Functional adaptability in playing style: A key determinant of competitive football performance

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Abstract

The present study examined the relationship between playing style adaptability and team match performance indicators throughout the season. Three playing style adaptability metrics were analysed, namely, (1) flexibility (i.e., exhibiting a wide range of playing styles), (2) reactivity (i.e., adapting playing style based on opposition) and (3) imposition (i.e., executing predetermined playing style regardless of opposition. Team playing styles were derived through a clustering analysis of 21,708 matches played in the top five male European leagues from 2014/15 to 2019/20. Spearman's correlation was utilized to assess the association between the three playing style adaptability metrics and four team match performance indicators (e.g., shots taken in opposition penalty box; shots conceded in own penalty box; goals scored; goals conceded; and total wins). Playing style flexibility was positively associated with both offensive and defensive match performance indicators and win frequency. Conversely, playing style reactivity and imposition were negatively associated with these team match performance indicators. Our results suggest that the capacity to exhibit a wide range of playing styles throughout a season is associated with greater team performance. Furthermore, it is possible that high performing teams are capable of functionally switching between playing style reactivity and imposition, depending on match dynamics.

Keywords

Behavioural variability, football, playing style, adaptability, flexibility, performance analysis

Introduction

In competitive football, teams have to rapidly and continuously adapt their collective tactical behaviours to successfully respond to constantly evolving contextual constraints, such as opposition tactics, match score, match location, or game time remaining (Gómez et al., 2018; Lago, 2009; Lago-Ballesteros et al., 2012). This continuous adaptation of collective tactical behaviour occurs throughout each of the ~120 sequences of possession in each match (Tenga et al., 2010b), and also across the 34-38 game weeks in each season, as teams engage in a repetitive cycle of enforcing their own playing styles and initiating countermeasures to opposition tactics (Gómez et al., 2018; Hewitt et al., 2016). This continuous adaptation of behaviour has spurred researchers to examine football teams through the lens of the ecological dynamics approach, wherein teams are viewed as complex collective systems that (re)organize their tactical behaviours through continuous interactions and exchanges of information with a performance environment In ecological dynamics, broadly describing a team by a single, summarized playing style (e.g., 'counter-attacking' or 'high possession'), as widely used in commentaries, broadcasting and coaching (Hewitt et al., 2016), contributes little to understanding the characteristics of high performing teams. This is because it fails to account for the ongoing adaptations (or failures to adapt) and resulting match up of playing styles between the team and its opposition in each sequence (Gómez et al., 2018; Lago, 2009; Lago-Ballesteros et al., 2012). More precisely, successful performance (represented by key performance indicators, or ultimately, match outcome) is likely to be more closely associated with a team's ability to successfully exploit everchanging environmental and task constraints of competition, in order to collectively produce a functional behavioural response (Seifert et al., 2016). The

ability to generate and execute a wide range of functional, goal-directed behaviours in different contexts, has been identified as a hallmark of expert performance, and is widely referred to as *behavioural flexibility* (Johnson, 1961; Ranganathan et al., 2020), conceptually known as system *degeneracy* (Seifert et al., 2016).

Earlier work in ecological dynamics has also highlighted that behavioural responses of expert performers could be described as *interactive*, dynamically emerging from as they functionally shift between an: (1) independence of, and (2), dependence on perceived information from the environment (Davids et al., 2015). Under specific competitive performance dynamics, expert performers need to gravitate towards *behaviour reactivity*, in which certain preferred coordination tendencies are acted out in response to changes in specific task or environmental constraints. Conversely, expert performers may also demonstrate *behaviour imposition* in certain situations, characterized by the propensity forimposing a pre-determined set of tactical plans that are independent of the unfolding situation. Crucially, the emergent behavioural interactions of an expert performer would neither be completely reactive, nor completely imposed, as intentional behaviour is guided by the detection of information to accomplish task goals. In football, however, perhaps due to limitations in player technical abilities or coaching philosophies, teams may choose to utilize a predominantly impositional approach to their playing styles, whereby an adherence to specific match strategies is emphasized, regardless of actual match dynamics (Cordes et al., 2012).

