

Article

What are the most frequent movement combinations leading to goals in professional male and female soccer?

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Abstract: Different studies have analysed the movements performed in key moments of a soccer match such as goal scoring situation. Anyhow, no study has analysed how these movements are combined. This study aimed to identify the most habitual combination of movements occurring before a goal in the English Premier League and Women's Super League.

Data was collected through video-analysis using a modified version of the Bloomfield Movement Classification. The frequency of each of the movements performed before and after a selected movement (for example, linear advancing motion) was analysed in both English Premier League and Women's Super League.

Linear advancing motion, deceleration and turn in different orders accounted for 25.3% and 22.9% of individual involvements in Premier League and Women's Super League, respectively. The most common movement before a linear advancing motion was a turn, while the most common movement performed after was a deceleration. Decelerations were most frequently preceded by a linear advancing motion and followed by a turn. Turns were most preceded and followed by deceleration and turn, respectively.

Male and female professional soccer players are exposed to different sequences of actions before a goal. Within this, the combination of linear advancing motion, turn and deceleration is the most commonly performed, usually following a particular order. Coaches and trainers should focus on improving players' proficiency in transitioning between these various movements, with special attention to the most common sequences observed.

Keywords: agility, change of direction, sprints, goal actions, professional soccer.



1. Introduction

Soccer is a team sport where players need technical and tactical ability (Forsman et al., 2016) and a high level of athleticism to be successful (Turner & Stewart, 2014). Soccer match activities have been widely analysed for both males and females (Datson et al., 2017; Griffin et al., 2021; Mara et al., 2017). Researchers have generally utilised static or linear direction activities such as standing, walking, jogging, running, sprinting, high intensity running, very high intensity running (Barros et al., 2007; Mallo et al., 2015) with acceleration and deceleration activities gaining interest in recent years (Harper et al., 2019; Mara et al., 2017). Moreover, lateral movements during matches have also been analysed, with senior male players covering mean distances ranging from 263 to 548 metres (Pereira Da Silva et al., 2007; Rienzi et al., 2000). In addition, different studies have investigated the number changes in direction or turning activities during matches (Baptista et al., 2018; Bloomfield et al., 2007b; Dos' Santos et al., 2022; Granero-Gil et al., 2020; Morgan et al., 2022; Nedelec et al., 2014). These studies have shown considerable differences, going from 11.9 hard changes of direction to 700 turns and swerves (Bloomfield et al., 2007b; Nedelec et al., 2014).

In order to contextualize movements occurring in key moments of the games, several studies have analysed movements occurring before a goal through time-motion analysis, with 3 studies analyzing actions occurring before goals. Faude et al. (Faude et al., 2012) found straight sprint to be the most common action before a goal followed by

jump in the male German national League, while Martínez-Hernández (Martínez-Hernández et al., 2023) and Martínez-Hernández et al. (Martínez-Hernández et al., 2024) showed linear advancing motion actions, such as sprint, to be the most common action in goal scoring situations followed by deceleration and turn in EPL and WSL, respectively. More so, movements considered as CODs have been shown to be in 71.6% and 70.6% of players' involvements during goal-scoring situations in EPL and WSL, respectively (Martínez-Hernández & Jones, 2024). While these studies provide insight into the most common movements involved in goal-scoring actions, these typically occur in combination with other movements. In fact, soccer match analysis has shown numerous changes in activity during games with males averaging 1431 ± 206 (Rienzi et al., 2000) and females ranging from 1336 to 1529 (Krustrup et al., 2005). Previous studies have analysed movements before and after turning and decelerating in a whole game of soccer using the BMC (Bloomfield et al., 2007a; Bloomfield et al., 2007c). Bloomfield et al. (2007a) found decelerations to be preceded by sprints in 77% of the occasions. In addition, a different study from the same group found jogging and shuffling frequently preceding and following turns of $\leq 90^\circ$ while turns of $> 90^\circ$ were performed while skipping, stopping and slowing down (Bloomfield et al., 2007c). While these studies bring insight into the combinations of crucial movements such as deceleration and turns, there is a need for a more thorough analysis that includes a wider range of movements in key moments of the game (i.e. goal-scoring situations) as well as differentiation between attacking and

defending players. Developing knowledge of how specific movements are commonly combined in goal-scoring situations can also provide insight into the physical qualities required to execute these actions effectively, helping with the selection of specific soccer drills, strength, and power exercises as well as the selection of the most applicable tests.

