

1 **Visual exploratory activity in elite women's soccer: An analysis of the**
2 **UEFA Women's European Championship 2022**

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32 Recent research has developed understanding of the technical and tactical
33 determinants of success in elite women's soccer, however a lack of research
34 exists on analysing how elite female players visually explore their environment to
35 support skilled soccer performance. This study aimed to describe the visual
36 exploratory activity (VEA) of elite female central midfield players and
37 understand the relationships between VEA, performance with the ball and
38 specific contextual and situational factors. Thirty female central midfield players
39 (M age = 26.7 years, SD = 3.8) from the eight teams who competed in the knock-
40 out stages of UEFA Women's European Championship 2022 were analysed.
41 Television broadcast and UEFA tactical footage were combined to analyse
42 players across the seven knock-out stage matches, totalling 1,038 individual ball
43 possessions. The mean scan frequency before receiving the ball was 0.35
44 scans/second. Results showed pitch location when receiving the ball to be the
45 main predictor of scan frequency, which in turn predicted action result (p =
46 0.003) and turn with the ball (p = 0.003). Scan frequencies were lower compared
47 to men's elite and academy players. This study sets a platform for experimental
48 research to further our understanding of VEA and performance with the ball in
49 women's soccer.

50 Key Words: central midfielders, scan frequency, women's soccer (football),
51 visual perception, exploratory activity.

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61 **Introduction**

62 Soccer is a dynamic invasion game that requires players to have awareness of the movements
63 of the ball, teammates, and opposition players (Pokolm, 2021). Skilled performance requires
64 players to visually explore their surroundings to identify opportunities for action (McGuckian
65 et al., 2018). Visual exploratory activity (VEA), or ‘scanning’ as typically referred to by
66 coaches (Eldridge et al., 2023), when one’s team is in possession of the ball can be defined as
67 a head or body movement where a player’s face is temporarily directed away from the ball to
68 locate teammates, opposition players or empty space, before engaging with the ball (Jordet et
69 al., 2020). In men’s soccer, players who engage in more frequent VEA typically perform
70 more successful actions with the ball (e.g., higher pass success rates; Aksum et al., 2021;
71 Jordet et al., 2020). However, there is a lack of understanding of how elite female players
72 engage in VEA to support skilled performance. Recent literature has identified differences
73 between male and female soccer in both tactical elements such as pass accuracy, ball
74 recovery time (Pappalardo et al., 2021) and the start and development of possession
75 (Mitrotasios et al., 2022), as well as specific physiological characteristics (de Araújo et al.,
76 2020). With research identifying tactical differences between men’s and women’s soccer, and
77 VEA having previously been shown to be important for skilled performance in men’s soccer,
78 there is a need to analyse VEA and performance with the ball in elite women’s soccer.

79 Women’s soccer is currently experiencing a dramatic increase in popularity and
80 professionalism (Griffin et al., 2020; Okholm Kryger et al., 2021), with the UEFA Women’s
81 European Championship 2022 (UEFA Women’s Euro 2022) setting a record aggregate
82 attendance of 574,875 and the Championship having been watched by over 365 million
83 people globally (UEFA, 2022). To date, research into women’s soccer has largely focused on
84 the physical (Vescovi et al., 2021) and physiological demands of the game (Datson et al.,
85 2014; Martínez-Lagunas et al., 2014). Current literature has also emphasised the importance

86 of understanding technical and tactical characteristics of the game (de Jong et al., 2020; de
87 Jong et al., 2023). When compared to elite men's soccer, elite women's soccer appears to
88 adopt a more attacking style of play, possession is lost more frequently, and passes are
89 performed with less accuracy (Bradley et al., 2014; Garnica-Caparros & Memmert, 2021).
90 These differences could have potential links to how a player visually explores their
91 environment to inform their subsequent action with the ball. Previous literature has also
92 found the more successful teams in elite women's soccer are those who maintain longer
93 spells of possession (Iván-Baragaño et al., 2022; Maneiro et al., 2020; Soroka & Bergier,
94 2010), make more passes resulting in goal scoring opportunities (Kubayi & Larkin, 2020),
95 and have high interconnectivity with more successful ball transfers and effective ball
96 movements (de Jong et al., 2023). It appears that successful women's teams are those which
97 are highly interconnected and able to effectively transfer and move the ball quickly to create
98 goal scoring opportunities, factors which are related to the ability to effectively pick up
99 information from the environment. Also, with central midfield players being mainly located
100 in central areas of the pitch, research has suggested central midfielders may play a crucial
101 role in successful ball transfers in teams that achieve international or domestic success (de
102 Jong et al., 2023). These findings demonstrate the importance of maintaining possession and
103 highlight the potential significance of VEA in elite women's soccer.

104 Previous studies investigating VEA in elite men's soccer have focused on
105 understanding the influence of contextual factors on performance with the ball (Aksum et al.,
106 2021; Jordet et al., 2020; Pokolm et al., 2022). Notable findings have identified positive
107 relationships between VEA and pass success (Aksum et al., 2021; Jordet et al., 2013), as well
108 as VEA being constrained by pitch location, playing position, phase of play (McGuckian et
109 al., 2020) and opponent pressure (Jordet et al., 2020). More specifically, research has found
110 central midfield players have higher scan frequencies compared to wide players (Pocock et

111 al., 2019), central defenders and strikers (Aksum et al., 2021; Jordet et al., 2020). Central
112 midfielders are frequently required to pass the ball forwards and turn with the ball,
113 highlighting the need for players to have a 360-degree visual input to pick up information
114 (Phatak & Gruber, 2019). Despite comprehensive observational studies into VEA in soccer
115 (see Jordet et al., 2020; Pokolm et al., 2022), there is limited evidence on the influence of
116 game-related contextual and situational factors on a female soccer player's VEA and
117 subsequent performance with the ball.

118 The importance of VEA in soccer and the influence of contextual factors can be
119 conceptually explained through the cyclical relationship between perception and action
120 (Gibson, 1979). Soccer players engage in eye, head, and body movements to pick-up the most
121 relevant environmental information, therefore recognising affordances (Pokolm et al., 2022;
122 McGuckian et al., 2018). Affordances can be defined as opportunities for action that the
123 environment provides an individual in relation to an individual's action capabilities (Gibson,
124 1979; Fajen et al., 2009). For example, a central midfielder may receive a pass from a team-
125 mate whilst facing the goal their team is defending. Prior to the ball arriving, the player may
126 search their environment for affordances, dependent on the location of teammates, opposition
127 players and empty spaces located behind them. Through exploring the environment and
128 depending on their own action capabilities, the player can recognise relevant affordances (e.g.
129 turn; pass; dribble) and prospectively control actions with the ball (Fajen et al., 2009). A
130 higher frequency of VEA could therefore underpin the search for more information to act
131 upon, which may be linked to more effective performance with the ball.

132 Despite increasing interest in elite women's soccer, a lack of empirical evidence
133 exists to investigate VEA and its contribution to successful performance. Previous literature
134 has highlighted the need further investigate the technical and tactical match-play
135 characteristics in women's soccer to gain a more holistic insight into match performance

136 (Harkness-Armstrong et al., 2022). Taking this into account alongside the growing body of
137 work into VEA in elite men’s soccer (see Eldridge et al., 2023; Jordet et al., 2020), there is a
138 need to understand the role VEA plays in elite women’s soccer, particularly in central
139 midfield players. Therefore, the aim of this study is to describe the visual exploratory
140 activity of elite female central midfield players and understand the relationships between
141 VEA, performance with the ball and specific contextual and situational factors in elite
142 women’s soccer.

