How football team composition constrains emergent individual and collective tactical behaviours: Effects of player roles in creating different landscapes for shared affordances in small-sided and conditioned games

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Published version

LAAKSO, T, DAVIDS, Keith, LUHTANEN, P, LIUKKONEN, J and TRAVASSOS, B (2021). How football team composition constrains emergent individual and collective tactical behaviours: Effects of player roles in creating different landscapes for shared affordances in small-sided and conditioned games. International Journal of Sports Science and Coaching, p. 174795412110300.

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Abstract

The aim of the present study was to examine how team composition of players with different roles constrains individual and collective tactical behaviours, and ball possession effectiveness, during competitive 3 vs 3 small-sided and conditioned games (SSCGs) in youth soccer players. Fifteen male players (under 15 yrs, mean age 13.2 +- 1.03 years, mean years of practice: 4.2 +- 1.10 years) from the same club participated in this study. For analysis purposes, on advice from the coaching staff, participants were categorised according to their main team performance role, resulting in sub-samples of 5 defenders (centre-backs=2 and full- backs=3), 7 midfielders (central midfielders=3 and wide midfielders=4) and 3 attackers (forwards). In order to assess participant tactical behaviours, a notational analysis system was created with four categories: i) team behaviours, ii) individual players' offensive actions, iii) individual players' defensive actions, and iv), ball possession effectiveness. Analysis of players' offensive actions revealed that the team composed only of midfielders revealed a higher frequency of diagonal and vertical passes in relation to the attackers' team. In offensive individual actions, the attackers' team revealed more dribbles in relation to the teams of defenders and midfielders. Analysis of ball possession effectiveness revealed that the team of defenders achieved higher values of shots on goal compared to the team of midfielders. These findings exemplified how playing role constrains the emergence of different collective behaviours and individual actions in 3 vs 3 SSCGs.

Key words: Playing roles, Decision-making, Game-based situations, Ecological dynamics, Association Football

Introduction

In line with the ecological dynamics perspective, tactical behaviours of players and teams result from information exchanges that emerge among players, based on their action capabilities (physical, technical, and tactical) (Folgado et al., 2018; Travassos et al., 2012). Players and teams constantly interact to form synergies and create information, making decisions and organizing actions, according to collective *possibilities for action* of the team, known as affordances (Araújo et al., 2017; Gibson, 1979).

Ecological dynamics views competitive performance behaviours in sports teams as emerging from the sharing of available affordances (Silva et al., 2013). According to Gibson (1979), affordances are opportunities or possibilities for action that exist in a performance environment. In football, players are able to perceive the availability of space and time provided by the movements of teammates and opponents, which offers information about the possibilities for action (affordances) such as an open space for dribbling, a passing or a shooting gap. Affordances are not only dependent on changes in the contexts of play, but also dependent on individual players' capabilities and their intentions during performance (e.g., to attack urgently or play conservatively) (Silva et al., 2013). Players' adaptations to changes in competitive performance environments are regulated by the environmental information surrounding each individual, that they perceive in order to interact with other individuals (Gonçalves et al., 2017). For each individual, and collective sub-units of players (e.g., attackers, defenders, midfielders), previous research has revealed that affordances are available in the environment, but their utilisation is dependent on each individual's intentions, motivations, values and capabilities (Araújo et al., 2017). Not all individuals perceive and utilise the same affordances in a performance environment, due to differences in their situated intentions, skill levels and attunement to the information available to support the actions required by their roles (Jordet et al., 2020; Laakso et al., 2017).

In the sport of football, the number of players involved, and the use of structured patterns of play, have promoted a greater specialization of players' roles. Each player's role (generally categorised as defenders, midfielders and attackers) has specific technical, tactical and physical playing demands, which may need to be adapted due to varying performance constraints (Davids et al., 2005). For example, recent research has revealed some differences in the perceptual scanning frequency of players of different roles, with the central midfielders revealing the highest mean frequency (perhaps due to density of player numbers in that field

location) and attackers the lowest mean frequency of emergent scanning behaviours (perhaps due to proximity to goal affording shots) (Jordet et al., 2020).

The use of available affordances during performance is sustained by variations in space-time relations defined by co-positioning of teammates and opponents, as well as co-variations in their displacement trajectories and their movement velocities with respect to field markings and dimensions (Silva et al., 2013; Vilar et al., 2012). Players perceptually attune to information specifying affordances for action through, for example, visual exploratory actions, which entail eye, head and body movements, supporting the pick-up of visual information (McGuckian et al., 2018). So, the capability of individuals to perceive and act upon affordances in a performance environment, should be continually influenced by each player's role, continually shaping their ability to pick up and use information from the competitive environment and functionally adjust their individual tactical behaviours (Passos et al., 2013).