The aim of this study was to gain a clear understanding of the most habitual combination of movements occurring before a goal in male and female soccer. In order to achieve this aim, the study had the following objectives: 1. Identify the most frequent actions occurring before and after certain movements. 2. Examine differences between EPL and WSL. 3. Identify differences between attackers and defenders.

We hypothesised that the movements' linear advancing motion, deceleration and turn would be the most common combination of movements. More so, we hypothesised that the combination of movements would show similar patterns between leagues and roles with some differences.

2. Materials and Methods

2.1. Methodology - All the goals from EPL and WSL from 2018/2019 season were analysed through video analysis using the same broadcast footage provider. Researchers had access to all goals, which could be seen in slow motion and from multiple angles. Analysis was performed identically as the study by Martínez-Hernández *et al.* (Martínez-Hernández et al., 2023) and Martínez-Hernández *et al.*, (Martínez-Hernández et al., 2024) using a modified version of the BMC (Bloomfield et

al., 2004). This included 769 goals in the EPL and 256 in the WSL. Coding was conducted by the lead author using a computerised notation system within a customised Excel spreadsheet (Office 365 ProPlus), following established guidelines for computerised performance analysis systems (O'Donoghue, 2014). The coding process involved setting up information for each column:

- Matchday: identifying the match round.
- Home team and away team: the teams participating in the match.
- Score home and score away: the score at the time of the goal.
- Player: the type of player involved in the play (e.g., "Scorer," "Assistant," "Defender of Scorer").
- Movements (-5 to final movement): the sequence of actions leading to the goal.

All possible movement combinations (e.g., linear advancing motion, turn, deceleration, cut, arc run) were initially created and then entered in the following order: 1. Movement, 2. Direction (if applicable), 3. Intensity (if applicable), 4. Ball involvement. For example, movement -5 could be recorded as "deceleration, lateral, high intensity, no ball."

The lead researcher reviewed all goals in slow motion and from multiple angles to ensure precise motion analysis. Each movement required between 5 seconds and 5 minutes to analyze. Overall, the analysis of a single matchday took approximately 3–6 hours for the EPL and 1.5–3 hours for the WSL, with work conducted daily in sessions of 1–3 hours. These differences reflect the structure of each league, including the number of teams (WSL

= 11; EPL = 20) and the number of matches per matchday (5 in the WSL and 10 in the EPL).

Motion analysis evaluated for the scoring (scorer) assisting player (assistant), closest defender to the scorer (defender of scorer) and closest defender to the assisting player (defender of assistant). Scorer and assistant were named 'attackers' while defender of scorer and defender of assistant were named 'defenders'. Analysis was limited to the last 6 movements of each player, with this sequence of movements being named "involvement". Focusing on the final movements allows for a precise and manageable scope, highlighting the most decisive actions while fully leveraging the breadth and diversity of the dataset (Daly et al., 2025). The frequency of each of the movements performed before and after a selected movement (for example, deceleration) was analysed in both EPL and WSL. This analysis was performed with separation of roles (attackers and defenders) as well as pooled together. More so, the frequency of involvements where the 3 most common movements were all performed was analysed.