143 Figure 1 presents the hypothesised relationships based on current research evidence.
144 Each arrow represents a potential relationship between VEA (scan frequency), contextual
145 (“on or around the ball”), situational (“off the ball”) and performance with the ball factors. It
146 is hypothesised that central pitch locations will elicit higher scan frequencies compared to
147 wide locations on the pitch and players experiencing higher amounts of opponent pressure
148 will result in lower scan frequencies compared to players experiencing lower amounts of
149 opponent pressure. Higher scan frequencies will be observed when the score line is a draw
150 compared to winning and losing and when the score line is losing compared to winning.
151 These hypotheses are informed by findings in men’s soccer from Jordet et al. (2020) who
152 found game standing to be significantly related to scan frequency. Therefore, it is predicted in
153 the current study that higher scan frequencies will be observed when the score line is a draw
154 compared to winning and losing and when the score line is losing compared to winning.
155 Higher scan frequencies will be observed in earlier stages of a game (between 0-15 minutes)
156 compared to later stages of a game (>75 minutes) as well as in the final compared to the
157 semi-finals and quarter final matches. Due to limited research that currently exists
158 investigating the influence of contextual factors on scan frequency, these hypotheses are
159 presented following tendencies and trends found in previous literature in elite men’s soccer
160 (see Fernandes et al., 2020; Jordet et al., 2020). For the factors that may be influenced by scan

161 frequency, it is hypothesised that higher scan frequencies will result in more successful
162 actions with the ball, more forward passes compared to sideways and backwards passes, more
163 passes completed over greater distances (e.g., 15-34 m and 35 m +) compared to shorter
164 passes (e.g., 0-14 m), more forwards and sideways orientated body positions compared to a
165 backwards orientated body position and more turns with the ball.

166 **Method**

167

168 **Insert Figure 1 near here**

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171 ***Participants***

172 Participants were thirty female central midfield players (M age = 26.7 years, SD = 3.81) from
173 the eight teams who competed in the knock-out stages of UEFA Women's Euro 2022.
174 Knock-out stage matches were selected to include the top eight European teams in the
175 championship, similar to the approach of Aksum et al. (2021). All players satisfied the
176 following inclusion criteria: i) to have competed in a minimum of two out of three group-
177 stage matches, ii) to have accumulated a minimum of 150 minutes playing time over the
178 course of the UEFA Women's Euro 2022 and iii) to be classified as a central midfield player
179 based upon UEFA tactical line-ups for each knock-out stage match. The current
180 investigations inclusion criteria is similar to that reported in previous literature into VEA in
181 men's soccer (Phatak & Gruber, 2019). Due to the observational nature of the study involving
182 elite female soccer players in their natural sport setting (matches of an international
183 tournament), no informed consent was gained due to data being analysed using broadcast

184 footage which was publicly available. Ethical approval was granted from the lead author's
185 institution.

186 *Footage*

187 Two types of match footage were obtained for the current study. Firstly, broadcast
188 angle footage was obtained through screen-recording publicly available televised footage, as
189 well as UEFA tactical camera (wide angle) footage. The video quality of the UEFA tactical
190 camera footage was 1920x1080 ('Full HD'). All footage was then imported into Hudl
191 Sportscode (Hudl, Nebraska, USA) with the broadcast footage synced and aligned with
192 UEFA wide angle footage which resulted in split screen footage being generated to enable all
193 players to be on screen at all times. All matches were analysed on a Dell Computer
194 (Windows 10) at a resolution of 1920 x 1080 connected to an Apple MacBook Pro (Version
195 12.6.3). In instances where a player was visible on the broadcast footage and then left the
196 televised picture, the remainder of the instance was analysed using the UEFA tactical camera
197 footage. A total of 402 instances were analysed solely using broadcast footage and 636
198 instances analysed using the broadcast footage and tactical camera footage specifically
199 provided by UEFA.

200 *Procedures*

201 Prior to data collection, pilot testing was conducted by analysing the Women's FA
202 Cup Final 2022 to allow the researcher to identify any issues with the operational definitions
203 and code window. As a result of the pilot test, minor changes were made to the operational
204 definitions of action type, turn with the ball and line break. A ball possession in the current
205 study was defined as a player receiving the ball from a teammate and performing an action
206 with the ball (e.g., a pass). For an instance (individual ball possession) to be included in the
207 final analysis all instances were required to meet specific inclusion criteria (see Table 1).

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209

****Insert Table 1 near here****

210

211 ***Data Collection***

212 *Phase 1*

213 All knockout matches were coded using a bespoke code window, which included the
214 creation of a ‘contextual’ (including performance with the ball factors) and ‘situational’
215 window. All instances were labelled with situational factors (“off the ball”) which were then
216 edited to capture the final 10 seconds prior to the analysed player receiving the ball from a
217 teammate, or from the point when the analysed player’s team won possession of the ball
218 during the 10 s interval. The 10 second cut-off point was chosen to allow comparison to be
219 made with previous studies into VEA in elite male soccer (see Aksum et al., 2021; Jordet et
220 al., 2020).

221 *Phase 2*

222 Contextual factors (“on or around the ball”) were labelled with the exception of pass
223 distance and opponent pressure. To adequately analyse the players’ scans, the magnifying
224 trackable zoom feature tool was utilised to track the analysed players’ scans throughout the
225 10 second interval. This magnifying zoom feature was placed over the individual player
226 being analysed and then tracked the movements of the player through the 10 second interval.
227 This feature was used in combination with reducing the speed of each instance by 50% in
228 order to accurately capture all head and or body movements of the analysed players between
229 the 5-10 second interval. The ruler feature was utilised to measure pass distance and
230 opponent pressure which uses 3-D calibration technology where X and Y coordinates track

231 the movements of the players and the ball. Similar methods have been previously used by
232 OPTA statistics which has demonstrated high levels of reliability (Bradley et al., 2007; Liu et
233 al., 2013). Known distances of goal-line to six yard box, goal-line to 18-yard box and goal-
234 line to penalty spot were measured and checked for accuracy of the ruler. For all passes
235 analysed, the ruler measuring feature in Hudl Studio which uses 3-D tracking and calibration
236 technology measured the exact point from which the ball left the analysed player's foot and
237 was then either received by a teammate, intercepted by an opposition player or the exact point
238 in which the ball left the pitch. Instances were then cut to the exact point at which the
239 analysed player received the ball from a teammate. Finally, instances from Sportscodes
240 timelines were exported as CSV files and transferred to Microsoft Excel (Microsoft
241 Corporation, Washington, USA, Version 16.67) for data analysis purposes.

242 *Measures and Variables*

243 The following variables were analysed: scan frequency, body orientation and
244 performance with the ball. Performance with the ball was split up into action type (with the
245 final action of a pass also including pass distance, pass direction and lines broken), action
246 result and turn with the ball. Pass distance categories were classified following previous
247 research in elite women's soccer (Mara et al., 2012). We present scan timing across the final
248 five seconds prior to ball contact as a result of all 1,038 instances analysed capturing the
249 analysed players VEA across the final five seconds prior to ball contact because a number of
250 instances were six, seven, eight and nine seconds in duration. To gain a more comprehensive
251 insight into how elite female central midfield players visually explore their environment, the
252 contextual variables of opponent pressure and pitch location were also investigated. All
253 operational definitions were informed by previous research and validated by a UEFA A
254 License Football Coach with 22 years soccer coaching experience (see supplementary
255 material for list of operational definitions).

256 ***Data Analysis***

257 ***Reliability***

258 An independent observer with three years' experience as a soccer analyst performed
259 additional coding on all variables to assess inter-rater reliability. A total of 156 individual ball
260 possessions were re-analysed across two matches for both inter and intra-rater reliability
261 totalling 15% of the entire sample, similar to samples presented in previous research in elite
262 men's soccer of 10% and 8.2%, respectively (Aksum et al., 2021; Jordet et al., 2020). Intra-
263 rater reliability was completed following a six-week gap to minimise the chances of any
264 potential learning effects. Intra-class correlations (ICC) were utilised for the continuous
265 variable of number of scans which formed the basis variable for scan frequency. ICC were
266 assessed following Cicchetti (1994) criteria to understand the strength of agreement between
267 two separate coders and repeated observations of the same coder (see Table 2). For all
268 remaining categorical variables, Cohen's Kappa values (Cohen, 1960) were produced for
269 both inter and intra-rater reliability with the strength of agreements classified following
270 Landis and Koch (1977) criteria (see Table 3).