These ideas suggest that, in performance, players in different playing roles should use different sources of information to successfully regulate their competitive actions (Jordet et al., 2020). In fact, each player assumes a specific role on field according to the tactical system and principles defined by the coach to defend or exploit space and create/prevent scoring opportunities (Duarte et al., 2012; Gonçalves et al., 2017). The exploitation of affordances by each player is influenced by the team's general patterns of play, but particularly by their surrounding information. That is, when a player is in a defensive area of the pitch (mostly populated by defenders), the majority of game-relevant information for that player is likely to be in front of them (i.e. in an attacking direction). In contrast, a player who is situated in a midfield area of the pitch (midfielders) is likely to be completely surrounded by game-relevant environmental information (Aksum et al., 2020). Accordingly, it is likely that each player's main role on the pitch influences, not only the perceptual scanning frequency (Jordet et al., 2020), but also the nature of the exploratory actions that are used to perceive the surrounding environment (McGuckian et al., 2018). These important performance constraints on behaviour led us to expect to observe different individual and collective tactical behaviours for players, not only inside of the game dynamics, but also to accomplish the same performance goals.

Indeed, previous research has revealed that players with different roles (such as mainly attacking or defending) display different individual tactical behaviours to manage the spatial-temporal relations with teammates and opponents in 1 vs 1 (Laakso et al., 2017) and 2 vs 1

sub-phases of football (Laakso et al., 2019). Also, in the context of the manipulation of small-sided and conditioned games (SSCGs), Baptista et al. (2020) revealed that variations in tactical systems of play, according to the players' roles used in each team (i.e. defenders, midfielders or attackers), promoted changes in interpersonal dynamics during SSCGs.

Despite these findings, in the practice of SSCGs, particularly in teams of youth players (from 3x3 to 5x5), coaches usually mix players up into small teams without at all considering the impact of mixing players with different playing roles (i.e. defenders, midfielders or attackers) on the emergent tactical behaviours of players and teams during practice. There is a need to understand how teams constituted by players of different roles influences the tactical exploration of possibilities for action during performance as well as their effectiveness percentages. These findings could inform sport practitioners on the need for players to be exposed to more specialised (i.e., role-based) and more general (varying roles) affordances from the design of small-sided and conditioned games. Thus, the aim of the present study was to examine how team composition of players with different roles constrains emergence of individual and collective tactical behaviours, as well as effectiveness, during competitive SSCGs in youth soccer players. Due to the influence of their roles on performance dynamics, we expected to observe changes in emergence of collective and individual offensive and defensive tactical behaviours, according to the nature of each team's role composition (whether attackers, defenders, or midfielders).

Methods

Participants

Fifteen male players (under 15 yrs, mean age 13.2 ± 1.03 years, mean years of practice 4.2 ± 1.10 years), from the same club in a national level Finnish team, participated in this study (2016/2017 season). For purposes of analysis, participants were divided into three groups according to their main playing role on field (defenders, midfielders and attackers). On advice of the coaching staff, participants were categorised into their main team performance role, resulting in sub-samples of 5 defenders (centre-backs=2 and full-backs=3), 7 midfielders (central midfielders=3 and wide midfielders=4) and 3 attackers (forwards). All players were right-foot dominant and were part of the U15s team of the club. All participants undertook five training sessions per week (90 minutes per session) and played one official GK+11 v 11+GK competitive match at the weekend. The club, all parents and participants

provided prior informed consent for participation in the study. The study was approved by the Ethics local Committee according to the Declaration of Helsinki.

Task and procedure

All small-sided games were played in one training session during the summer break of the competitive season (July) on an artificial grass pitch, with an ambient temperature of about 18-20 °C. In the summer break, the team had no official competitive matches, only daily training sessions. Before data collection, all participants engaged in a thorough warm-up routine (15 mins of jogging, 10 mins of technical actions with ball and 10 mins of stretching). Each team played against each other (i.e. defenders vs midfielders, defenders vs attackers, attackers vs midfielders) in a playing area of 30 x 25 m (Owen et al. 2004). Three games were played in each training session in a random order over three different days, resulting in a total number of 9 games. A regulation ball size 5 was used in all games. The small-sided game constraints included a regular size goal (2.44 m x 7.32 m) protected by a goalkeeper for both sides (Gk+3 vs 3+Gk). Each game was timed for 5 minutes. All the players/teams had at least 10mins of rest between trials and played a maximum of two games each day, in order to avoid fatigue. The goalkeepers stayed guarding the same goals, but the team's direction of play was systematically changed. The Gk+3 vs 3+Gk format was used to better capture the players' adaptations to the context of play according to players' specific roles.

The Gk+3 vs 3+Gk sub-phase was played with official football rules, with some exceptions /modifications: i) the offside rule did not apply; ii) when the ball left the field or a goal was scored, the game was always restarted by the goalkeeper of team with ball possession, with both teams located in their own pitch half; and iii), as the goalkeeper opened the game and the first player touched the ball, both teams played without restrictions.