2.2. Statistical Analysis - Data analysis was performed through SPSS for Windows software version 22.0 (SPSS, Inc., Chicago, IL). Data was found to be not normally distributed based on a Kolmogorov-Smirnov test ($p \leq 0.05$). Chi-square (χ^2) was utilised for the analysis of differences between movements, players (attackers and defenders) and leagues (WSL and EPL). In particular, chi-square was utilised to analyse frequency differences between the movements that occurred before a certain movement (i.e., linear advancing motion),

with a separate analysis for movements occurring after the selected movement. More so, if chi-square analysis showed a difference in frequency between movements (i.e., movements before deceleration), then a separate chi-square analysis was performed between each of the movements. When analysing solely attackers or defenders, only movements before and after linear advancing motion, deceleration and turn (the 3 most common movements) were analysed. When analyzing differences between attackers and defenders (EPL, WSL and both leagues pooled), chi-square analysis was performed for each of the movements. For example, turn before decelerations for attacker vs defender. Finally, analysis was performed to calculate the frequency in the total number of involvements where the 3 most common actions were combined together in different orders.

Intra-rater reliability was obtained through intraclass correlation coefficient (two-way mixed model, single rater, consistency) using pilot data from the same matchday (10 matches) which included 72 players' involvement in 22 goals. The same researcher analysed twice each of the goals with 4 weeks in between these analysis, obtaining values of 0.87 which is considered a good level of agreement (Koo & Li, 2016). To obtain inter-rater reliability videos corresponding to 10 clips of each movement were analysed by 2 different investigators. Weighted Cohen's Kappa showed movement agreement of moderate to almost perfect agreement (Movement agreement: $K = 0.864$, Direction agreement: $K = 0.588$, Intensity agreement: $K = 0.762$, Ball agreement: $K = 0.844$).

3. Results

3.1. Differences Between Movements (before and after the selected movement) - The different movements occurring before and after a particular movement were analysed in both EPL and WSL with both leagues following similar trends (Table 1 and Table 2). More so, for attackers and defenders, movements before and after linear advancing motion, deceleration and turn (the 3 most common movements) were also analysed (attackers: Supplementary Table 1 and Supplementary Table 3 for EPL and WSL, respectively), (defenders: Supplementary Table 2 and Supplementary Table 4 for EPL and WSL, respectively). Chi-square showed significant differences for movements occurring before and after the selected movement for attackers, defenders and both pooled for EPL and WSL.

Attackers (Supplementary Table 1 and Supplementary Table 3 for EPL and WSL, respectively), defenders (Supplementary Table 2 and Supplementary Table 4 for EPL and WSL, respectively) and attackers and defenders pooled together (Table 1 and Table 2 for EPL and WSL, respectively) showed common trends for EPL and WSL when analyzing movements before and after linear advancing motion, decelerations and turns.

The most common movements before and after a linear advancing motion were a turn and a deceleration, respectively. The most frequent movement before and after a deceleration was a linear advancing motion and a turn respectively. Turns were most frequently preceded by deceleration and followed by linear advancing motion. Cut as well as arc run were most frequently preceded and followed by linear advancing

motion in both EPL and WSL. Crossover was most commonly preceded by a turn in EPL and turn and deceleration in WSL and followed by a deceleration in EPL and deceleration and turn in WSL. Finally, shuffle was preceded mostly by turn and deceleration in WSL and EPL and followed by deceleration in EPL and deceleration and turn in WSL.

3.2. Differences between EPL vs WSL - WSL showed a significantly higher percentage of linear advancing motion before decelerations ($64.8\% \pm 4.9\%$) when compared to EPL ($56.9\% \pm 2.8\%$) ($\chi^2 (1) = 7$, $p = 0.006$). Moreover, significant differences were found regarding the most frequent movement after an arc run ($\chi^2 (6) = 6$, $p = 0.016$). While in EPL $54.2\% (\pm 6.7\%)$ of the movements following an arc run were linear advancing actions, in WSL this occurred in $74.7\% (\pm 8.5\%)$ of the occasions. This lower percentage of linear actions after arc runs for EPL was compensated with a higher percentage of decelerations in EPL ($36\% \pm 6.4\%$) compared with WSL ($11.1\% \pm 6.2\%$) ($\chi^2 (1) = 4$, $p = 0.03$).