271 ****Insert Table 2 near here****

272

273 ****Insert Table 3 near here****

274

275 ***Statistical Analysis***

276 All statistical analysis was conducted in RStudio (R Core Team. R, 2022). As a result
277 of only achieving a moderate agreement for the variable of 'lines broken' for inter-rater
278 reliability, the variable was not included in any statistical modelling. To achieve the first aim

279 of the study, descriptive statistics were presented for VEA (scan frequency) against each
280 variable of interest. To achieve the second aim, a linear mixed model (LMM) was built to
281 understand the relationships between scan frequency and contextual and situational variables,
282 with mixed effects logistic regression models developed to understand relationships between
283 scan frequency and performance with the ball variables.

284 A LMM was developed with the dependent variable of scan frequency and fixed
285 effects of pitch location, opponent pressure, game state, stage of competition and time in the
286 game. Repeated measurements in the data were accounted for within the random effects
287 structure of subject (player) nested within fixture. The lme4 package (see Bates et al., 2014)
288 in RStudio was used to fit the LMM. The emmeans package was used provide estimate
289 means for each variable, and the results were reported as mean \pm SE. Tukey's pairwise
290 comparisons were conducted to identify differences between individual fixed effects, with
291 statistical significance set at $p < 0.05$. The effsize package was used to calculate effect size
292 (ES), which was classified as trivial (<0.2), small (0.2-0.59), moderate (0.6-1.19), large (1.2-
293 1.99), or very large (>2.0) (Batterham & Hopkins, 2006). Effects were considered unclear if
294 the 90% confidence intervals included both positive and negative values below 0.2 (Hopkins
295 et al., 2009). The assumptions of linearity, normality of the distribution of the model and
296 homogeneity of variance were verified visually.

297 Mixed effects logistic regression models with separately considered dependent
298 variables (performance with the ball variables, see Figure 1) were developed with scan
299 frequency as a fixed effect. Mixed effects ordinal logistic regression was performed for the
300 variable pass distance using the Ordinal package (Christensen, 2018). Mixed effects binomial
301 logistic regression was performed for the variables of action result and turn with the ball
302 using the lme4 package (Bates et al., 2014). Mixed effects multinomial logistic regression
303 was performed for the variables of pass direction, action type and body orientation using the

304 Mclogit package (Elff, 2021). The random effects structure of subject (player) nested within
305 fixture was maintained. The *summary* and *anova* functions in RStudio were used to produce
306 estimates, standard errors, *z*-values, and *p*-values for the separate models built. Through
307 utilising mixed effect models, this enabled us to examine the condition/factor of interest
308 while accounting for variability within and across participants and items (Brown, 2021). For
309 all models developed the assumptions of the distribution of the model, linearity and
310 homogeneity of variance were verified visually, with the assumption of proportional odds
311 satisfied visually for the mixed effects ordinal logistic regression. Statistical significance was
312 set at $p < 0.05$.

313 **Results**

314 *Description of VEA behaviours*

315 Central midfielders ($n = 30$) recorded a mean scan frequency of 0.35 ± 0.17
316 scans/second (scans/s) prior to receiving the ball in the knock-out stages of the UEFA
317 Women's Euro 2022 ($n \text{ instances} = 1,038$). An average of 34 instances per player were
318 analysed across the knockout stages ($SD = 21.75$, $\text{min} = 7$, $\text{max} = 93$). Across the final five
319 seconds prior to receiving the ball, the highest mean scan frequency was observed in the final
320 1-2 seconds before ball contact (see Figure 2). Table 4 presents mean scan frequencies and
321 the number of instances per variable for all analysed variables except pitch location. Figure 3
322 presents mean scan frequencies, standard deviations and the number of instances analysed
323 across twelve pitch locations.

324

325 ****Insert Figure 2 near here****

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Insert Table 4 near here

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Insert Figure 3 near here

335

336 *Pitch Location and Scan Frequency*

337 Table 5 shows the estimated means \pm SE for all individual pitch locations. Pairwise
338 comparisons revealed players performed significantly more scans in DMCL compared to
339 ACL pitch locations (0.39 ± 0.02 vs 0.26 ± 0.04 scans/s; $p = 0.019$; moderate ES: $0.83 \pm$
340 0.22) and in DMCR compared to ACL pitch locations (0.39 ± 0.02 vs 0.26 ± 0.04 scans/s; $p =$
341 0.013 ; moderate ES: 0.84 ± 0.22). Significant differences were also identified in DMR
342 compared to ACL pitch locations (0.39 ± 0.02 vs 0.26 ± 0.04 scans/s; $p = 0.044$; moderate
343 ES: 0.83 ± 0.24) and in DMCL compared to AMCL (0.39 ± 0.02 vs 0.39 ± 0.02 scans/s; $p =$
344 0.007 ; small ES: 0.48 ± 0.12) and in DMCR compared to AMCL (0.39 ± 0.02 vs 0.31 ± 0.02
345 scans/s; $p = 0.004$; small ES: 0.49 ± 0.12). Figure 4 presents all small and moderate effect
346 sizes (90% Confidence intervals) within pitch location. All other pairwise comparisons
347 revealed trivial or unclear effect sizes.

348 *Opponent Pressure and Scan Frequency*

349 There were no significant differences between different amounts of opponent
350 pressure. Pairwise comparisons revealed players performed more scans when opponent

351 pressure was at 7-9 m compared to 0-3 m (0.35 ± 0.03 vs 0.31 ± 0.02 scans/s; small ES: 0.22
352 ± 0.12), however the difference was not statistically significant ($p > 0.05$). Table 5 presents
353 estimated means \pm SE for all opponent pressure categories.

354 ***Game State and Scan Frequency***

355 No statistical differences, nor substantial effect sizes were identified between
356 winning, drawing and losing. Table 5 displays the estimated means \pm SE for all game state
357 categories.

358 ***Time in the Game and Scan Frequency***

359 Table 5 presents the estimated means \pm SE for all different time in the game
360 categories. Pairwise comparisons revealed players performed more scans between 0-15
361 minutes compared to 90-105 minutes (0.34 ± 0.02 vs 0.30 ± 0.03 scans/s; small ES: $0.26 \pm$
362 0.15) and between 16-30 minutes compared to 90-105 minutes (0.35 ± 0.03 vs 0.30 ± 0.03
363 scans/s; small ES: 0.31 ± 0.16), however the differences was not statistically significant ($p >$
364 0.05). Players also performed more scans between 45-60 minutes compared to 90-105
365 minutes (0.35 ± 0.02 vs 0.30 ± 0.03 scans/s; small ES: 0.31 ± 0.16) and between 61-75
366 minutes compared to 90-105 minutes (0.34 ± 0.02 vs 0.30 ± 0.03 scans/s; small ES: $0.28 \pm$
367 0.16), however the differences were not statistically significant ($p > 0.05$). All other pairwise
368 comparisons revealed trivial or unclear effect sizes.

369

370 **Insert Figure 4 near here**

371

372 ***Stage of competition and Scan Frequency***

373 No statistical differences, nor substantial effect sizes were identified between the quarter-
374 final, semi-final and final. Table 5 displays the estimated means \pm SE for all the three stages
375 of competition.

376

377

378 ****Insert Table 5 near here****

379

380 ***Scan Frequency and Action Type***

381 Results show scan frequency significantly predicted action type for dribble vs pass (β
382 = -3.68, $z = -2.55$, $p = 0.011$), with a higher scan frequency associated with a decrease in the
383 odds of choosing to dribble over pass. Higher scan frequencies were also associated with a
384 significant decrease in the odds of choosing to shoot over pass, ($\beta = -2.36$, $z = -2.48$, $p =$
385 0.013). No relationship was observed for receiving vs pass ($\beta = -1.36$, $z = -1.81$, $p = 0.070$).
386 The action type 'pass' was labelled as the reference category.