Before the small-sided games, all participants were informed about the rules and the goals of the task/exercise and encouraged to compete to win games. The goalkeepers were also instructed to perform as if in a competitive game. No coach feedback or encouragement was allowed during the games to avoid the potential biasing effects of feedback on individual participant performance. The aim of the participants in these games was to score and prevent goals and try to win each game.

Participant movements were captured by using a digital video camera (Sony HRX-MC50E) placed 7 m above the ground, forming an angle of approximately 45º with the longitudinal axis of the performance area to capture participant movements during the whole task (for more details see Fernandes et al., 2010). All the video recordings captured the displacement trajectories of all participants without moving the camera.

Instruments

In order to assess the tactical behaviours of teams and players, and based on variables recorded in previous studies (see Andrzejewski et al., 2014; Hughes & Probert, 2006) a notational analysis system was created with four categories: i) team behaviours, ii) players' offensive individual actions, iii) players' defensive individual actions, and iv), ball possession effectiveness (see Table 1 for independent variables and their description). All data were collected by the first author. As a preliminary step, all the variables coded were discussed and described by the authors in line with recommendations in previous research (see Andrzejewski et al., 2014; Hughes & Probert, 2006). To check the reliability of measurements, the same sample of matches were coded after an interval of two weeks. Intra-observer reliability was calculated using the Cohen K index (Hughes & Franks, 2008). We found values of $K = 0.913$ ensuring an adequate reliability of data.

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

Statistical analysis

A Shapiro-Wilks test was used to assess the normality of data distribution. Due to the existence of non-normal distribution of data, differences between performance variables were assessed using a non-parametric test. A Kruskall-Wallis test was conducted to evaluate differences between the values observed for teams composed of defenders, midfielders, and attackers. Observed significant effects were followed up using the Bonferroni post hoc test. All statistical analyses were performed using the Statistical Package for Social Sciences software V24.0 (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp.), and statistical significance levels were set at $p < .05$. Additionally, *Cohen's d* was calculated to obtain the magnitude of differences through an effect size calculator for non-parametric tests (www.psychometrica.de/effect_size.html), classifying values as very low (0–0.2), low (0.2–0.6), moderate (0.6–1.2), high (1.2–2.0) or very high (>2.0) (Hopkins et al., 2009).

Results

Regarding team tactical behaviours, no statistically significant differences were observed for the variables: ball possession and number of players involved in the attack, in teams composed of players with different roles ($p > 0.05$) (see Table 2).

Analysis of participants' offensive individual actions did not reveal significant differences between teams with players of different roles for the following variables: number of completed successful passes, lateral and backward passes and penetrative passes ($p > 0.05$). However, statistically significant between-team differences in performance variables were observed for the number of diagonal and vertical passes and dribbles completed ($p < 0.05$) (see Table 2). For diagonal and vertical passes, post hoc analysis revealed that the team of midfielders revealed the higher number of diagonal and vertical passes (1.22±0.67) during performance, with significant differences in relation to values displayed by team of attackers (0.73±0.59, $p < 0.05$, $d = 0.71$, moderate effect). No other differences were observed for diagonal and vertical passes between the teams ($p > 0.05$). Regarding the number of dribbles completed, post hoc analysis revealed that the team of attackers displayed the highest number of successfully completed dribbles (0.53±0.78), with significant differences in relation to values displayed by teams of defenders (0.18±0.39, $p < 0.05$, $d = 0.65$, moderate effect) and midfielders (0.16±0.37, $p < 0.05$, $d = 0.66$, moderate effect). No differences in that performance variable were observed between the teams of defenders and midfielders ($p > 0.05$).

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

Analysis of participants' defensive individual actions did not reveal significant differences between teams for the variables of ball recoveries and balls intercepted ($p > 0.05$) (see Table 2). However, even without a statistically significant outcome, a tendency for the team of defenders to intercept a greater number of passes was recorded.

Finally, analysis of ball possession effectiveness, revealed significant differences for the variables lost possession and shots at goal between teams' roles ($p > 0.05$) (see Table 2). For lost possession, post hoc analysis revealed that the team of attackers displayed the highest number of lost balls (0.65±0.74), with significant differences in relation to values displayed by team of defenders (0.28±0.45, $p < 0.01$, $d = 0.60$, moderate effect). Significant differences

were also displayed between defenders (0.28±0.45) and midfielders (0.57±0.64, $p < 0.03$, $d =$ 0.53, low effect) for this variable, although no differences were observed between the teams of midfielders and attackers ($p > 0.05$). Regarding the variable Shots at goal, post hoc analysis revealed that the team of defenders displayed the highest number of shots completed (1.28±0.84), with significant differences in relation to values displayed by the teams of midfielders (0.63±0.78, $p < 0.01$, $d = -0.80$, moderate effect). No differences in this performance variable were observed between the teams of defenders and midfielders and midfielders and attackers ($p > 0.05$).