3.3. Differences Between Attackers and Defenders - Defenders compared to attackers showed a significantly higher percentage of turns before linear advancing motion in both EPL ($\chi^2 (1) = 22$, $p < 0.001$) and WSL ($\chi^2 (1) = 7$, $p = 0.007$) and significantly higher decelerations after linear advancing motion ($\chi^2 (1) = 21$, $p < 0.001$) in EPL, with WSL also showing a similar trend but without reaching significance. This lower percentage for attackers was compensated with significantly higher percentages of cuts (second most common movement before and after linear advancing motion) before and after linear runs. Moreover, EPL showed a significantly higher percentage of turns after

deceleration in attackers vs defenders (χ^2 (1) = 6, $p = 0.011$). This was compensated by higher percentages of lateral movements (crossover + shuffle) in defenders (18.2%) vs attackers (3.8%).

3.4. Frequency of the 3 Most Common Movements During Players' Involvements - Linear advancing motion, deceleration and turn combined subsequently in different manners were found in $25.3\% \pm 1.7\%$ and in $22.9\% \pm 2.9\%$ of the involvements in EPL and WSL, respectively.

Table 1. Movements occurring before and after each movement in EPL.**BEFORE**

Linear Advancing	0 (0%, 0% - 0.3%)*	680 (56.9% ±2.8%)*	238 (22.2% ±2.5%)*	285 (92.2% ±3%)*	159 (68.5% ±6%)*	5 (4.5% ±3.8%) ^{def}	4 (3.1% ±3%) ^{fg}
Deceleration	190 (13.8% ±1.8%)*	0 (0%, 0% - 0.3%)*	663 (61.8% ±2.9%)*	1 (0.3% ±0.6%) ^{cde}	31 (13.4% ±4.4%) ^{defg}	41 (36.6% ±8.9%)*	62 (48.8% ±8.7%) ^{adefg}
Turn	754 (55% ±2.6%)*	238 (19.9% ±2.3%)*	36 (3.4% ±1.1%)*	8 (2.6% ±1.8%)	30 (12.9% ±4.3%) ^{defg}	60 (53.6% ±9.2%)*	52 (40.9% ±8.6%) ^{adefg}
Cut	278 (20.3% ±2.1%)*	18 (1.5% ±0.7%)*	6 (0.6% ±0.5%) ^{fg}	8 (2.6% ±1.8%)	4 (1.7% ±1.7%)	0 (0%, 0% - 3.3%)	0 (0%, 0% - 2.9%) ^f
Arc Run	116 (8.5% ±1.5%)*	77 (6.4% ±1.4%)	12 (1.1% ±0.6%) ^{fg}	7 (2.3% ±1.7%)	1 (0.4% ±0.8%)	0 (0%, 0% - 3.3%)	1 (0.8% ±1.6%) ^f
Crossover	23 (1.7% ±0.7%)*	99 (7.9% ±1.5%)	60 (5.6% ±1.4%)	0 (0%, 0% -1.2%) ^{cde}	4 (1.7% ±1.7%)	0 (0%, 0% - 3.3%)	8 (6.3% ±4.2%)
Shuffle	11 (0.8% ±0.5%)*	88 (7.4% ±1.5%)	57 (5.3% ±1.3%)	0 (0%, 0% -1.2%) ^{cde}	3 (1.3% ±1.5%)	6 (5.4% ±4.2%) ^{def}	0 (0%, 0% - 2.9%) ^f

MOVEMENT	LINEAR ADVANCING MOTION	DECELERATION	TURN	CUT	ARC RUN	CROSSOVER	SHUFFLE
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AFTER