In the present study, the team's emergent collective behavioural responses (i.e., match actions performed) are considered to be reflective of the team's playing style, surfacing from the adaptations (or failure to adapt) occurring throughout the match. The

term playing style variability is, therefore, used to collectively describe the flexibility, reactivity, and imposing of a team's tactical behaviours in response to competitive match dynamics throughout the season. At present, existing work has reinforced the notion that functional playing style variability, displayed in response to game constraints emerging in each match (within-match adaptation), is critical in determining match performance and competition outcomes s(Gómez et al., 2015; Lago-Ballesteros et al., 2012). To expand on this area of research, the current study examines playing style variability of teams throughout the course of the season (i.e., functional variability between matches) and its relationship with match performance outcomes. Building on earlier work in this area (e.g., Duch et al., 2010; Grund, 2012), the current study hypothesizes that teams displaying greater playing style flexibility throughout the season would achieve more successful match performance outcomes. Conversely, as expert performers can functionally adapt their behavioural responses towards an independence of, or dependence on the match situation, the current study also hypothesizes that a greater tendency for either tactical imposition or reactivity in playing styles would be negatively associated with performance outcomes. Secondarily, the current study hypothesizes that solely examining playing styles utilized by professional football teams in Europe, and that of their opponents in one-off matches would not be predictive of match outcomes. Consequently, two research questions are put forth in the current study:

1. Are the match-up of playing styles exhibited by teams associated with match outcomes?
2. What is the association between team playing style variability and match performance outcomes within a competitive season?

Method

Playing style clustering

Data source. In order to derive the playing style exhibited by teams in each match, match event data were collected for all competitive matches played in the English Premier League, French Ligue 1, German Bundesliga, Italian Serie A, and Spanish La Liga from the 2014/15 to 2019/20 season. These data were collected from the football data website Whoscored (www.whoscored.com), which primarily acquires data from Opta Sports. Prior studies have been conducted to establish the reliability and validity of this dataset (Liu et al., 2013), and the dataset has been widely used in football performance analysis research (Kim et al., 2021; Nsolo et al., 2019, p. 2; Yi et al., 2019). The match actions dataset consisted of 31 actions classified into three categories that detail three fundamental phases of the game (Wade, 1998): attacking, defending, and possession (i.e., preparation or build up). A list and description of the match actions used in the clustering analysis of opposition playing styles are depicted in Appendix A.

Data pre-processing. As the variance of features in the match actions dataset were not homogeneous (e.g., number of ball touches compared to shots from fast break attacks), the features were scaled by removing the mean and scaling to the unit variance. This statistical procedure was conducted as machine learning estimators may not work well if each feature does not resemble standard normally distributed data (Pedregosa et al., 2011).

Clustering analysis

In general, the challenges of identifying team playing styles from match event data are twofold. First, there are no consensus guidelines that can be utilized to classify team

playing styles. Second, because of the absence of quantifiable guidelines, the total number of team playing styles are not known. To address these challenges, a clustering analysis using unsupervised machine learning is proposed. This clustering approach reveals patterns in the dataset by clustering similar data points, resulting in different groups emerging. For this study, these emergent groups are taken to represent the different team playing styles.

The Expectation-Maximization Gaussian Mixture Model algorithm (GMM) was utilized for the clustering analysis. The GMM was selected based on its success with match event performance indicators in football - specifically in identifying goal scoring patterns (Wei et al., 2013) and team formations (Bialkowski et al., 2014, 2016). For the GMM, number of clusters to be identified, *k*, must be provided during model construction. However, as the total number of clusters (i.e., playing styles) are not known, a model selection process was necessary to derive a statistically 'optimal' *k*. To this end, the clustering analysis was conducted 14 times, each time with a different *k* ranging from 2 to 15. The 'optimal' *k* was determined as the value that provides a best fit model. This process was determined through implementing the Akaike's information criterion (AIC) and Bayesian information criterion (BIC) of each model iteration (Huang et al., 2017). In both criteria, a lower score indicates a better model fit.

Playing style and match outcome

To examine the relationship between playing style and match outcome, a Random Forest classifier model (RF) was utilized (Araújo et al., 2021). Playing style of the home team and away team, derived from the clustering analysis, were utilized as input variables.

Match outcome of the home team (win, lose, or draw) was entered as the output variable. To ensure a more accurate representation of RF precision, fivefold cross-validation was performed. Specifically, the model was computed five times, in each iteration the dataset was split into a training and testing set. Although the split was conducted randomly, observations were included only once in the testing set across the five iterations. Accuracy of the RF was assessed using the weighted average precision, recall and F1-score of the five iterations.