Discussion

The aim of this study was to examine how SSCG teams, composed of players with team differing roles, influenced the emergence of individual and collective tactical behaviours, as well as the ball possession effectiveness in youth soccer players. In line with our expectations, results revealed variations in individual offensive and defensive tactical behaviours that emerged from teams of players with different roles in the U15 yrs squad, as well as in the ball possession effectiveness of the composed teams. No differences were observed for team behaviors in analyses of time spent in ball possession and number of players involved in each attack. These results reinforced the co-adaptive behaviours of players of different roles, through the creation of particular game dynamics, and according to their role dispositions and capacities.

These findings support the idea that the current methods of player development in practice, performance and learning environments promote the development of role-specific skills and expertise, founded on motivations, values and capabilities of players. In particular current development methods shape the use of different individual affordances for players in similar game environments (Silva et al., 2013). Thus, it can be assumed that playing roles in association football may not only be characterized by different anthropometrical or physiological differences of individuals (Di Salvo et al., 2007; Marques et al., 2016), but also by different technical-tactical capabilities required by specific roles in which players are specialising (Laakso et al., 2019). An ecological dynamics rationale for the current findings suggest that players' main team roles seem to impact on their perception-action systems (i.e. the way they use information to regulate their actions), changing their capabilities for action during these learning experiences (intrinsic effectivities or readiness for action) (Araújo et al.,

2006; Davids et al., 2005). Our findings show that players' roles are a key constraint on the nature of the individual tactical actions that they learn to perform. Our evidence, showing role effects on learned behaviours, is well aligned with previous data, for example, evidencing role effects on players' spatial-temporal relations to perform (Laakso et al., 2019) or on the exploratory movements used to perceive the specifying properties of the surrounding environment (Jordet et al., 2020; McGuckian et al., 2018) that sustain affordances.

The lack of differences of role effects on team behaviors could be influenced by the numerical relations and the format of play used. Further research should be developed to understand the impact of individual changes at team level, by changing the number of players involved in practice games. In this particular format, it mean that variations in players' roles may not promote adaptive behaviours at the team level, but only in the process of synergy formation at individual (i.e. organization of actions) and sub-group levels of performance (i.e. coordinated activities between players) (Duarte et al., 2012). These findings emphasize that exploitation of available affordances in SSCGs, as key learning environments, by players is particularly sustained by increased capacity to attune to the nature of surrounding information. Further research is required to understand the impact of manipulating players' roles on emergent collective behaviors of SSCG teams in practice environments, using different metrics of analysis related to spatial-temporal relationships that emerge between players during performance.

Coaches' favoured designs and tendencies to maintain players in specialized roles during practice may impact their capacity to adapt and use available affordances in different locations of the field. This idea was supported by data from analyses of players' offensive individual actions, revealing that the team composed only of midfielders revealed a higher frequency of completed diagonal and vertical passes, compared to the team of attackers. Also, in performing individual offensive actions, the attackers' team displayed more dribbles in relation to teams of defenders and midfielders. Interestingly, analysis of ball possession effectiveness revealed that the team of defenders achieved a greater number of shots on goal, compared to the team of midfielders.

Defenders' team role

The role of defenders in 11-a side versions of football, when in possession of the ball is to initiate attacks by creating space to pass the ball to the midfield players and ensure the

creation of space for supportive passes to maintain ball possession under pressure (Baptista et al., 2018). The lower number of dribbles completed by the team of defenders, which was statistically different to the number of dribbles completed by the attackers, highlighted that field location constrains the information and actions that players tend to explore to successfully progress up field. In fact, previous research (Headrick et al., 2011) has revealed that the proximity to the goal constrains the spatial-temporal relations of players involved in 1v1 contexts. Also, evidence suggests that defenders tend to explore the affordances to progress upfield, based on the notion of risks of a change in ball possession in spaces nearer the goal (Travassos et al., 2014). Thus, supporting the notion of exploration and utilisation of available affordances during competitive performance, these findings signify how players act on affordances available in spatio-temporal properties of a performance environment, available for themselves according to their own roles and spaces of play (Baptista et al., 2020).

Consequently, in line with previous research, the team of defenders in this study, in comparison to teams of midfielders and attackers, revealed greater capability to control and manage available space relative to the opposition (Baptista et al., 2020). Since the main role of defenders during performance, is to protect their own goal, prevent use of free space in critical scoring areas by attackers, and recover ball possession, our findings suggest that players in defensive roles tend to develop greater awareness of affordances of space in front, between and behind themselves, than teammates with other roles.