387 ***Scan Frequency and Action Result***

388 A positive relationship was identified between scan frequency and action result
389 indicating for every one-unit increase in scan frequency, the log odds of the result of the
390 action with the ball being successful increase by 1.33, while keeping all other factors
391 constant. Players demonstrated a higher scan frequency when possession was maintained (M
392 = 0.36 ± 0.17 scans/s) compared to when possession was lost after their action with the ball
393 ($M = 0.32 \pm 0.18$ scans/s). The mixed effects binomial logistic regression model was

394 statistically significant $\chi^2 (1) = 8.81, p = 0.003$. An unsuccessful action ('0') was labelled as
395 the reference category.

396 *Scan Frequency and Pass Direction*

397 Significant relationships were found between scan frequency and the direction of a
398 pass. Results show scan frequency significantly predicted pass direction for forwards pass vs
399 backwards pass, ($\beta = -0.85, z = -0.43, p = 0.049$), with a higher scan frequency associated
400 with a decrease in the odds of performing a forward pass. No relationship was observed when
401 comparing sideways vs backwards passes ($\beta = -1.07, z = -1.77, p = 0.077$). Higher scan
402 frequencies were associated with a significant decrease in the likelihood of not performing a
403 pass compared to performing a backwards pass, ($\beta = -2.59, z = -4.14, p < 0.001$). The pass
404 direction 'backwards' was labelled as the reference category.

405 *Scan Frequency and Pass Distance*

406 Scan frequency was not found to have a significant effect on pass distance ($\beta = -0.30,$
407 $SE = 0.36, p = 0.403$).

408 *Scan Frequency and Body Orientation*

409 A relationship was identified between scan frequency and body orientation. Higher
410 scan frequencies were associated with a significant decrease in the likelihood of having a
411 forward body orientation compared to a backwards body orientation, ($\beta = -1.63, z = -3.16, p =$
412 0.002). No relationship was observed when comparing sideways vs backwards body
413 orientation ($\beta = -0.84, z = -1.79, p = 0.073$). A 'backwards' body orientation labelled as the
414 reference category.

415 *Scan Frequency and Turn with the ball*

416 A positive relationship was found between scan frequency and the probability of
417 turning with the ball indicating for every one-unit increase in scan frequency, the log odds of
418 performing a turn with the ball increase by 1.58, while keeping all other factors constant.
419 Players exhibited a higher scan frequency when performing a turn with the ball ($M = 0.39 \pm$
420 0.18 scans/s) compared to when no turn with the ball was performed ($M = 0.35 \pm 0.17$
421 scans/s). The mixed effects binomial logistic regression model was statistically significant χ^2
422 $(1) = 9.02, p = 0.003$. No turn with the ball ('0') was labelled as the reference category.

423 **Discussion**

424 The purpose of this study was to describe the visual exploratory activity (VEA) of
425 elite female central midfield players and understand the relationships between VEA,
426 performance with the ball and specific contextual ("on or around the ball") and situational
427 ("away from the ball") factors. Results showed that pitch location was a significant predictor
428 of scan frequency where players performed a higher number of scans in central defensive
429 midfield pitch locations compared to defensive midfield wide and attacking central or wide
430 pitch locations. Additionally, scan frequency was found to be a significant predictor for a
431 number of performance with the ball variables. Higher scan frequencies resulted in an
432 increased likelihood of performing a successful action with the ball and performing a turn
433 with the ball. VEA appears linked to a player's performance with the ball and seems to vary
434 depending on contextual demands (i.e. pitch location).

435 The first aim of this study was to describe VEA in elite central midfield players
436 across the knock-out stages of the UEFA Women's EURO 2022. Players performed on
437 average 3-4 scans in the final 10 seconds before receiving the ball (scan frequency = $0.35 \pm$
438 0.17 scans/s). This average is lower than that of similar studies investigating VEA in elite
439 male youth (0.42 scans/s in U17 and U19's; Aksum et al., 2021) and professional male soccer

440 (0.44 scans/s; Jordet et al., 2020) players. These differences in findings could be linked to the
441 higher passing tempo in elite men's soccer compared to elite women's soccer (Mitrotasios et
442 al., 2022), which could in turn influence the frequency and timing of how a player needs to
443 scan their environment. For example, we might expect a relationship between a higher
444 passing tempo and an increase in scan frequency, as a result of players being required to have
445 a greater understanding of their environment due to the ball arriving at their feet quicker.
446 Similarly, with a slower passing tempo, we may expect lower scan frequencies due to players
447 potentially having more time and space to scan their environment and so may perform scans
448 of a longer duration that are less frequent. Aksum et al. (2021) found U19 male soccer
449 players conducted their final scans significantly closer to ball contact compared to U17
450 players. It was suggested that the increase in tempo demands of the U19 game may provide
451 an explanation for this finding (Aksum et al., 2021). Therefore, it could be suggested that a
452 slower passing tempo may lead players to scan their environment less frequently.

453 In line with previous work (e.g., Aksum et al., 2021), we measured scan frequency up
454 to ten seconds prior to receiving the ball. To understand the timing of a 'final scan' before
455 completing an action, we also measured the timing of scans in the final five seconds relative
456 to a player receiving the ball. Data showed that scan frequency was highest in the final 1-2
457 seconds prior to receiving the ball. A potential explanation for this finding is that players may
458 direct their attention away from the ball in the final two seconds before ball contact to receive
459 the most up to date information from the environment to subsequently inform their actions
460 with the ball (Aksum et al., 2021; McGuckian et al., 2018). Previous research in men's soccer
461 has found players that perform more scans in the one and two seconds prior to receiving the
462 ball were more likely to turn with the ball (McGuckian et al., 2018). Therefore, in the context
463 of the current study, by performing scans closer to receiving the ball, central midfield players
464 may become more attuned to dynamically evolving game situations to enable them to make

465 the most appropriate action with the ball using the most relevant information (Aksum et al.,
466 2021). Rather than players simply increasing scan frequency, there appears a need to
467 understand where and when players should scan to inform coaching interventions.

468 In line with our hypotheses, results showed pitch location when receiving the ball to
469 be a significant predictor of scan frequency. The highest scan frequencies were observed in
470 defensive midfield central left and right locations, with findings also showing higher scan
471 frequencies observed in defensive midfield wide locations, compared to attacking wide
472 locations. These findings align with current literature on VEA in elite men's youth (Aksum et
473 al., 2021) and adult male soccer (Jordet et al., 2020) which has found players scan more
474 frequently in central pitch locations compared to peripheral pitch locations. Central midfield
475 players are often required to drop deeper to collect the ball and so are required to have a
476 greater awareness of their surroundings due to also being surrounded by teammates (Aksum
477 et al., 2021; Jordet et al., 2020). More specifically, central midfield players may also be more
478 inclined to perform a greater number of scans in defensive midfield central pitch locations
479 due to the potentially detrimental consequences of losing possession (Jordet et al., 2020).
480 This current finding can be further explained by research that has found the more successful
481 women's teams appear to be highly centralised and interconnected, with suggestions that
482 midfielders play a crucial role in performing a high volume of passes through central areas of
483 the pitch (de Jong et al., 2023). Taken together, it seems players when receiving the ball in
484 defensive central midfield positions scan their environment more frequently to identify
485 multiple passing options, with this pitch location being particularly important for progressing
486 play and starting attacks. Therefore, pitch location appears an important variable when
487 understanding VEA in elite women's soccer.