Linear Advancing	0 (0%, 0% - 0.3%)*	190 (19.2% ±2.5%)*	754 (64% ±2.5%)*	278 (88.5% ±3.5%)*	116 (54.2% ±6.7%)*	23 (12.1% ±4.6%)*	11 (6.7% ±3.8%) ^{deg}
Deceleration	680 (49.6% ±2.7%)*	0 (0%, 0% - 0.4%) ^{efg}	238 (20.2% ±2.5%)*	18 (5.7% ±2.6%) ^{cdefg}	77 (36% ±6.4%)*	96 (50% ±7.1%)*	88 (53.3% ±7.6%)*
Turn	238 (17.4% ±2%)*	663 (67.1% ±2.9%)*	36 (3.1% ±1.1%) ^f	6 (1.9% ±1.5%) ^{fg}	12 (5.6% ±3.1%) ^{efg}	60 (31.6% ±6.6%)*	57 (34.5% ±7.3%)*
Cut	285 (20.8% ±2.2%)*	1 (0.1% ±0.2%) ^{efg}	8 (0.7% ±0.5%)*	8 (2.5% ±1.7%) ^{fg}	7 (3.3% ±2.4%) ^{efg}	0 (0%, 0% - 2%)	0 (0%, 0% - 2.3%)
Arc Run	159 (11.6% ±1.7%)*	31 (3.1% ±1.1%) ^g	30 (2.5% ±1%) ^{fg}	4 (1.3% ±1.3%) ^{fg}	1 (0.5% ±1%)	4 (2.1% ±2%)	3 (1.8% ±2%)
Crossover	5 (0.4% ±0.3%)	41 (4.1% ±1.2%)	60 (5.1% ±1.4%)	0 (0%, 0% -1.2%)	0 (0%, 0% -1.8%)	0 (0%, 0% - 2%)	6 (3.6% ±2.8%) ^{dg}
Shuffle	4 (0.3% ±0.3%)	62 (6.3% ±1.5%)	52 (4.4% ±1.3%)	0 (0%, 0% -1.2%)	1 (0.5% ±1%)	8 (4.2% ±2.9%)*	0 (0%, 0% - 2.3%)

Data expressed as frequency (percentage ±95% confidence intervals). *Significant different from the rest, ^asignificant different from linear advancing motion, ^bsignificant different from deceleration, ^csignificant different to turn, ^dsignificant different to cut, ^esignificant difference to arc run, ^fsignificant difference to crossover, ^gSignificant difference to shuffle

Table 2. Movements occurring before and after each movement in WSL.