Playing style variability

The emergent playing style clusters were used to determine playing style flexibility and reactivity, and impositioning for each team. To best constrain the influence of external and internal perturbations (e.g., changes in player roster or coaching staff), variability of team playing styles was examined within each season. The coefficient of unalikeability (COA), which provides a measure of variability for categorical variables (Kader & Perry, 2007), was utilized in the computation of playing style flexibility, reactivity, and impositioning. The COA computation generates a coefficient on a scale from 0 (all observations are identical) to 1 (all observations are non-identical).

Flexibility. To determine team playing style flexibility, the COA of all playing styles utilized by the team throughout the season was computed (see Equation (1)). A COA value closer to 1 indicates that a team utilizes a larger range of playing styles throughout the season.

$$\text{Flexibility} = \frac{\text{Total unalike pairs of playing styles}}{\text{Total pairs of playing styles}} \quad (1)$$

Reactivity. To determine team playing style reactivity, the COA of playing styles utilized against each opposition playing style throughout the season was computed. Building on earlier work in ecological dynamics (e.g., Hristovski, Davids, & Araújo, 2006; Hristovski, Davids, Araújo, et al., 2006), greater playing style reactivity was determined as a greater proficiency in realising a consistent movement response, based on affordances perceived (i.e., affordances perceived from opposition playing style). Therefore, in computing playing style reactivity, the derived COA value of the playing styles utilized, when facing a particular opposition playing style was inverted (i.e., 1 – Actual COA). This was because greater playing style reactivity would designate a greater likelihood of generating a consistent playing style response when facing a specific opposition playing style. Therefore, a value closer to 1 is indicative of greater reactivity in playing styles utilized against each opposition playing style (i.e., more consistency in playing style responses when facing a particular playing style). The playing style reactivity values derived against different opposition playing styles was then weighted by the number of times the team faced that opposition playing style. Ultimately, overall team playing style reactivity was computed as the sum of all weighted playing style reactivity scores. Equation (2), where *n* encompasses the opposition playing styles faced, describes the computation of playing style reactivity.

$$\text{Reactivity} = \sum_{i=1}^{n} \left(\left(1 - \frac{\text{Total unalike pairs of playing style vs style } i}{\text{Total pairs of playing style vs style } i} \right) \text{x} \frac{\text{Times faced style } i}{\text{Total matches in season}} \right) \quad (2)$$

Imposing. To determine team playing style impositioning, COA of playing styles faced by the team throughout the season when utilizing a particular playing style was calculated. Building on earlier work, a team with greater tendency to impose their playing style on a game would be more likely to execute predetermined behavioural responses, regardless of the unfolding match dynamics (Davids et al., 2015). Therefore, in the current study, imposing a playing style is derived from the dissimilarity with opposition playing styles faced by the team when they utilize a particular playing style. Consequently, a value closer to 1 was indicative of greater imposition in playing styles utilized against each opposition playing style (i.e., the team utilizes a predetermined playing style, even when facing a large variety of opposition playing styles). Each value for imposing a playing style, when using a particular playing style, was then weighted by the number of times the team utilized that playing style. Ultimately, overall team playing style impositioning was computed as the sum of all weighted playing style impositional values. Equation (3), where *n* encompasses the opposition playing styles faced, describes the computation of playing style impositioning.

$$\text{Impositioning} = \sum_{i=1}^{n}\left(\left(\frac{\text{Total unalike pairs of playing styles faced when using style } i}{\text{Total pairs of playing styles faced when using style } i}\right) \text{x } \frac{\text{Times used style } i}{\text{Total matches in season}}\right) \quad (3)$$

Performance outcomes

Four match events, derived from the same source as the input data for clustering, were utilized as performance outcomes. These match events were: (1) shots taken in the

opposition penalty box; (2) shots conceded in their own penalty box; (3) goals scored; (4) goals conceded. These indicators were normalized by the number of matches played throughout the season, and were selected as they represent critical moments in competitive football matches, and are significant in determining match outcomes (Bartlett et al., 2012; Frencken et al., 2012; Ruiz-Ruiz et al., 2013; Sarmento et al., 2018). To avoid data dredging, these performance outcome variables were excluded from the input dataset for playing style clustering (Smith & Ebrahim, 2002). Number of wins in each season was utilized as a performance outcome as it closely represents overall team success. Spearman's correlation coefficient was utilized to compute the association between playing style flexibility, reactivity, imposition, and the four performance outcome measures.