488 Contrary to our hypotheses, no relationship was observed between opponent pressure
489 and scan frequency. Findings revealed players appeared to perform more scans when

490 experiencing less defensive pressure (i.e. when the distance to the nearest opponent was 7-9
491 metres away compared to 0-3 metres away), however only a small and non-significant effect
492 was identified (0.04; small ES: 0.22 ± 0.12). Research has found central locations of the pitch
493 tend to be highly congested, with playing spaces in the centre of the pitch observed to be
494 wider than they are deeper, with suggestions that successful possession may be more likely to
495 be maintained in wide, shallow areas of the pitch compared to central areas (Zubillaga et al.,
496 2013). Previous research investigating VEA in youth men's soccer found significant
497 differences between scan frequency and opponent pressure, with higher amounts of opponent
498 pressure resulting in lower scan frequencies compared to when experiencing low amounts of
499 opponent pressure (Aksum et al., 2021; Pokolm et al., 2022). The disparities in findings could
500 be attributed to differences across age groups and playing positions being investigated (e.g.
501 elite youth male defenders, midfielders, and attackers vs elite women's soccer central
502 midfield players). Future research should aim to further investigate the influence of opponent
503 pressure across different playing positions, as well as investigate a potential relationship
504 between pitch location and opponent pressure.

505 No relationships were found between situational variables (state of the game, time in
506 the game and stage of competition) and scan frequency. A possible explanation for this could
507 be attributed to all matches being played in a major senior international tournament with all
508 games being highly pressurised knock-out matches. Our data further suggests VEA is highly
509 individualised and unique to each player with regards to how a player visually explores their
510 environment. Previous research into visual search behaviours in men's soccer has emphasised
511 the importance understanding individuals strengths and weaknesses relative to their own
512 action capabilities as this may constraint one's ability to pick up the most important
513 information during visually guided behaviours (Button et al., 2011). Future research should

514 therefore consider analysing these factors not in isolation, but in the context of other variables
515 to understand the influence these factors have on how a player scans their environment.

516 Scan frequency was a significant predictor of both action result and turn with the ball.
517 Higher scan frequencies resulted in increased odds of performing a successful action with the
518 ball and turning with the ball. Applied to the context of the current study, if a player has an
519 enhanced understanding of their surroundings as a result of frequently exploring their
520 environment, they may be more likely to perform a turn with the ball in order to identify
521 potential empty space in an opposition's defensive structure. Research investigating
522 possession tactics in UEFA Women's Euro 2022 (O'Donoghue & Beckley, 2023) found the
523 most successful possessions were those of nine or more passes at a slower pass rate. These
524 findings highlight the importance of well-constructed build-up play where possession is
525 developed gradually resulting in more goal-scoring opportunities being created. In elite men's
526 soccer, players scanned significantly more when possession was maintained (Jordet et al.,
527 2020) and a higher likelihood of turning with the ball was identified with a higher exploration
528 excursion and exploratory frequency (McGuckian et al., 2018). Therefore, with the current
529 study finding a significant relationship between scan frequency and action result (i.e. higher
530 scan frequencies resulting in players being more likely to maintain possession of the ball),
531 this could have important implications for elite women's soccer.

532 Higher scan frequencies resulted in decreased odds of players choosing to dribble or
533 shoot compared to pass. This aligns with research into elite men's soccer which has found a
534 higher likelihood of players performing a pass compared to a shot, dribble or receiving
535 (Jordet et al., 2020). Contradictory to our hypotheses, higher scan frequencies resulted in
536 decreased odds of players performing a forward pass compared to a backwards pass and
537 receiving the ball in a forward body orientation compared to a backwards orientation. This
538 accumulation of evidence contradicts that of previous research into elite youth soccer which

539 found higher scan frequencies have been associated with more forward passes compared to
540 backwards passes (Eldridge et al., 2013) and research into elite youth soccer identifying
541 higher scan frequencies resulted in more forwards and sideways body orientations compared
542 to backwards (Aksum et al., 2021). A potential explanation for the differences in findings
543 could be reflected by differences in developmental activities where literature has found elite
544 women's soccer players may have spent less time in formalised training during early
545 adolescence (e.g. academies) and so may have a lower 'training age' compared to elite male
546 players (Ford et al., 2020). As a result, less time may have been spent developing specific
547 technical and perceptual-cognitive skills, such as decision making and visual search
548 (Pappalardo et al., 2021). Moreover, these contradictory findings can be further explained by
549 research into the technical and tactical demands of elite male and women's soccer, which has
550 found possession is lost more frequently, and passes are performed with less accuracy in elite
551 women's soccer compared to elite men's soccer (Bradley et al., 2014; Garnica-Caparros &
552 Memmert, 2021). Therefore, these differences in the technical and tactical demands of the
553 game provide additional explanations for the differences in findings between the current
554 study and that found in previous research in elite men's soccer. No relationship was identified
555 between scan frequency and pass distance, with a potential reason for this being the
556 combination of the study's random effects structure nesting players within fixtures as well as
557 a considerably greater number of ball possessions analysed falling in the '0-14m' category
558 compared to the '35m+' category (565 v 52) resulting in this analysis potentially being
559 underpowered. Consolidating the above-mentioned findings, higher scan frequencies were
560 associated with a high likelihood of players performing a pass over a shot, dribble or
561 receiving as well as receiving the ball with a backwards body orientation and performing a
562 backwards pass. This collection of evidence provides an initial insight into the relationships
563 between VEA and a players performance with the ball.

564 Current findings can be interpreted through the lens of ecological psychology and
565 Gibson's (1979) concept of affordances. Gibson's (1979) ecological approach to visual
566 perception places an emphasis on the reciprocal nature of perception and action suggesting
567 how the pickup of information from the environment is as an active process which involves
568 the mobile body (see Fajen et al., 2009). Applied to the findings of the current study, if a
569 player scans their environment more frequently, they may be more likely to see a greater
570 number of opportunities for action (affordances), whilst having a better understanding of the
571 positions of teammates and opposition players. Research has suggested that a player can turn
572 their head frequently to perceive affordances in the playing environment, but their ability to
573 act upon this information remains grounded in their own action capabilities (Fajen et al.,
574 2009; Pocock et al., 2019). Therefore, from a theoretical perspective, our study reinforces the
575 coupling of perception and action, with players appearing to support performance by visually
576 exploring their environment immediately prior to engaging with the ball.

577 Based upon the study's findings we propose some practical implications. Our results
578 revealed differences in VEA across pitch locations as well as VEA being related to a player's
579 performance with the ball. It is recommended that coaches design practice activities where
580 central midfield players are exposed to a high volume of passes being received in central
581 defensive pitch locations with an emphasis on linking their visual exploratory activity to their
582 subsequent actions with the ball. Coaches should further strive to provide players with active
583 decision-making practices (e.g. small-sided or full sided game related practices) that involve
584 modifications placed upon the game (Eldridge et al., 2023). This may allow for players to be
585 exposed to frequently occurring in-game situations with sufficient contextual variation, for
586 example receiving the ball under varying amounts of opponent pressure with different body
587 orientations (Pokolm et al., 2022). Therefore, is strongly encouraged that practices are
588 designed to promote the coupling of perception and action whilst taking into consideration

589 the context and environment in which players visually explore their environment to support
590 skilled performance. It is also worth highlighting how current findings have been compared
591 and contrasted to that of VEA in elite and youth and men's soccer. Research has highlighted
592 how professional women's soccer has been required to adapt to the rules and regulations of
593 men's soccer, with evidence suggesting soccer may be more demanding for female players
594 (Pedersen et al., 2019). Current findings shine a light on the challenges and difficulties of
595 comparing men's and women's soccer and so it is imperative to design practice environments
596 that are tailored specifically to women's soccer. For example, based upon the current study's
597 findings, coaches should aim to design practice activities that encourage central midfield
598 players to develop not just scan frequency, but also the timing of their scans relative to ball
599 contact. When receiving the ball in central locations of the pitch coaches are encouraged to
600 develop a player's ability to scan their environment in the final seconds prior to ball contact
601 in order for players to identify the most up to date information from the environment.