BEFORE							
Linear Advancing	0 (0%, 0% - 0.8%) ^{bcdef}	236 (64.8% ±4.9%)*	60 (19.1% ±4.4%)*	94 (94% ±4.7%)*	74 (74.7% ±8.5%)*	1 (2.5% ±4.8%)	1 (2.9% ±5.6%)
Deceleration	53 (11.7% ±2.3%) ^{dfg}	0 (0%, 0% - 1%) ^{efg}	205 (65.3% ±5.3%)*	3 (3% ±3.3%)	11 (11.1% ±6.2%) ^{defg}	15 (37.5% ±15%) ^{adefg}	16 (47.1% ±16.8%) ^{adefg}
Turn	241 (53.3% ±4.6%)*	67 (18.4% ±4%)*	10 (3.2% ±2%) ^{de}	0 (0%, 0% - 3.7%)	12 (12.1% ±6.4%) ^{defg}	22 (55% ±15.9%) ^{adefg}	16 (47.1% ±16.8%) ^{adefg}
Cut	89 (19.7% ±3.7%) ^{efg}	3 (0.8% ±0.9%) ^{efg}	2 (0.6% ±0.9%)	0 (0%, 0% - 3.7%)	2 (2% ±2.7%)	0 (0%, 0% - 8.8%)	0 (0%, 0% - 10.2%)
Arc Run	63 (13.9% ±3.2%) ^{fg}	21 (5.8% ±2.4%)	3 (1% ±1.1%)	3 (3% ±3.3%)	0 (0%, 0% - 3.7%)	0 (0%, 0% - 8.8%)	0 (0%, 0% - 10.2%)
Crossover	4 (0.9% ±0.9%)	22 (6% ±2.4%)	20 (6.4% ±2.7%) ^{de}	0 (0%, 0% - 3.7%)	0 (0%, 0% - 3.7%)	0 (0%, 0% - 8.8%)	1 (2.9% ±5.6%)
Shuffle	2 (0.4% ±0.6%)	15 (4.1% ±2%)	14 (4.5% ±2.3%) ^{de}	0 (0%, 0% - 3.7%)	0 (0%, 0% - 3.7%)	2 (5% ±7%)	0 (0%, 0% - 10.2%)
MOVEMENT	LINEAR ADVANCING MOTION	DECELERATION	TURN	CUT	ARC RUN	CROSSOVER	SHUFFLE
AFTER							
Linear Advancing	0 (0%, 0% - 0.8%)	53 (17.5% ±4.3%)*	241 (65.5% ±4.9%)*	89 (92.7% ±5.2%)*	63 (70% ±9.5%)*	4 (8.5% ±8.1%) ^{abcdef}	2 (6.1% ±8.4%)
Deceleration	236 (50.6% ±4.5%)*	0 (0%, 0% - 1.3%) ^{efg}	67 (18.2% ±4%)*	3 (3.1% ±3.5%)	21 (23.3% ±8.7%)*	22 (46.8% ±14.4%) ^{defg}	15 (45.5% ±17.5%) ^{adefg}
Turn	60 (12.9% ±3%) ^{adfg}	205 (67.7% ±5.3%)*	10 (2.7% ±1.7%) ^f	2 (2.1% ±2.9%)	3 (3.3% ±3.7%)	20 (42.6% ±14.3%) ^{defg}	14 (42.4% ±17.4%) ^{adefg}
Cut	94 (20.2% ±3.6%) ^{afg}	3 (1% ±1.1%) ^{efg}	0 (0%, 0% - 1%) ^{efg}	0 (0%, 0% - 3.8%)	3 (3.3% ±3.7%)	0 (0%, 0% - 7.6%)	0 (0%, 0% - 10.4%)
Arc Run	74 (15.9% ±3.3%) ^{fg}	11 (3.6% ±2.1%)	12 (3.3% ±1.8%)	2 (2.1% ±2.9%)	0 (0%, 0% - 4.1%)	0 (0%, 0% - 7.6%)	0 (0%)
Crossover	1 (0.2% ±0.4%)	15 (5% ±2.5%)	22 (6% ±2.4%)	0 (0%, 0% - 3.8%)	0 (0%, 0% - 4.1%)	0 (0%, 0% - 7.6%)	2 (6.1% ±8.4%)
Shuffle	1 (0.2% ±0.4%)	16 (5.3% ±2.5%)	16 (4.3% ±2.1%)	0 (0%, 0% - 3.8%)	0 (0%, 0% - 4.1%)	1 (2.1% ±4.1%)	0 (0%, 0% - 10.4%)

Data expressed as frequency (percentage ±95% confidence intervals). *Significant different from the rest, ^asignificant different from linear advancing motion, ^bsignificant different from deceleration, ^csignificant different to turn, ^dsignificant different to cut, ^esignificant difference to arc run, ^fsignificant difference to crossover, ^gSignificant difference to shuffle

4. Discussion

The most common movements before and after a linear advancing motion were a turn and a deceleration, respectively. Decelerations were most frequently preceded by a linear advancing motion and followed by a turn. Turns were most preceded and followed by deceleration and linear advancing motion, respectively. This tendency was very similar in both leagues as well as positions, and while it makes sense that the 3 most common actions combine between them more frequently than not, it is worth mentioning that this was performed habitually in a certain cycle (Figure 1).

The cyclical pattern of linear advancing motion → deceleration → turn → linear advancing motion observed in both leagues and across positions reflects more than a statistical tendency; it mirrors the fundamental locomotor constraints imposed by Newtonian mechanics and the perceptual-motor demands of open-skill environments. From an ecological dynamics perspective (Davids et al., 2008), this cycle can be understood as an emergent solution arising from the interaction between the player's action capabilities, the spatiotemporal affordances presented by the game, and the physical constraints of redirecting linear momentum. Rather than representing a learned, prescriptive movement sequence, its consistency across EPL and WSL suggests it reflects a deeply stable attractor state within the movement landscape of soccer — one shaped by biomechanical necessity rather than tactical instruction.