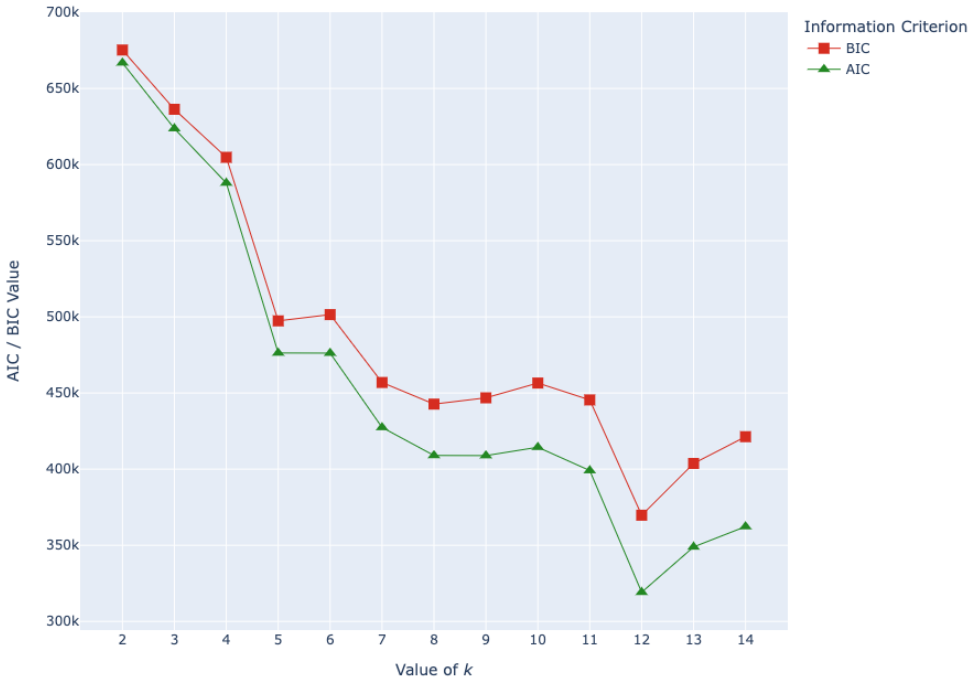
Results

Playing style clusters

Through the playing style clustering model selection process, AIC and BIC values were lowest when the value of *k* was 12 (see Figure 1). These findings suggest that clustering the match action profiles into twelve playing style clusters provides a model of best fit.

Figure 1.

Akaike (AIC) and Bayesian Information Criterion (BIC) values in model selection for clustering opposition team playing styles



Note. Model selection process for clustering team playing styles with *k* ranging from 2 to 15. Lower AIC and BIC values are indicative of best fit.

Playing style and match outcome

Using the fivefold cross-validated RF classification model, match outcome was classified with a weighted average precision of 49.2%, weighted average recall of 54.6%, and weighted average F1-score of 46.4%. The RF demonstrated best precision in predicting when the home team would win (82.66%), but demonstrated very low precision in predicting drawn matches (0.48%).

Table 1

Accuracy of playing styles in predicting match outcome

	Predicted (by Random Forest Classifier)	Accuracy

		Draw	Lose	Win	
Actual	Draw	13	911	1783	0.48%
	Lose	14	1806	1401	56.07%
	Win	17	837	4072	82.66%