Against our expectations, analysis of ball possession effectiveness revealed that teams of defenders also displayed a lower tendency to lose ball possession, which significantly differed to the team of attackers. The team of defenders also displayed a greater number of shots at goal in relation to the team of midfielders, an unexpected finding given their main team role. However, the explanation for this unexpected finding could be a result of the players being able to maintain team balance when involved counter-attacks, from defensive positions (Baptista et al., 2020). That is, even without statistical differences to performance behaviours of the teams of midfielders and attackers, the defenders revealed a tendency to recover the ball by interceptions, facilitating a great number of counterattacks and shots at goal. According to our previous research, teams of defenders tend to maintain higher values of interpersonal distances with opponents and play with lower levels of risk, than teams of midfielders and attackers (Laakso et al., 2019). Thus, the higher number of completed shots in 3v3 SSCGs may be a consequence of being able to perceive affordances for passes in

opponents and, therefore, intercept more passes, as well as losing possession less often, allowing them to progress forward for shots at goal. However, more information is required to sustain this assumption and further research is required to analyse the origin of the ball re-possessions that ended in shots at goal by defenders, midfielders, and attackers. Also, there is a need for further research with e SSCGs involving different numbers of players to understand whether the effectiveness obtained by the team of defending players in 3v3 transfers to other task constraints (e.g., 5v5 or 7v7).

Midfielders' team role

The midfielders' main role is to operate between attackers and defenders, creating variability in the exploration of possibilities for action of attackers to destabilize the defending team and score goals. It means that they constantly need to explore the relevant environmental information during performance that support their positioning and actions to allow the team to progress up field (Clemente et al., 2015). In the analysis of individual attacking actions, team of midfielders tended to perform a greater number of diagonal and vertical passes, compared to the team of attackers. Such results are aligned with previous findings on passing frequency of midfielders. It has been observed that midfielders preferentially explore affordances for passing opportunities to progress up field, through the defensive lines, seeking to play penetrative passes to attackers in space (Liu et al., 2016; Passos et al., 2020). In fact, midfielder players are usually the players with higher centrality of play (i.e., the players that receive and distribute more passes to other players) inside of the network of relations of a team, assuming the main responsibility to promote the flow of passes between different team sectors (Gonçalves et al., 2017).

In line with our previous findings, midfielders revealed, in ball possession effectiveness, a lower number of shots at goal, compared to teams of defenders. Due to their greater propensity to perform more passes and to explore opportunities for penetrative passes in progressing up field, the performance analysis of the midfielder teams highlighted how previous experience in their specific roles influenced participants to explore the affordances of the 3vs3 performance landscape (Clemente et al., 2015; Konefał et al., 2019).

Attackers' team role

The attackers' main role is to perform in areas of the field outnumbered by defenders, with restrictions on space and time to receive the ball, dribble and create opportunities to assist or to shot at goal. Attackers should have good skills with the ball to win 1vs 1 contexts with immediate opponents and to dribble into critical scoring spaces. That is, they usually reveal versatile and creative technical actions that allow them to be more unpredictable in de-stabilising defensive formations and to create space to shoot at goal (Coutinho et al., 2018). However, previous research has revealed that attackers display the lowest rate of perceptual scanning frequency for information during play (Jordet et al., 2020). Perhaps, because attackers have restrictions of space and time to receive the ball in dangerous areas of the field and to perform shots at goal, they tend to focus their attention on nearby surrounding information (i.e. goal location) in order to gain advantages in relation to immediate opponents (Clemente et al., 2015). In line with this role tendency, attackers displayed a higher number of dribbles in relation the teams of defenders and midfielders and, in general, a lower number of completed diagonal and vertical passes in comparison to the midfielders. Such observations are in line with data from previous studies that revealed that the lower perceptual scanning frequency of attackers could be associated with the fewer number of completed passes and higher number of completed dribbling actions (McGuckian et al., 2018). This finding is also in line with outcomes of previous studies where attackers completed fewer forward passes, compared players in other roles, perhaps explained by attackers typically having their back to goal during build-up play (Dellal et al., 2011).

Analysis of ball possession effectiveness revealed differing results compared to previous studies (Gai et al., 2019; Yi et al., 2019), where attackers performed more shots and scored more goals compared to players in other roles. However, such studies have reported differences in tactical performance behaviours emerging from performance in different playing roles, but within a single SSCG team composed of a mix of defenders, midfielders and attackers. Also, as previously stated, the use of the 3vs3 format cannot sample the perceptual-action task constraints that attackers face in 11vs11 competitive conditions. It is clear that players will use different perceptual information, available affordances and action requirements to constrain performance under different task constraints, for example, when shooting at goal. The attacking team also tended to lose the ball more often, compared to the team of defenders. One explanation for a greater frequency of lost ball possession is that the team of attackers were the group most focused on taking risks to go past opponents to win 1 vs 1 situations.