The deceleration that invariably precedes a turn is not simply a preparatory phase; its characteristics are governed by the

interacting constraints of approach velocity, turn angle, and cognitive-perceptual processing time (Havens & Sigward, 2015; Kimura & Sakurai, 2013; Popowiczak et al., 2020). Critically, the timing and nature of pre-orientation strategies (David et al., 2018) reveal how perceptual coupling with the environment (reading an opponent's movement, anticipating ball trajectory) modulates the motor solution selected. A late pre-orientation, for instance, may demand greater braking impulse and a two-phase turning strategy (as observed in 180° CODs), whereas early perception of the required direction allows players to exploit foot progression angle to reduce total rotation, minimising velocity loss (Jones et al., 2016).

The positional differences in movement sequencing further support a constraints-led interpretation. The higher frequency of turns following deceleration in attackers, compared to the greater prevalence of lateral movements in defenders, cannot be attributed solely to role convention. Rather, it reflects the distinct affordance landscapes each player navigates: defenders operate under the persistent ecological constraint of maintaining goal-side positioning relative to a moving ball and opponent. Attackers, conversely, operate in a space-seeking role where turning after deceleration could serve to exploit perceptual gaps, identifying passing lanes or spaces behind the defensive line. The predominance of cuts before and after linear advancing motion in attackers, with approximately 9 in 10 arc runs and cuts, further underscores that attackers' movement ecology is defined by rapid, momentum-preserving direction changes aimed at destabilising defensive structure, rather than the momentum-reducing

strategies more characteristic of defensive repositioning.

The divergence from Bloomfield *et al.* (2007b), where decelerations represented fewer than 2% of total movements compared to over 20% in the present study, is mechanistically meaningful beyond simply contextual differences. Bloomfield *et al.* sampled across general match play, where the majority of player time is spent in low-intensity, positionally maintaining activity far from goal-scoring situations (Rampinini *et al.*, 2007). The present study, by focusing exclusively on the six movements preceding a goal, captures a fundamentally different phase of play, characterised by higher spatiotemporal pressure (Liang *et al.*, 2025). In ecological terms, this constitutes a distinct task constraint that radically reshapes the distribution of movement solutions. The compressed space and time afforded near goal forces players into higher-velocity linear advances and more frequent, more intense decelerations and turns (Martínez-Hernández *et al.*, 2023, 2024).

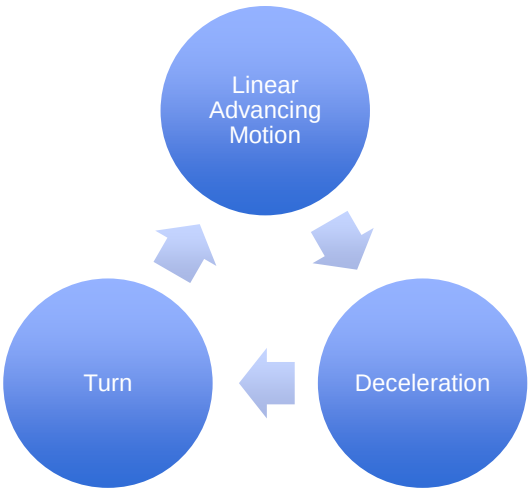
Similarly, the discrepancy with Bloomfield *et al.* (2007c), where shuffles and jogging frequently flanked turns, likely reflects a difference in the information-movement coupling present in each context. In non-goal-threatening situations, players have greater temporal latitude to maintain perceptual orientation through shuffling, keeping visual contact with the ball and opponents. In pre-goal sequences, the increased urgency and spatial crowding may compress with this window, forcing players

toward more committed turning and sprinting solutions even at the cost of momentary perceptual occlusion. This interpretation aligns with the constraints-led understanding that movement variability is not noise but a functional response to shifting task and environmental constraints (Newell, 1986).

