Understanding Tactical Behaviour in Football Small-Sided Games Through Task Constraint Manipulation: Adopting Ecological Approach

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ABSTRACT

Small-sided and conditioned games (SSCGs) are widely used in football training because they allow the simultaneous development of physical, technical, and tactical performance. Although previous studies have extensively examined physiological responses and technical actions during SSCGs, less attention has been given to how tactical behaviours emerge through interactions between players and environmental constraints. Therefore, this review aimed to examine the influence of task constraint manipulation on tactical behaviour in football SSCGs from an ecological dynamics perspective. The review synthesised literature related to SSCGs, nonlinear pedagogy, representative learning design, ecological dynamics, and tactical performance analysis in football. Particular emphasis was placed on how modifications in player numbers, pitch dimensions, numerical superiority or inferiority, game rules, and relative playing area per player affect individual and collective tactical behaviours. The findings suggest that manipulating task constraints substantially influences interpersonal coordination, spatial-temporal organisation, and decision-making during football performance. Smaller SSCGs formats generally increase player involvement, technical actions, and frequency of ball contacts, while larger formats and numerical imbalances encourage greater tactical adaptation, spatial exploration, and coordinated attacking and defensive behaviours. In addition, representative learning design appears essential for creating training environments that closely reflect competitive match demands and support effective perception-action coupling. From an ecological dynamics perspective, tactical behaviours are understood as emerging from continuous interactions between players, teammates, opponents, and task constraints. Consequently, coaches should carefully manipulate SSCGs conditions to create representative and adaptive practice environments that enhance tactical awareness, skill acquisition, and decision-making. Future studies should further investigate collective tactical variables using contemporary positional analysis methods across different developmental and competitive contexts.

Keyword: Small-sided and conditioned games; task constraints; tactical behaviour; ecological dynamics; nonlinear pedagogy; representative learning design; football training

INTRODUCTION

In team sports, there has been an over emphasis on research in small-sided and conditioned games (SSCGs) focusing on a physiological perspective, such as conditioning. Most studies conducted on SSCGs have focused on the physiological benefits and its potential as an alternative to interval training. Most of the studies in the literature have measured performance variables such as heart-rate (Clemente et al., 2023; Hill-Haas et al., 2009; Impellizzeri et al., 2006; Rampinini et al., 2007), time-motion characteristics (Casamichana & Castellano, 2010; Clemente et al., 2022; Gabbett & Mulvey, 2008; Hill-Haas et al., 2010), blood lactate (Castagna et al., 2009; Coutts et al., 2009) and rate of perceived exertion (RPE) (Casamichana & Castellano, 2010; Fanchini et al., 2011). SSCGs are one of the most common methods used by coaches of team games as an alternative to drills for training purpose especially in football (Hill-Haas et al., 2011). A key benefit of this type of training method is that it purports to save time for coaches and players, especially when physical training is integrated with technical or tactical aspects of preparation. The present review critically examines how individual and collective tactical behaviours in football small-sided and conditioned games (SSCGs) are influenced by the manipulation of task constraints, from an ecological dynamics perspective.

LITERATURE SEARCH

To identify pertinent articles and reviews, a comprehensive search of PubMed, SPORTDiscus, Scopus, and Google Scholar databases was undertaken from inception to September 2025. Titles, abstracts, and keywords were searched using Boolean operators ("AND" and "OR") and truncation symbols ("*") to identify articles that were related to the objectives of this review. The terms used in various combinations were 'Football', 'Soccer', 'Small-Sided Games', 'Small-Sided and Conditioned Games', 'Task Constraints', 'Tactical Behaviour', 'Collective Behaviour', 'Ecological Dynamics', 'Nonlinear Pedagogy', 'Representative Learning Design', 'Decision-Making', 'Interpersonal Coordination', and 'Positional Analysis'.

Studies were included if they: (1) examined football SSCGs, (2) investigated the effect of manipulating task constraints on tactical, technical, behavioural, or collective output, (3) examined concepts of ecological dynamics, nonlinear pedagogy, or representative learning design, and (4) were peer-reviewed articles written in English. Articles were excluded if they: (1) did not examine football SSCGs or task constraint manipulation, (2) did not contain sufficient information regarding tactical or behavioural outcomes, and (3) were not peer-reviewed. No restrictions were placed on age, sex, competitive level, or geographical location of players to provide an overview of all evidence currently available.