602 The findings presented here should be considered in the context of some limitations.
603 Firstly, the data presented is from one international tournament investigating central midfield
604 players in isolation and so the results may not necessarily be representative of other
605 populations and leagues. Secondly, the number of individual ball possessions analysed is
606 relatively low ($n = 1,038$) in comparison to studies in men's soccer which were conducted in
607 a similar vein (Pokolm et al., 2022; $n = 5,338$) and so findings must be interpreted and
608 applied with caution. Also, as a result of achieving a moderate agreement for the variable
609 'lines broken', this variable was not included in any statistical modelling. In future research,
610 one approach to improving the inter-rater reliability of the variable 'lines broken', is to
611 conduct further video familiarisation. For example, to achieve greater consistency, both
612 coders could be presented with numerous video examples of passes that broke and did not
613 break an oppositions line of defence, and the coders would then justify their decisions whilst

614 referring back to the operational definition. Whilst important to recognise these limitations,
615 we provide a number of recommendations for how future research can address these
616 limitations. Future investigations should aspire to further understand how both contextual and
617 situational factors influence a player's VEA with a potentially fruitful avenue to explore VEA
618 in the context of positional differences whilst coupling this to performance with the ball.
619 Additionally, future work should investigate VEA in more in-situ and immersive
620 environments which may provide an insight into understanding the type of practice activities
621 that develop VEA. Recent advancements in technology have opened the door on participants
622 being able to be surrounded with representative match scenarios in a 360-degree setting (see
623 Höner et al., 2023; Musculus et al., 2021; Vater et al., 2019). Therefore, a logical next step
624 appears to be to apply the study's findings in a more controlled setting by manipulating
625 variables of interest (e.g., pitch location, opponent pressure, action type). By manipulating
626 these variables in an immersive environment players could be presented with real life footage
627 from an 11v11 match and are required to visually explore their environment and make
628 decisions about their subsequent performance with the ball.

629 **Conclusion**

630 The primary objective of the study was to describe VEA in elite women's soccer as
631 well as gain insight into the potential relationships that may exist between scan frequency and
632 contextual, situational, and performance with the ball factors. The study found a significant
633 relationship between pitch location and scan frequency as well as scan frequency being a
634 significant predictor of both action result and turn with the ball. More specifically, higher
635 scan frequencies were observed in central defensive midfield pitch locations, with players
636 also more likely to perform a turn with the ball and perform a successful action with the ball
637 (maintain possession) compared to an unsuccessful action (losing possession). When
638 designing representative practice environments, pitch location seems an important variable to

639 help further understand the contextual demands associated with how a player visually
640 explores their environment to guide subsequent actions with the ball. Therefore, the study has
641 established VEA is influenced by pitch location and related to performance with the ball in
642 elite women's soccer. Future research is therefore required to extend and develop upon these
643 findings across different age groups (e.g. women's youth soccer), playing positions (e.g.
644 defenders, wide players, and forwards) and skill levels (e.g. semi-professional) as well as
645 adopting more experimental research designs to further understand the influence of VEA on
646 performance with the ball.

647

648

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653 Disclosure statement

654 Author ND is a current consultant for UEFA which enabled us access UEFA tactical footage. UEFA
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656 Data availability statement

657 All relevant data is available online from:

658 https://osf.io/2cnh7/?view_only=613db7aaada144e1abfefb648a0b272f

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661 Ethical approval

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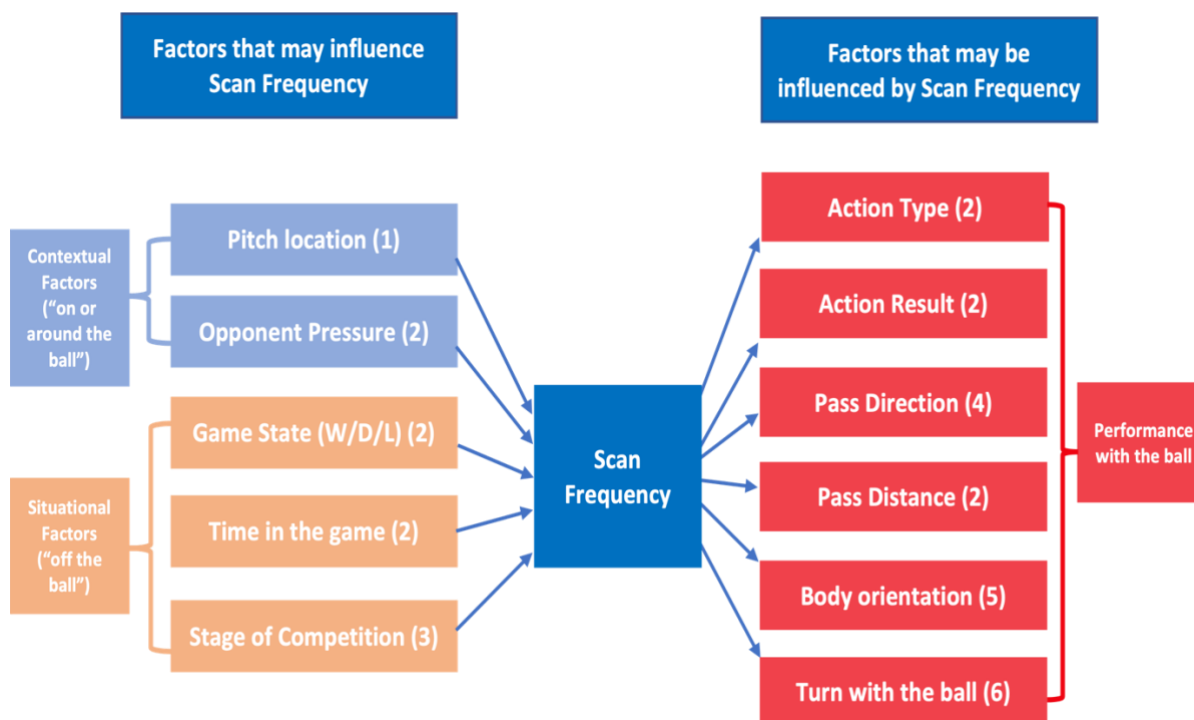
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Figure 1. Hypothesised relationships between contextual (“on or around the ball”), situational (“off the ball”), performance with the ball factors and scan frequency. Each arrow represents a hypothesised relationship. Numbers denote references for each example: (1) Aksum et al. (2021); (2) Jordet et al. (2020); (3) Fernandes et al. (2020); (4) Eldridge et al. (2013); (5) Pokolm et al. (2022); (6) McGuckian et al. (2018).



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Table 1. *Instance Inclusion Criteria*

	Explanation
1	Visual explorations (scans) were measured in possession with all head movements that occurred in the final 10 seconds prior to receiving the ball from a teammate
2	If there was a turnover of possession in the final 10 seconds prior to analysed player receiving the ball from a teammate, analysis began the moment the analysed players team received control of the ball. For example, if the opposition team had control of the ball for 4 seconds and lost possession to the analysed players team, the analysis started at 6 seconds (the moment possession was won) and finished on the analysed players first touch of the ball.
3	In situations where the opposition team made contact with the ball, however, did not have the ball under control (e.g., duelling for the ball, clearing the ball or a deflected pass), it was deemed that the analysed players team had not lost possession in our analysis.
4	For set pieces (e.g., corner kicks, throw-ins, and free kicks) the 10 second interval for analysing visual explorations was kept consistent to enable the successful registering of scans. The minimum of 5 seconds and maximum of 10 seconds interval was maintained to ensure that there was consistency across all of instances analysed. As a result of pilot testing, central midfield players prior to the ball entering play from a set play (e.g., throw-in) were scanning their environment for information prior to receiving the ball. Therefore, by maintaining the 10 second interval the aim was to minimise the chance of excluding potentially important scans that may have informed the analysed players subsequent action with the ball.
5	In instances where the analysed player received a pass from a teammate, performed a pass to a teammate and then received the

ball again within the 10 second interval (e.g., combination play), without the opposition gaining control of the ball, visual explorations were analysed throughout the entire 10 second interval and ended on the analysed players first touch of the ball.

