85 - 87). Abingdon, UK: Taylor & Francis.
- 5 Mooi, E., & Sarstedt, M. (2011). *A concise guide to market research*. Berlin: Springer-Verlag.
- 6 O'Connor, D., Larkin, P., & Williams, A. M. (2017). What learning environments help improve  
7 decision-making? *Physical Education and Sport Pedagogy*, 22(6), 647-660.
- 8 O'Connor, D., Larkin, P., & Williams, A. M. (2018). Observations of youth football training: How do  
9 coaches structure training sessions for player development? *Journal of Sports Sciences*, 36(1), 39-47.
- 10 Nelson, L., Cushion, C., & Potrac, P. (2013). Enhancing the provision of coach education: the  
11 recommendations of UK coaching practitioners. *Physical Education & Sport Pedagogy*, 18(2), 204-  
12 218.
- 13 Partington, M., & Cushion, C. (2013). An investigation of the practice activities and coaching  
14 behaviors of professional top-level youth soccer coaches. *Scandinavian Journal of Medicine &*  
15 *Science in Sports*, 23, 374-382.
- 16 Partington, M., Cushion, C., & Harvey, S. (2014). An investigation of the effect of athletes' age on the  
17 coaching behaviours of professional top-level youth soccer coaches. *Journal of Sports Sciences*, 32(5),  
18 403-414, DOI:10.1080/02640414.2013.835063.
- 19 Patton, M. Q. (2015). *Qualitative Research & Evaluation Methods: Integrating theory and practice* (4<sup>th</sup>  
20 edition). London: Sage.
- 21 Pocock, C., Dicks, M., Thelwell, R. C., Chapman, M., & Barker, J. B. (2017). Using an imagery  
22 intervention to train visual exploratory activity in elite academy football players. *Journal of Applied*  
23 *Sport Psychology*, DOI:10.1080/10413200.2017.1395929.
- 24 Roca, A., Ford, P.R., McRobert, A.P., & Williams, A.M. (2011). Identifying the processes underpinning  
25 anticipation and decision-making in a dynamic time-constrained task. *Cognitive Processing*, 12(3), 301-  
26 310.
- 27 Smith, A.C., Roberts, J.R., Kong, P.W., Wallace, E., & Forrester, S. (2015). Golf Coaches' Perceptions  
28 of Key Technical Swing Parameters Compared to Biomechanical Literature. *International Journal of*  
29 *Sports Science and Coaching*, 10(4), 739-755, DOI: 10.1260/1747-9541.10.4.739.

- 1 Sparkes, A. C. (1998). Validity in qualitative inquiry and the problem of criteria: Implications for sport  
2 psychology. *Sport Psychologist*, 12(4), 363-386.
- 3 Stoszkowski, J., & Collins, D. (2016). Sources, topics and use of knowledge by coaches. *Journal of*  
4 *Sports Sciences*, 34(9), 794-802, DOI:10.1080/02640414.2015.1072279.
- 5 Thomas, J.R., & Nelson, J.K. (1996). *Research methods in physical activity* (3rd Edition). Champaign,  
6 IL: Human Kinetics.
- 7 Thomas, G. L., & Wilson, M. R. (2014). Introducing children to rugby: elite coaches' perspectives on  
8 positive player development. *Qualitative Research in Sport, Exercise and Health*, 6(3), 348-365.
- 9 Thomas, G. L., Coles, T., & Wilson, M. R. (2017): Exploring mini rugby union coaches' perceptions  
10 of competitive activities. *Sports Coaching Review*, 6(1), 94-107,  
11 DOI:10.1080/21640629.2016.1244425.
- 12 Timmerman, E. A., Farrow, D., & Savelsbergh, G. J. P. (2017). The effect of manipulating task  
13 constraints on game performance in youth field hockey. *International Journal of Sports Science &*  
14 *Coaching*, 12(5), 588-594.
- 15 Vaeyens, R., Lenoir, M., Williams, A., & Philippaerts, R. (2007). Mechanisms Underpinning  
16 Successful Decision Making in Skilled Youth Soccer Players: An Analysis of Visual Search Behaviors.  
17 *Journal of Motor Behavior*, 39(5), 395-408.
- 18 van der Kamp, J., & Dicks, M. (2017). Looking further! The importance of embedding visual search in  
19 action. *Behavioral and Brain Sciences*, e158, 45-46.
- 20 van der Kamp, J., Rivas, F., van Doorn, H., & Savelsbergh, G. (2008). Ventral and dorsal system  
21 contributions to visual anticipation in fast ball sports. *International Journal of Sport Psychology*, 39(2),  
22 100-130.
- 23 van Maarseveen, M. J., Oudejans, R. R., Mann, D. L., & Savelsbergh, G. J. (2016). Perceptual-cognitive  
24 skill and the in situ performance of soccer players, *The Quarterly Journal of Experimental Psychology*,  
25 17, DOI: 10.1080/17470218.2016.1255236
- 26 Ward, P., & Williams, A. M. (2003). Perceptual and cognitive skill development in soccer: The  
27 multidimensional nature of expert performance. *Journal of Sport and Exercise Psychology*, 25, 93-111.

- 1 Watts, D. W., & Cushion, C. J. (2017). Coaching journeys: longitudinal experiences from professional  
2 football in Great Britain. *Sports Coaching Review*, 6(1), 76-93.
- 3 Whelan, N., Kenny, I. C., & Harrison, A. (2016). An Insight into Coaches' Knowledge and Use of  
4 Sprinting Drills to Improve Sprinting Technique and Performance. *International Journal of Sports  
5 Science & Coaching*, 11(2), 182-190.
- 6 Whitehead, A. E., Taylor, J. A., & Polman, R. C. (2016). Evidence for Skill Level Differences in the  
7 Thought Processes of Golfers During High and Low Pressure Situations, *Frontiers in Psychology*, 7(6),  
8 1974, DOI: 10.3389/fpsyg.2015.01974
- 9 Whitehead, A. E., Cropley, B., Huntley, T., Miles, A., Quayle, L., & Knowles, Z. (2016). 'Think  
10 Aloud': Toward a Framework To Facilitate Reflective Practice Amongst Rugby League Coaches,  
11 *International Sport Coaching Journal*, 3(3), 269-286.
- 12 Williams, A. M., & Davids, K. (1998). Visual search strategy, selective attention, and expertise in  
13 soccer. *Research quarterly for exercise and sport*, 69(2), 111-128.
- 14 Williams, A.M., Hodges, N.J., North, J., & Barton, G. (2006). Perceiving patterns of play in dynamic  
15 sport tasks: Investigating the essential information underlying skilled performance. *Perception*, 35,  
16 317-332.
- 17 Williams, A. M., Ford, P. R., Eccles, D. W., & Ward, P. (2011). Perceptual-cognitive expertise in sport  
18 and its acquisition: Implications for applied cognitive psychology. *Applied Cognitive Psychology*,  
19 25(3), 432-442.