This study has several limitations. The analysis was restricted to successful attacking actions preceding goals, meaning data are primarily representative of effective offensive sequences and unsuccessful defensive actions, limiting generalisability to other phases of play. Additionally, analysing only the six movements immediately preceding a goal may have excluded relevant movement combinations occurring earlier in the sequence, potentially providing an incomplete picture of pre-goal movement demands.

The observational methodology introduces potential classification subjectivity, as the boundaries between certain movement types (e.g. distinguishing a cut from a turn), may not always be clearly defined, risking misclassification bias. Finally, while findings were compared across leagues and positions, individual player characteristics, including physical capacity, technical ability, and tactical role, were not accounted for. These individual constraints may substantially influence movement tendencies and represent an important source of variability that aggregate positional analyses cannot fully capture.

Figure. 1. Most common cycle of movements.



5. Practical Applications

The consistent cyclical pattern of linear advancing motion → deceleration → turn → linear advancing motion, and its positional variations, suggests that training should reflect the coupled, sequential nature of these actions rather than addressing each in isolation. From a constraints-led perspective (Davids et al., 2008), both physical preparation and drill design should recreate the mechanical and informational conditions driving these combinations in competition. COD drills should therefore manipulate approach velocity, turning angle, and spatial pressure from opponents, with

positional specificity considered given the divergent movement tendencies observed between attackers and defenders.

When looking at specific strength and power work aiming to transition between movements eccentric strength training, especially for the quadriceps muscles to enhance the absorption of greater kinetic energy to decelerate, should be considered when transitioning from linear advancing motion to deceleration (Harper et al., 2022; McBurnie et al., 2022). When the objective is to enhance the transition from deceleration to a turn, exercises should aim to transfer as fast as possible from an eccentric contraction to a concentric rotational movement. For instance, power and strength exercises could involve performing turning actions using a band, bungee, medicine ball, pulley, conical pulley, or flywheel squat, immediately after a double-leg or split-leg drop, or following a rapid countermovement. Finally, power exercises to help transition from a turn to a linear advancing motion, would include rotation actions with band, bungee, med ball, pulley or conical pulley, followed by an acceleration forward step.

Table 3. Key physical qualities required for the most common movement transitions.

Transition	Linear advancing motion to deceleration	Deceleration to turn	Turn to linear advancing motion
Main physical capacity required	Eccentric strength	Eccentric strength – concentric power	Power

6. Conclusions

This study provides novel insight into the sequential movement patterns preceding goals in elite soccer, demonstrating that linear advancing motion, deceleration, and turning combine in a consistent cyclical manner across both EPL and WSL. Rather than reflecting prescribed tactical behaviors, this cycle emerges as a functional solution to the interacting biomechanical, perceptual, and spatiotemporal constraints characterizing pre-goal phases of play — a context distinguished from general match play by elevated movement intensity, compressed decision-making time, and heightened spatial pressure. Positional differences in movement sequencing further highlight that attackers and defenders navigate fundamentally distinct affordance landscapes. These findings extend previous whole-match movement analyses by demonstrating how contextual constraints radically reshape locomotor solutions and challenge the use of general movement profiles as the sole basis for physical preparation in soccer. Practically, this work underscores the importance of designing training environments that reflect the sequential, perception-action nature of these movement combinations, with physical preparation and drill design tailored to the specific transitional demands and positional requirements identified here. Future research should examine unsuccessful attacking actions and defensive sequences to provide a more complete picture of the movement demands across all phases of play.

Supplementary Materials: The following are available online at

<http://eurjhm.com/index.php/eurjhm>,

Supplementary Table 1. Movements occurring before and after each movement in attackers for EPL, Supplementary Table 2. Movements occurring before and after each movement for Defenders in EPL, Supplementary Table 3. Movements occurring before and after each movement for attackers in WSL, Supplementary Table 4. Movements occurring before and after each movement for defenders in WSL.

Conflicts of Interest: The authors declare no conflict of interest.

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