SMALL-SIDED AND CONDITIONED GAMES IN FOOTBALL

Physiological Responses to Small-Sided and Conditioned Games

A comprehensive systematic review by Muhyi et al. (2025) has been published, mainly focusing on the physiological effects in SSCGs training especially in football. This review highlighted that there has been an increasing quantity of multidisciplinary research conducted into SSCGs in football. Earlier study on SSCGS, Rampinini, et al. (2007) examined the effects of motivation (coach encouragement), pitch size and number of players on exercise intensities during SSCGs. They found that irrespective of pitch size and motivation, games with fewer players (e.g. 3v3) showed higher intensities compared with others formats of games (e.g. 4v4, 5v5 and 6v6). They argued that when there were fewer players on the field and the coach provided verbal encouragement, there was more possession and control of the ball individually, therefore, enhancing the exercise intensity of players. In contrast, the study by Kelly and Drust (2009) showed different results suggesting that pitch size generally did not influence training intensity when the number of players was kept constant. This may have been because this study did not examine the influence of motivational factors, such as coach encouragement to increase their player performance intensities. Whilst, complementing these enhancements in physiological indicators of performance, it has been argued that technical abilities, in terms of the number of shots and tackles made for example, also significantly improve in smaller pitch games. Owen et al. (2004) also found similar findings in their study when manipulating the number of players and pitch size during practice. They found that, by adding extra players on the pitch, there was an increase and decrease the number of technical actions observed. In addition, when the pitch size remains constant, the physical demands (i.e. intensity) of the performers was decreased. These studies indicate that, manipulating pitch size and number of players, may alter technical and physiological aspects during SSCGs in predictable ways. In this regard, the data on the role of SSCGs on physiological adaptation and some of technical abilities of players in previous studies provide a rationale for the study of tactical behaviours in SSCGs. This is presumably because changes in HR reflect a response by players to the new spatio temporal properties promoted by altering the available field size and/or number of players.

Previous research on SSCGs (Coito et al., 2020; Hill-Haas et al., 2009; Katis & Kellis, 2009; Owen et al., 2004; Sarmento et al., 2018) has tended to examine effects of manipulating task constraints by varying the number of players, by maintaining the same number of players on opposing teams (e.g. 3v3 or 4v4). In full-sided games of association football, sub-phases occur where there is an imbalance of players involved such as 3v1, 5v2, or 6v4. Therefore, it is common for coaches during practice to create player imbalances such as extra players on one side (an overload) or fewer players on another side (an underload) during training to create physiological pressure or to improve specific technical/tactical skills in play (e.g. how to play in sudden overload/underload situations e.g., 2v1 or 3v2). Hill-Haas and colleagues (2010) examined the influence of imbalanced player numbers on opposing teams during SSCGs, reporting significantly higher ratings of perceived exertion (RPE) in players during SSCGs involving imbalanced team numbers. That study determined that by manipulating the number of players in each side during SSCGs, training intensity can be enhanced. Research is needed to advance understanding for coaches or practitioners in using SSCGs formats involving unequal numbers of players, not only to improve physiological responses, but also to technical/tactical skills in game play. However, to this point, unequal numbers of players on the pitch have only been examined through physiological measures and there is an assumption that creating unequal team numbers in training might also influence the development of technical skills (Hill-Haas et al., 2010). To exemplify, in 6v4, during attacking scenarios, 3 defensive players (+1 player position near the opponent scoring zone) are often faced with having to prevent a 5 attacking players (+1 defender). During this situation, players' organization is a key factor, as the defenders need to keep the attackers out of scoring zone, while the opposing attackers try to find a way through to shoot a goal. Moreover, the defenders need to work harder and make lots of interpersonal adjustments to stabilize dyads. At the same time pressure defenders need to pressure opponents to prevent goal scoring opportunities and attackers might maintain ball possession to create space for goal scoring. The adjustments that the attackers and defenders have to make in these imbalanced scenarios can be learned to develop their interpersonal interactions in achieving their distinct performance goals. For example, unequal numbers of players in SSCGs might develop specific skills, such as timing a through pass, and can help players identify patterns of play to create or prevent scoring opportunities. However, to date there is limited or no research examining the influence of player number imbalance and it is not well understood how player imbalance might shape tactical and decision-making.

The increasing trend of using SSCGs in order to achieve desirable physiological adaptations reflects the belief that SSCGs may also carry benefits for technical (e.g. ball control) and tactical (e.g. achieving game objectives) skill development (Owen et al., 2004). However, the question still remains, whether using SSCGs to create complex practice environments provides opportunities for players to improve and adapt their movement behaviours when attempting to complete specific task goals.

Currently research on technical/tactical behaviours in team sports tends to focus on how training interventions influence discrete actions such as number of passing, tackling, goal shooting and etc. However, these measures have been criticised in the past for their insensitivity to understanding team behaviour. Measures of performance behaviours have also been taken in SSCGs formats and may provide important additional tools for evaluating the impact of training interventions on learning and performance. The purpose of the following section is to review the current literature on skill adaptation in order to understand the emergence of player behaviours and skills during training and learning in SSCGs.

Tactical and Technical Performance Studies

To date, researchers into team sports performance have primarily investigated the type of actions or performance indicators that are performed by the players in a competitive game. Typically, such investigations involve recording discrete actions (e.g. number of tackles, number of passes, number of ball possessions) in order to look for correlations that might indicate what behaviours are related to winning or losing (known as performance analysis) (Klingner et al., 2022; Sarmento et al., 2018). Moreover, performance in sports also can be measured through scoring indicators (e.g. goals, errors, baskets). These variables are typically recorded as functions of sports behaviour. In football, for example, goal scoring has been recognised as the most important event. For example, Hughes and Franks (2005) have described how goals were scored in association football matches by analysing the style of play (e.g. direct or possession play) by analysing the relationship between the number of ball passes to goal scoring. Although, some expert coaches have emphasised the use of longer passing sequences as a means to score goals, notational analysts have described that the strike ratio of goals from shots is better for direct play than for possession play (Hughes & Franks, 2005).