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The analysed players team were required to be in possession of the ball for a minimum of 5 seconds prior to the analysed player receiving the ball from a teammate (to provide sufficient time to analyse a player's VEA and ensure all analysed players are performing VEA in attacking situations). Therefore, all instances were a minimum of 5 seconds and a maximum of 10 seconds in duration due to the analysed players team often gaining possession of the ball and the analysed player then receiving a pass from a teammate between 5-10 seconds of possession being won.

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Table 2. *Intra-class correlations for number of scans (continuous variable).*

Variable	Inter-rater			Intra-rater		
	ICC (95% CI)	<i>p</i>	Strength of Agreement	ICC (95% CI)	<i>p</i>	Strength of Agreement
Number of scans	0.899 (0.861-0.926)	<0.001	Excellent	0.912 (0.801-0.953)	<0.001	Excellent

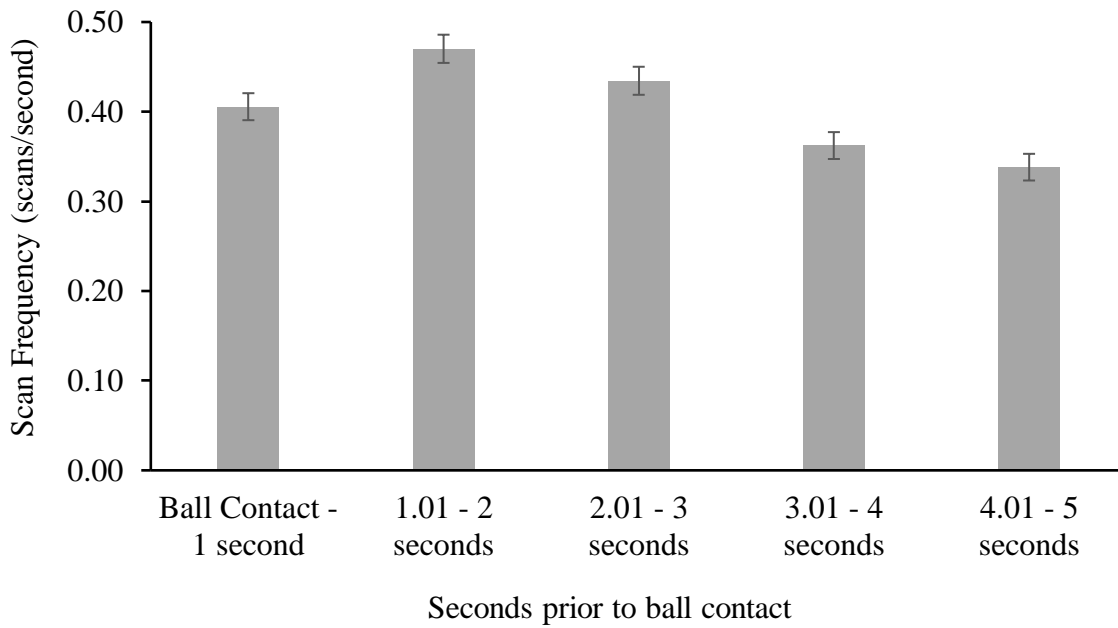
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Table 3. *Cohen's k for all categorical variables.*

Variable	Inter-rater			Intra-rater		
	Kappa (κ)	p	Strength of Agreement	Kappa (κ)	p	Strength of Agreement
Action Type	0.871	<0.001	Almost Perfect	0.939	<0.001	Almost Perfect
Pitch Location	0.935	<0.001	Almost Perfect	0.897	<0.001	Almost Perfect
Lines Broken	0.594	<0.001	Moderate	0.842	<0.001	Almost Perfect
Action Result	0.925	<0.001	Almost Perfect	0.980	<0.001	Almost Perfect
Pass Distance	0.855	<0.001	Almost Perfect	0.928	<0.001	Almost Perfect
Pass Direction	0.906	<0.001	Almost Perfect	0.933	<0.001	Almost Perfect
Turn with the ball	0.810	<0.001	Almost Perfect	0.846	<0.001	Almost Perfect
Opponent Pressure	0.818	<0.001	Almost Perfect	0.826	<0.001	Almost Perfect
Body Orientation	0.870	<0.001	Almost Perfect	0.900	<0.001	Almost Perfect

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Figure 2. Mean (\pm SE) scan frequency (scans/s) during the final five seconds prior to ball contact.



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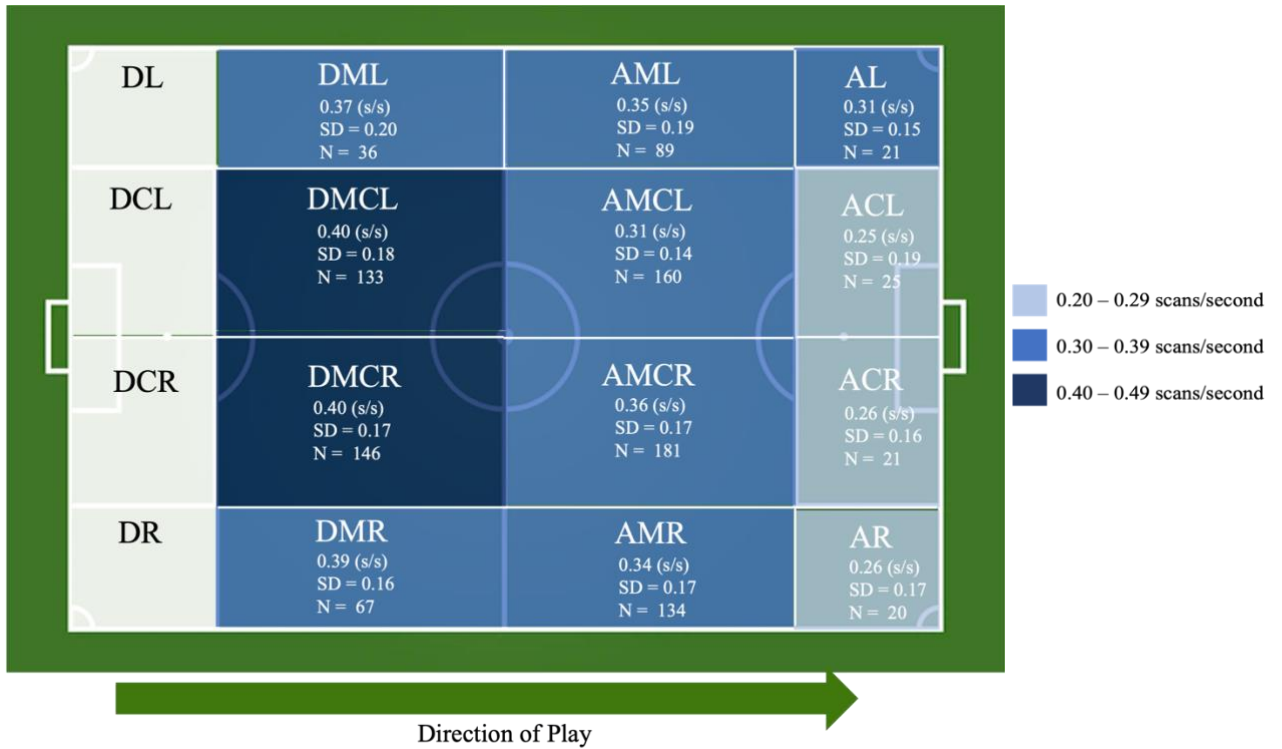
Table 4. Mean Scan frequency and number of instances for all analysed variables.