Practical implications

The obtained results allow coaches to understand how manipulating the players' role in SSCGs can change the affordance landscape and the training session dynamics. The findings suggest also that coaches should manipulate SSCGs situations for players to experience a variety of playing roles to increase opportunities for the players to explore synergy formation with teammates. These manipulations in practice design could help players to develop new effectivities (capabilities) to explore competitive performance environments from different perspectives, rather than just from the roles developed in an early specialization process.

Results suggested that coaches could design SSCGs with a team of defenders against midfielders or attackers to promote specific skills and collective behaviours. For example, after losing ball possession, the players could learn to perform individually and collectively to regain spatial-temporal equilibrium relative to ball location, while exploring the possibility to recover the ball. Also, an SSCG pitting a team of midfielders against a team of defenders or attackers could be used to promote spatial-temporal balance in defence, providing affordances for making or preventingdiagonal and vertical passes and for recovering ball possession. Finally, an SSCG with a team of attackers against of a team of defenders or midfielders, could be designed to improve players' defensive capability to face the dribbles of attackers and also practice recovering ball possession.

In summary, players' main team roles seem to have an impact on their current capabilities for action that can emerge during performance. In line with that finding, our data imply that coaches should constantly promote changes in the field dimensions and other properties of SSCGs, allowing players to explore different performance sub-phases or different playing roles, promoting opportunities for exploration of different possibilities for action, in different affordance landscapes.

Conclusions

Our findings suggested how the main playing role of a performer may constrain and promote different emergent collective behaviours and individual actions in 3 vs 3 SSCGs. Due to differences in performance context, players with different playing roles seem to exploit affordances and perform differently in competitive conditions (Aksum et al., 2020). Some

previous studies also observed similar results of effects of players roles in 1 vs 1 contexts (Headrick et al., 2011; Laakso et al., 2017) and 2 vs 1 (Laakso et al., 2019) sub-phases in football. Despite these obtained results, some limitations should be acknowledged. In this study, only U15 yrs players from one team were considered for analysis. Nevertheless, the findings suggest the need for further research for investigations with a larger sample and using different SSCGs formats (i.e. 4 v 4, 5 v 5, 6 v 6 or 7 v 7) in order to discover whether similar results may be observed with players of different ages and level of practice. In fact, the efectiveness of players, the constitution of teams or even the structure of play used seems influence the exploitation of possibilities for action and should be considered as a part of the formula of the design of training sessions to improve the learning and the performance development of players.

References

Aksum, K. M., Magnaguagno, L., Bjørndal, C. T., & Jordet, G. (2020). What Do Football Players Look at? An Eye-Tracking Analysis of the Visual Fixations of Players in 11 v 11 Elite Football Match Play [Original Research]. *Frontiers in Psychology, 11*(2624). https://doi.org/10.3389/fpsyg.2020.562995

Andrzejewski, M., Chmura, J., & Pluta, B. (2014). Analysis of motor and technical activities of professional soccer players of the UEFA Europa League. *International Journal of Performance Analysis in Sport, 14*(2), 504-523.

Araújo, D., Davids, K., & Hristovski, R. (2006). The ecological dynamics of decision making in sport. *Psychology of Sport and Exercise, 7*(6), 653-676. https://doi.org/10.1016/j.psychsport.2006.07.002

Araújo, D., Hristovski, R., Seifert, L., Carvalho, J., & Davids, K. (2017). Ecological cognition: expert decision-making behaviour in sport. *International Review of Sport and Exercise Psychology*, 1-25.

Baptista, J., Travassos, B., Gonçalves, B., Mourão, P., Viana, J. L., & Sampaio, J. (2020). Exploring the Effects of Playing Formations on Tactical Behavior and External Workload During Football Small-Sided Games. *The Journal of Strength & Conditioning Research, 34*(7), 2024-2030.

Clemente, F. M., Martins, F. M. L., Wong, P. D., Kalamaras, D., & Mendes, R. S. (2015). Midfielder as the prominent participant in the building attack: A network analysis of national teams in FIFA World Cup 2014. *International Journal of Performance Analysis in Sport, 15*(2), 704-722.

Coutinho, D., Gonçalves, B., Travassos, B., Abade, E., Wong, D. P., & Sampaio, J. (2018). Effects of pitch spatial references on players' positioning and physical performances during football

small-sided games. *Journal of Sports Sciences*, 1-7. https://doi.org/10.1080/02640414.2018.1523671

Davids, K., Araújo, D., & Shuttleworth, R. (2005). Applications of dynamical systems theory to football. In T. Reilly, J. Cabri, & D. Araújo (Eds.), *Science and Football V: The Proceedings of the Fifth World Congress on Sports Science and Football* (pp. 537–550). Routledge.