Playing style variability and match performance outcomes

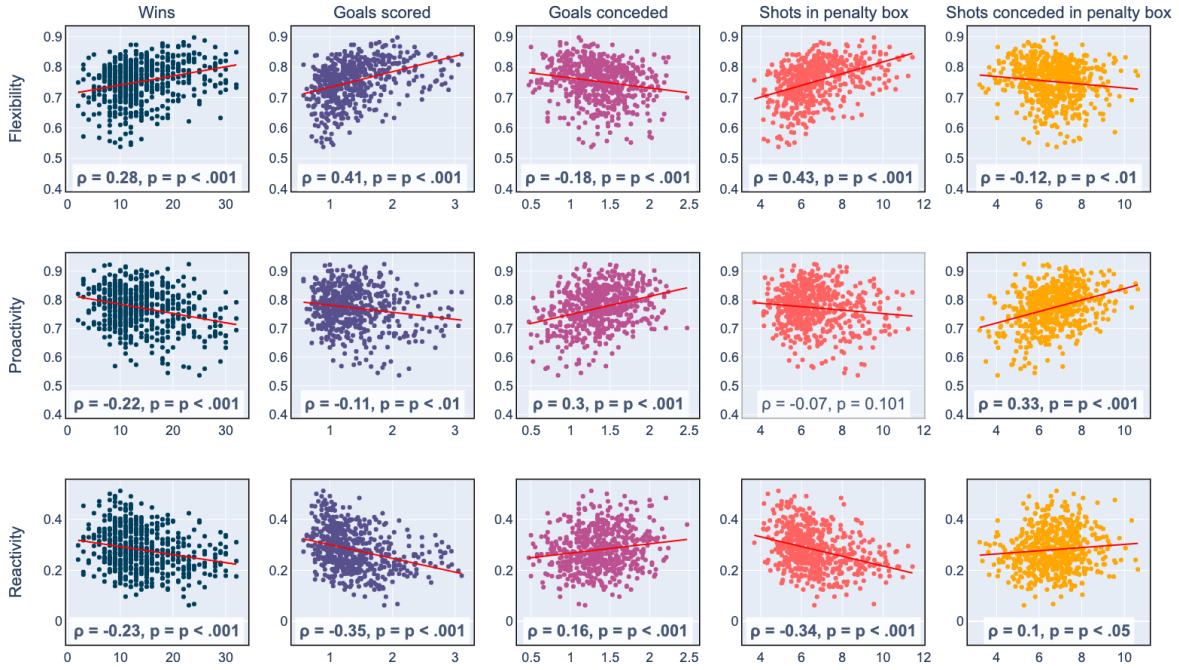
Playing style flexibility was found to have a small positive correlation with the number of wins, $r_s(586) = 0.28$, $p < .001$; moderate positive correlations with the number of goals scored, $r_s(586) = 0.41$, $p < .001$ and number of shots taken in the penalty box, $r_s(586) = 0.43$, $p < .001$; Playing style flexibility was found to have small negative correlations with the number of goals conceded, $r_s(586) = -0.18$, $p < .001$ and number of shots conceded in the penalty box, $r_s(586) = -0.12$, $p < .01$.

Playing style reactivity was found to have small negative correlations with the number of wins, $r_s(586) = -0.22$, $p < .001$ and with number of goals scored, $r_s(586) = -0.11$, $p < .01$. Furthermore, playing style reactivity was found to have moderate positive correlations with the number of goals conceded, $r_s(586) = 0.3$, $p < .001$ and number of shots conceded in the penalty box, $r_s(586) = 0.33$, $p < .001$.

Imposition of playing style was found to have: small negative correlations with the number of wins, $r_s(586) = -0.23$, $p < .001$ and with number of goals scored, $r_s(586) = -0.35$, $p < .001$; and a moderate negative correlation with number of shots in the penalty box $r_s(586) = -0.34$, $p < .001$. Furthermore, imposition of playing style was found to have small positive correlations with the number of goals conceded, $r_s(586) = 0.16$, $p < .001$ and number of shots conceded in the penalty box, $r_s(586) = 0.1$, $p < .05$.

Figure 3.

Relationship between playing style variability and performance outcomes.



Discussion

The aim of the current study was twofold. First, we sought to examine the relationship between playing styles (of the home team and that of the opponent) and match outcomes. Second, we examined the relationship between within-season playing style variability and average achievement of key match performance outcomes.

Playing style and match outcome

Association between playing style and match outcome was examined through the construction of a RF classification model. In general, the RF classification model could not predict match outcome with a precision greater than 50%, which suggests that playing style of the home team, and that of the opposition, has limited value in precisely determining

match outcome. A possible explanation for this result is that the playing style clusters emerging from the GMM clustering analysis represent a summation of all the within-match playing styles utilized in each of the offensive and defensive sequences used by a team throughout a match. More specifically, playing style clusters identified in the current study do not describe the within-match playing style adaptations that teams must execute across sequences of possession in the match in order to achieve a positive match outcome.

The importance of these within-match adaptations on match outcome have been highlighted by earlier work, suggesting that match outcome is significantly altered by a small number of ball possession sequences (Lago-Ballesteros et al., 2012; Scoulding et al., 2004, for a review see Sarmento et al, 2022). Moreover, existing research has highlighted that professional football teams average upwards of 120 possession sequences in each match, with each displaying a distinct playing style (Franks, 1988; Tenga et al., 2010a, 2010b). The status of the match - such as if the team was defending a lead or attempting to (re)gain the lead, also significantly influenced playing style choices. For example, in periods where a team was defending a lead, a counter-attacking playing style was preferred (James et al., 2002; Lago & Martín, 2007). Defensively, teams defended higher up the pitch (i.e., high pressing style) when they were behind in a match (Santos et al., 2017). Therefore, it is likely that the *matchups* of team playing styles in crucial possession sequences represent a more significant predictor of match outcomes compared to match-averaged playing styles of teams computed in this study. For example, in possession sequences where teams utilized a counter-attacking playing style (instead of an elaborate, ball possession-based, build up style) against an imbalanced defensive style, more successful offensive outcomes were achieved (Tenga et al., 2010a, 2010b).