Variable (s)	Scan Frequency (scans/s)	Number of Instances
	M (SD)	<i>n</i>
Contextual Factors		
<i>Opponent Pressure</i>		
0-3 m	0.34 (0.17)	645
4-6 m	0.37 (0.18)	295
7-9 m	0.40 (0.18)	82
10-32 m	0.39 (0.27)	16
Situational Factors		
<i>Game State</i>		
Winning	0.35 (0.15)	159
Drawing	0.36 (0.17)	693
Losing	0.31 (0.17)	186
<i>Time in the game</i>		
0-15 min	0.37 (0.15)	184
16-30 min	0.37 (0.17)	138
31-45 min	0.35 (0.17)	142
45-60 min	0.37 (0.18)	162
61-75 min	0.35 (0.17)	154
76-90 min	0.33 (0.20)	141
90-105 min	0.31 (0.16)	68
105-120 min	0.29 (0.15)	49
<i>Stage of competition</i>		
Quarter Final	0.36 (0.17)	616
Semi Final	0.35 (0.17)	277
Final	0.34 (0.18)	145
Performance with the ball		
<i>Action Type</i>		
Pass	0.36 (0.17)	904
Shot	0.29 (0.16)	44
Dribble	0.26 (0.18)	20
Receiving	0.32 (0.18)	70
<i>Action Result</i>		
Successful	0.36 (0.17)	776
Unsuccessful	0.32 (0.18)	262
<i>Pass Direction</i>		
Backwards	0.38 (0.16)	326
Sideways	0.35 (0.18)	135
Forwards	0.35 (0.17)	443
No Pass	0.30 (0.17)	134
<i>Pass Distance</i>		
0-14 m	0.35 (0.17)	565
15-34 m	0.37 (0.17)	287
35 m +	0.38 (0.19)	52

No Pass	0.30 (0.17)	134	933
<i>Body Orientation</i>			
Backwards	0.38 (0.17)	243	934
Sideways	0.33 (0.17)	477	935
Forwards	0.35 (0.18)	318	
<i>Turn with the ball</i>			936
Turn with the ball	0.39 (0.18)	148	
No turn with the ball	0.35 (0.17)	890	937
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Figure 3. Mean scan frequency (scans/second) presented in 12 pitch locations (attacking direction from left to right) with standard deviation values and the number of instances (n). Note. Only pitch location zones with a minimum of 5 instances included in the figure. In all defensive zones $n < 5$.



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Figure 4. *Effect Sizes for differences in estimated mean and statistical significance for pitch location.*
 Statistical difference ($p < 0.05^*$, $p < 0.001^{**}$).

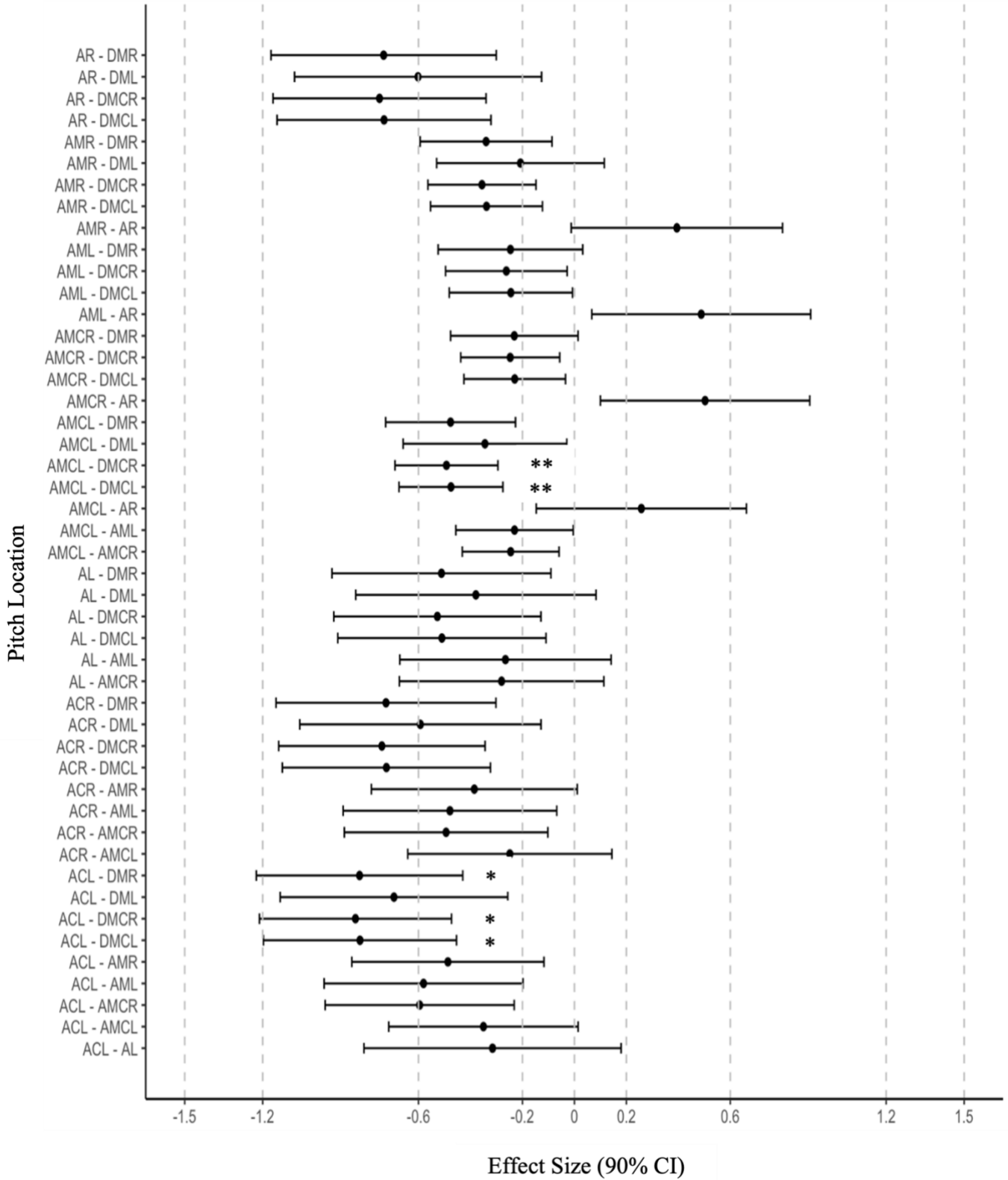


Table 5. *Estimated means ± SE for Scan Frequency for all contextual (“on or around the ball”) and situational (“off the ball”) factors.*

Variable (s)	Scan Frequency (scans/s) Estimated Means (SE)
<i>Contextual Factors</i>	
<i>Pitch Location</i>	
Defensive Right (DR)	0.26 (0.17)
Defensive Centre Left (DCL)	0.41 (0.12)
Defensive Left (DL)	0.26 (0.12)
Defensive Midfield Right (DMR)	0.39 (0.02)
Defensive Midfield Centre Right (DMCR)	0.39 (0.02)
Defensive Midfield Centre Left (DMCL)	0.39 (0.02)
Defensive Midfield Left (DML)	0.37 (0.03)
Attacking Midfield Right (AMR)	0.34 (0.02)
Attacking Midfield Centre Right (AMCR)	0.35 (0.02)
Attacking Midfield Centre Left (AMCL)	0.31 (0.02)
Attacking Midfield Left (AML)	0.35 (0.02)
Attacking Right (AR)	0.27 (0.04)
Attacking Centre Right (ACR)	0.27 (0.04)
Attacking Centre Left (ACL)	0.26 (0.04)
Attacking Left (AL)	0.31 (0.04)
<i>Opponent Pressure</i>	
0-3 m	0.31 (0.02)
4-6 m	0.33 (0.02)
7-9 m	0.35 (0.03)
10-32 m	0.34 (0.04)
<i>Situational Factors</i>	
<i>Game State</i>	
Winning	0.33 (0.03)
Drawing	0.34 (0.02)
Losing	0.31 (0.02)
<i>Time in the game</i>	
0-15 min	0.34 (0.02)
16-30 min	0.35 (0.03)
31-45 min	0.33 (0.02)
45-60 min	0.35 (0.02)
61-75 min	0.34 (0.02)
76-90 min	0.32 (0.02)
90-105 min	0.30 (0.03)
105-120 min	0.32 (0.03)
<i>Stage of Competition</i>	
Quarter Final	0.34 (0.02)
Semi Final	0.33 (0.02)
Final	0.32 (0.03)