Dellal, A., Chamari, K., Wong, D. P., Ahmaidi, S., Keller, D., Barros, R., Bisciotti, G. N., & Carling, C. (2011). Comparison of physical and technical performance in European soccer match-play: FA Premier League and La Liga. *European journal of sport science*, *11*(1), 51-59. https://doi.org/10.1080/17461391.2010.481334

Di Salvo, V., Baron, R., Tschan, H., Montero, F., Bachl, N., & Pigozzi, F. (2007). Performance characteristics according to playing position in elite soccer. *International journal of sports medicine*, *28*(3), 222-227.

Duarte, R., Araújo, D., Correia, V., & Davids, K. (2012). Sports Teams as Superorganisms: Implications of Sociobiological Models of Behaviour for Research and Practice in Team Sports Performance Analysis. *Sports Medicine*, *42*(8), 633-642. https://doi.org/10.2165/11632450-000000000-00000

Folgado, H., Duarte, R., Marques, P., Gonçalves, B., & Sampaio, J. (2018). Exploring how movement synchronization is related to match outcome in elite professional football. *Science and Medicine in Football*, *2*(2), 101-107. https://doi.org/10.1080/24733938.2018.1431399

Gai, Y., Volossovitch, A., Lago, C., & Gómez, M.-Á. (2019). Technical and tactical performance differences according to player's nationality and playing position in the Chinese football super league. *International Journal of Performance Analysis in Sport*, *19*(4), 632-645. https://doi.org/10.1080/24748668.2019.1644804

Gibson, J. J. (1979). *The ecological approach to visual perception*. Houghton Mifflin Boston.

Gonçalves, B., Esteves, P., Folgado, H., Ric, A., Torrents, C., & Sampaio, J. (2017). Effects of Pitch Area-Restrictions on Tactical Behavior, Physical, and Physiological Performances in Soccer Large-Sided Games [Article]. *Journal of Strength and Conditioning Research*, *31*(9), 2398-2408. https://doi.org/10.1519/JSC.0000000000001700

Headrick, J., Davids, K., Renshaw, I., Araújo, D., Passos, P., & Fernandes, O. (2011). Proximity-to-goal as a constraint on patterns of behaviour in attacker-defender dyads in team games. *Journal of Sport Sciences*, *30*(3), 247-253. https://doi.org/10.1080/02640414.2011.640706

Hopkins, W. G., Marshall, S. W., Batterham, A. M., & Hanin, J. (2009). Progressive Statistics for Studies in Sports Medicine and Exercise Science. *Medicine and Science in Sports and Exercise*, *41*(1), 3-12. https://doi.org/Doi 10.1249/Mss.0b013e31818cb278

Hughes, M., & Franks, I. (2008). *The essentials of performance analysis*. Routledge.

Hughes, M., & Probert, G. (2006). A technical analysis of elite male soccer players by position and success. *Notational Analysis of Sport-VII, Cardiff: UWIC*, 76-91.

Jordet, G., Aksum, K. M., Pedersen, D. N., Walvekar, A., Trivedi, A., McCall, A., Ivarsson, A., & Priestley, D. (2020). Scanning, Contextual Factors, and Association With Performance in English Premier League Footballers: An Investigation Across a Season [Original Research]. *Frontiers in Psychology*, *11*(2399). https://doi.org/10.3389/fpsyg.2020.553813

Konefał, M., Chmura, P., Zając, T., Chmura, J., Kowalczuk, E., & Andrzejewski, M. (2019). Evolution of technical activity in various playing positions, in relation to match outcomes in professional soccer. *Biology of sport*, *36*(2), 181.

Laakso, T., Davids, K., Liukkonen, J., & Travassos, B. (2019). Interpersonal Dynamics in 2-vs-1 Contexts of Football: The Effects of Field Location and Player Roles [Original Research]. *Frontiers in Psychology*, *10*(1407). https://doi.org/10.3389/fpsyg.2019.01407

Laakso, T., Travassos, B., Liukkonen, J., & Davids, K. (2017). Field location and player roles as constraints on emergent 1-vs-1 interpersonal patterns of play in football. *Human movement science*, *54*, 347-353.

Liu, H., Hopkins, W. G., & Gómez, M.-A. (2016). Modelling relationships between match events and match outcome in elite football. *European journal of sport science*, *16*(5), 516-525.

Marques, M. C., Izquierdo, M., Gabbett, T., Travassos, B., Branquinho, L., & van den Tillaar, R. (2016). Physical fitness profile of competitive young soccer players: Determination of positional differences. *International journal of sports science & coaching*, *11*(5), 693-701.

McGuckian, T. B., Cole, M. H., Jordet, G., Chalkley, D., & Pepping, G.-J. (2018). Don't turn blind! The relationship between exploration before ball possession and on-ball performance in association football. *Frontiers in Psychology*, *9*, 2520.