Playing style flexibility and match performance outcomes

The results of the current study propose that teams with greater playing style flexibility, or ability to exhibit a wide range of playing styles throughout the season, tended to win more games and achieved greater offensive and defensive performance outcomes. This finding is consistent with findings reported in earlier work linking greater flexibility in team tactical behaviour with greater performance outcomes (Duch et al., 2010; Grund, 2012). The positive relationship between playing style flexibility and offensive performance outcomes highlight the importance of being able to rapidly and voluntarily transition into using a variety of player and ball movement patterns in the offensive phase. The capacity to quickly transition into different playing styles appropriately (i.e., most advantageous response to the demands of the game context) (Launder & Piltz, 2013), contributes significantly towards creating imbalance within the opposition. This capacity draws them out of their homeostatic defensive structures, leading to more goal scoring opportunities (Casal-Sanjurjo et al., 2021; Frencken et al., 2012; Hewitt et al., 2016; Tenga et al., 2010a). Moreover, greater flexibility in team playing style allows for more unpredictability in player and ball movements during the offensive sequence, which affords the attacking team more space and ultimately creates more goal-scoring opportunities (Schulze et al., 2021).

In the current study, greater playing style flexibility was also associated with fewer goals conceded and fewer shots allowed in the penalty box. This finding may suggest that highly flexible teams are able to better reorganize their defensive structures after losing the ball, which is significantly associated with a team's chances of recovering the ball in the defensive phase (Casal-Sanjurjo et al., 2021). Specifically, highly flexible teams may be able (re)organize their defensive structures more appropriately, in response to the offensive

tactical strategy of the opposition (Tenga et al., 2010a, 2010b) or a match score situation (Santos et al., 2017), as they can adopt a wider range of playing styles. It is possible that highly flexible teams may be able to achieve greater defensive performance outcomes by deliberately transitioning into a playing style that constrains the attacking team, consequently forcing the opposition to play more predictably in the offensive phase (i.e., forcing opposition into the adoption of a playing style, *involuntarily*) (Stöckl et al., 2021).

From a practical perspective, teams that can display a wide range of playing styles are also harder to prepare for because of the uncertainty surrounding which styles they will opt for (and when) in a game. More specifically, when facing highly flexible teams, coaches must prepare their teams to face a wider range of potential playing styles, which reduces the time available for specialized training in one style as match preparation.

Playing style reactivity and match performance outcomes

Further than flexibility, the current study also examined the playing style reactivity of teams, or the team's propensity to respond to tactical affordances in the competitive environment (Davids et al., 2015; Seifert et al., 2016). Indeed, earlier work has highlighted that a reactive playing style strategy is one that professional football teams undertake in actual competition, characterized by a focus on reacting to opposition behaviour, rather than opting to dictate or impose their own (James et al., 2002)

However, results of the current study suggest that, within a season, greater playing style reactivity may contribute negatively to performance outcomes. Specifically, teams who were content with merely reacting to opposition tactics, averaged a lower number of goals scored and shots taken in the opposition penalty box in each match. Teams that

merely react to opposition behaviour may end up creating excessive predictability in their player and ball movement patterns, which limits their ability to create the necessary imbalance in the opposition and achieve successful offensive performance outcomes (Jones et al., 2004). More specifically, an excessive degree of team playing style reactivity in offense may be ineffective in shifting opposing teams out of their organized, homeostatic defensive structure, limiting creation of goal-scoring opportunities (Frencken et al., 2012; Tenga et al., 2010a).

Teams with greater playing style reactivity also conceded, on average, a greater number of goals and shots in their own penalty box in each match. It is possible that highly reactive teams, despite responding more consistently in playing style response to certain opposition playing styles, may be involuntarily trapped into responding in unfavourable ways, thus being unable to generate the optimal playing response given the match situation. To exemplify, utilizing a high press playing style as a tactical countermeasure to teams building up from the back during the build-up phase may be particularly effective, especially against less technical opponents and when playing at a familiar home stadium (Fernandez-Navarro et al., 2019). However, within this same match up of playing styles (high pressing versus building up from the back), the high press style significantly decreases in effectiveness when facing stronger opposition teams with players of higher technical ability. This is because it leaves fewer players available for defending crosses if the high press is broken through, increasing the probability of conceding a goal and losing (Fernandez-Navarro et al., 2019; Liu et al., 2016). The findings of the current study are therefore in line with earlier work, which have highlighted that teams experience poorer performance outcomes when they excessively react by altering their style of play

(particularly in recovering ball possession) to the task and environmental constraints that emerge during the match (Vogelbein et al., 2014)

Playing style imposing and match performance outcomes

The current study also examined the effect of an impositioning playing style approach on performance outcomes. Specifically, the measure of imposing a playing style described the degree in which teams displayed a predetermined playing style regardless of the opposition playing style encountered. The results of the current study highlighted that greater imposition of playing styles was negatively associated with offensive outcomes (fewer number of goals scored and shots in the penalty box) and defensive outcomes (greater number of goals conceded and shots conceded in the penalty box).

Findings of the current study are in contrast to earlier work, which have proposed that successful teams demonstrate greater imposition of their playing style, and are less likely to deviate from the premediated strategies that they have planned or worked on during preparation (Hughes et al., 2019; Lago & Martín, 2007). Particularly, earlier work has proposed that greater impositioning is crucial towards successfully achieving performance outcomes in an environment with a large variety of ever-changing external perturbations (Orth et al., 2018). It is important to note however, that earlier work advocating the merit of an impositional, dictatorial playing style approach drew their conclusions based on the styles of possession that teams displayed (i.e., 'direct-play' versus 'possession-play'). Specifically, more successful teams tended to undertake a more impositioning approach in their playing style by displaying a 'possession-play' playing style to dominate and maintain

ball possession against opponents (Bloomfield et al., 2005; Hughes et al., 2019; Lago & Martín, 2007).

In the current study, a potential explanation for the significant association between playing style imposition and poor match performance outcomes could be that weaker, less successful teams are forced to undertake a predominantly impositional playing style approach. For example, less successful teams generally have a lower number of attacking opportunities compared to top teams (Gollan et al., 2018), and may be forced towards adopting a impositional playing style approach, such as predominantly utilizing a defensive-oriented playing style (Gollan et al., 2018). Greater propensity towards imposition in playing style responses potentially limits the exploratory tactical behaviours (i.e., trying out new player movement patterns) that players can voluntarily engage in during defensive phases, which potentially limits the development of their ability to perceive tactical shared affordances offered by the opposition during the match (Araújo & Davids, 2016; Seifert & Davids, 2012). To this end, the findings of the current study are in line with earlier work proposing that inability to, or longer delays in, transition when entering the defensive phase, is associated with a greater number of goals conceded (Frencken et al., 2012; Tenga et al., 2010a). Conversely, teams that transitioned more rapidly (i.e., defensive transition lasts 15 seconds or less) had a significantly greater chance of recovering the ball (Casal-Sanjurjo et al., 2021).

At the highest level of competitive sport, teams are constantly seeking to analyse opposition performance tendencies and predict their match strategies (Gómez et al., 2018; Hewitt et al., 2016). Considering this, a potential downside of an excessively impositional playing style approach is that it provides greater certainty for opposition teams to reliably

predict how opponents will behave, allowing teams to develop appropriate countermeasures and prepare them in training.

Functional balance between playing style imposing and reactivity

The findings of the current study present a novel contribution to existing research, especially in highlighting the significant influence of functional variability in playing styles on match performance outcomes. In line with earlier work, results of the current study indeed corroborate that effective performance outcomes are a product of the performer being able to functionally shift between performance behaviour in imposing styles on, and reacting to, opponents (Davids et al., 2015). That is, results of the current study indicate that a rigid impositional or reactive approach are detrimental to match performance outcomes. Particularly, the findings of the current study seem to indicate that, akin to how specific playing styles are more efficient in certain contexts, effectiveness in varying playing style is also largely dependent on emergent contextual constraints.