Passos, P., Amaro E Silva, R., Gomez-Jordana, L., & Davids, K. (2020). Developing a two-dimensional landscape model of opportunities for penetrative passing in association football–Stage I. *Journal of Sports Sciences*, *38*(21), 2407-2414.

Passos, P., Araújo, D., & Davids, K. (2013). Self-organisation processes in team sports: Implications for leadership. *Sports Medicine*, *43*, 1-7. https://doi.org/10.1007/s40279-012-0001-1

Silva, P., Garganta, J., Araújo, D., Davids, K., & Aguiar, P. (2013). Shared Knowledge or Shared Affordances? Insights from an Ecological Dynamics Approach to Team Coordination in Sports. *Sports Medicine*(9), 765-772. https://doi.org/10.1007/s40279-013-0070-9

Travassos, B., Duarte, R., Vilar, L., Davids, K., & Araújo, D. (2012). Practice task design in team sports: Representativeness enhanced by increasing opportunities for action. *Journal of Sports Sciences*, *30*(13), 1447-1454. https://doi.org/10.1080/02640414.2012.712716

Travassos, B., Gonçalves, B., Marcelino, R., Monteiro, R., & Sampaio, J. (2014). How perceiving additional targets modifies teams' tactical behavior during football small-sided games. *Human movement science*, *38*, 241-250.

Vilar, L., Araújo, D., Davids, K., Travassos, B., Duarte, R., & Parreira, J. (2012). Interpersonal coordination tendencies supporting the creation/prevention of goal scoring opportunities in

futsal. *European Journal of Sport Sciences, 14*(1), 28-35. https://doi.org/10.1080/17461391.2012.725103

Yi, Q., Groom, R., Dai, C., Liu, H., & Ruano, M. Á. G. (2019). Differences in technical performance of players from 'the big five'European football leagues in the UEFA Champions League. *Frontiers in Psychology, 10*. https://doi.org/10.3389/fpsyg.2019.02738

Table 1. Description of the independent variables

Variables	Description
Team tactical behaviour	
Ball possession	The time a team has possession of the ball during one attack
Players involved	The number of players involved in that attack during ball possession
Participants' offensive actions	
Successful passes	Number of successful passes made by the team from one player to each other
Diagonal and vertical passes	Number of diagonal and vertical passes a team completed in one attack
Lateral and backward passes	Number of lateral and backward passes a team completed in one attack
Penetrative passes	A pass that split the last line of defence and plays a teammate through to shoot at the goal
Dribbles	Successfully completed dribbles made by a participant past layer an opponent
Players' defensive actions	
Ball recoveries	A player successfully wins the ball back for his own team
Interception	A player successfully intercepts an opponent's pass
Ball possession effectiveness	
Lost balls	A team loses the ball possession to an opponent or the ball goes out of play after an attempted interception or tackle
Shots	A team ends the ball possession with a missing shot, a shot resulting in a goal, or a shot saved by a goalkeeper.

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564 **Table 2.** Inferences for the effects of the game scenarios comparisons on performance measures.

Variables	Teams' constitution			χ^2	*p value* / d_{Cohen}		
	Defenders	**Midfielders**	**Attackers**		**Def vs Mid**	**Def vs Att**	**Mid vs Att**
Team behaviour							
Ball possession	6.81±4.73	6.94±4.09	8.07±5.11	1.72	-	-	-
Players involved	1.82±0.73	1.87±0.70	1.78±0.80	0.31	-	-	-
Players' offensive actions							
Successful passes	0.86±0.96	1.24±1.34	0.98±1.12	1.41	-	-	-
Diagonal and vertical passes	0.98±0.83	1.22±0.67	0.73±0.59	**8.75***	0.32 0.31	0.39 -0.35	**0,00**** 0.71
Lateral and backward passes	0.31±0.51	0.55±0.76	0.38±0.67	1.48	-	-	-
Penetrative passes	0.12±0.44	0.5±1.08	0.48±0.99	4.09	-	-	-
Dribbles	0.18±0.39	0.16±0.37	0.53±0.78	**7.57***	0.8 -0.05	**0.02*** 0.65	**0.01*** 0.66
Players' defensive actions							
Ball recoveries	0.12±0.39	0.13±0.34	0.10±0.30	1.27	-	-	-
Balls intercepted	0.22±0.42	0.11±0.31	0.13±0.33	2.74	-	-	-
Ball possession effectiveness							
Lost balls	0.28±0.45	0.57±0.64	0.65±0.74	**7.62***	**0.03*** 0.53	**0.01*** 0.60	0.77 0.12
Shots at goal	1.28±0.84	0.63±0.78	0.95±0.98	**11.51****	**0.00**** -0.80	0.19 -0.36	0.43 0.36

565 * p<.05; ** p<.001

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