However, it may be beneficial for teams to impose their playing style responses in certain contexts. For example, high ranking teams may benefit from imposing a possession-dominant playing style when facing lower ranked opponents, which has been highlighted to lead to more successful performance outcomes (Bloomfield et al., 2005; Fernandez-Navarro et al., 2019). In other contexts, such as when a large lead has been attained, impositioning by reverting to a counterattacking or direct style of play (instead of adapting to the opposition's behavioural responses) has been associated with greater performance outcomes (Lago, 2009; Lago-Peñas & Dellal, 2010).

When facing other high-ranking teams, greater performance outcomes may be achieved from shifting towards a reactive playing style approach, wherein the choice of team playing styles are adapted in response to the unfolding task and environmental constraints. In particular, earlier work has highlighted that successful teams adapt their ball possession recovery strategies depending on the match context, such as when they are losing or tied with the opposition (Vogelbein et al., 2014). Given the diversity of player roles and attributes that are unique to each player within the team, a certain degree of reactivity in team playing style may allow individuals in a team to perceive and use shared affordances, which in turn positively influences performance outcomes in competition (Silva et al., 2013).

Limitations and future work

Future research should consider examining the relationship between within-match playing style variability (i.e., playing style variability between ball possession sequences) and match performance outcomes. To the best of our knowledge, such work has primarily been limited to single season or single league analyses (Tenga et al., 2010a, 2010b), perhaps due to the complexities of data collection and quantification of within-match playing styles (Sarmento et al., 2022). Given the positive association between team playing style flexibility and team performance outcomes highlighted in the current study, future work may consider expanding the concept of playing style flexibility to individual performance. More precisely, as proposed by earlier work (Carrilho et al., 2020), higher performing players, or those with more successful playing careers may be those that are able to demonstrate greater playing style flexibility.

Conclusion

In conclusion, the present study reveals that solely examining the playing style of teams in one-off match instances may be a biased indicator of team performance. Alternatively, the functional variability in playing styles displayed are significantly associated with match performance outcomes. The present study found that the ability of teams to flexibly vary their playing style throughout the season is positively associated with team performance. Specifically, teams that can generate a wider range of playing style responses throughout the season are able to achieve more successful offensive and defensive performance outcomes, and ultimately also win more matches.

From a practical perspective, results suggested that coaches should prepare their teams to generate a diverse set of playing style responses, as the speed and range of playing style transitions may induce less predictability in player and ball movement patterns, providing teams with a clear tactical advantage resulting in more successful performance outcomes. The results also suggest that wholly relying on an impositional (independent of evolving match dynamics) or reactive (dependent or following evolving match dynamics) approach to adopt playing styles is detrimental to team performance. Teams that utilize a predominantly impositional or reactive playing style may end up executing very predictable responses to the emergent match situation. The capacity to functionally shift between impositive and reactive playing styles, depending on the demands of the task and environmental constraints, could be associated with more successful performance outcomes.

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Appendix A

Indicator no.	Indicator Name (Full)	Description
1	Ball touches	Collective number of on ball touches
2	Passes – Defensive Third	Passes in team's defensive third
3	Passes – Attacking Third	Passes in team's offensive third
4	Passes – Midfield Third	Passes in team's midfield third
5	Passes – Forward	Passes in forward direction
6	Passes – Left	Passes in left direction
7	Passes – Right	Passes in right direction
8	Passes – Backwards	Passes in backwards direction
9	Passes – Through balls	Passes where defensive line was split
10	Passes – Key passes	Passes leading to shot attempt but no goal scored
11	Passes – Corner	Passes from corner kicks
12	Passes – Set pieces	Passes from set pieces
13	Successful dribbles	Dribbles where defender was beaten
14	Unsuccessful dribbles	Dribbles where defender won the ball
15	Crosses attempted	Crosses attempted
16	Shots - 6-yard box	Shots within 6 yard box
17	Shots - Blocked	Shots blocked by defender
18	Shots – Fast break attack	Shots from fast break/counterattack
19	Shots – Off target	Shots off target
20	Shots – Open play	Shots from open play
21	Shots – Outside box	Shots from outside penalty box
22	Shots – Penalty box	Shots from inside penalty box
23	Shots – Set piece	Shots originating from set pieces
24	Shots – On target	Shots on target
25	Aerial duels won	Aerial duels won
26	Clearances	Ball clearances
27	Interceptions	Ball interceptions
28	Shots blocked in defence	Shots blocked in defence
29	Crosses blocked in defence	Crosses blocked in defence
30	Successful tackles	Successful tackles in defence

31	Unsuccessful tackles	Unsuccessful tackles in defence