Recently, the amount of research has expanded regarding the measured performance indicators in SSCGs, especially football (Essafi et al., 2026). Previous research has shown significantly more action indicators such as more touches, passes, fewer tackle, more shots, and 1v1 situations, suggesting that SSCGs may be suitable for training these skills in football players in preparation for the full game format. For example, Jones and Drust (2007) examined the technical demands during 4v4 and 8v8 SSCGs formats in football revealing that, in 4v4, there is more contact with the ball or more ball touches compared to the 8v8 format. They argued that the 4v4 format enhanced technical development more than the 8v8 format because of the greater potential frequency of contact with the ball. Moreover, Katis and Kellis (2009) compared the importance of using different SSCGs formats. They recommended that training in the 3v3 format is better for developing technique. On the other hand, the 6v6 format is better to improve tactical performance (by including opportunities for long passing). Fenoglio (2003) conducted a study of football practice in children under 9 years of age and claimed that there are more benefits to be gained from performing in the 4v4 format compared with the 8v8 format in terms of fitness and skill enhancement. He found these children had a greater number of ball touches, more interactions in 1v1 situations and therefore, they have much better all-round understanding and knowledge about the game. In contrast, he argued that the 8v8 format produced higher exercise intensity and was a better format for developing an individual's aerobic power, similar to the full version of the game (Capranica et al., 2001). Due to fewer players and the smaller size of the pitch, each player spends more time in ball possession and has more touches of the ball (Capranica et al., 2001). In a previous study, Platt et al. (2001) attempted to compare SSCGs (i.e. 5v5 and 3v3) by altering the playing fields measuring 40 x 30-yard and 30 x 20-yard respectively. Their findings indicated that the 3v3 format is more appropriate to use for the development of technical skills (i.e. dribbling, passing and shot at goal) because it allows more ball touches and contacts due to the extra space and time available compared with the 5v5 format.

These investigations on football have emphasized the frequency counts of actions performed as a proxy for skill acquisition. This measured approach presumes that there is a relationship between the frequency of ball contacts and the quality of skill acquisition in players. For example, it assumes that the more times that a learner touches the ball during practice, the more that skill acquisition is enhanced. As a consequence of this study, Manchester United in the English Premier League uses the 4v4 format as its sole format in the junior academy training programme. However, this decision is based on an assumption that the frequency of contact with the ball was the sole stimulus for skill acquisition in the 4v4 format. The results, which support this suggestion, are somewhat tentative. As Ericsson (2004) has argued, mere experience with an activity is not a valid predictor of skill level attainment (e.g., Ericsson, 2004). It is yet unknown whether the frequency of repetitions of actions is an appropriate proxy for the skill acquisition process. Further, there have been no attempts to compare and contrast how different training and practice formats in SSCGs shape skill acquisition and decision-making or as practice simulations in preparation for performance in full versions of team games. The key issue is that a theoretical framework needs to be developed to guide understanding on how skills may be acquired in small-sided games.

To date, there are no exact theoretical models or framework that can help coaches to determine which type of SSCGs format is more relevant to use in developing players' performance or when the best time to use in training is. This is a critical concern in SSCGs research, especially in skill acquisition, since the previous systematic research review by Clemente et al. (2022) only examined the role of SSCGs on player performance and did not examine their functional utility as a learning tool, as proposed in TGfU or Nonlinear Pedagogy. There are some important questions that need to be addressed in using SSCGs as part of team training (Gregson & Drust, 2000; Little, 2009) such as: (i), how can different formats of SSCGs shape athlete behaviours in performance in the full versions of team games?; (ii), how representative are the different formats of SSCGs as simulations of the full version of team games?; and (iii), how may they be used to acquired skill of players during training? This program of study will contribute research examining the behavioural effects of SSCGs so that the coaches and sport practitioners can identify which formats of SSCGs can shape skill acquisition and promote decision-making to practice. As mentioned earlier, the ecological dynamics framework has been established to understand performer-environment relationship from which to interpret emergent behaviours by manipulating task constraints such as SSCGs. On the basis of this framework, the following section will review SSCGs effects on the players and team behaviours that will be used in this programme of work and consequently contributed to current theory perspective used.

Ecological Dynamics

A relevant theoretical framework for interpreting SSCGS effects: Adopting ecological approach in sport Previous research on adopting ecological dynamics framework has suggest that interpersonal coordination is an important variable to understand players' behaviour (Araújo et al., 2023; Araújo et al., 2004; Passos et al., 2008). This complex adaptive system in team sports have been studied with the goal of identifying and explaining emerging player behaviours from an ecological dynamic perspective (Laakso et al., 2019). Team sports have been formulated as a complex adaptive system whose behaviour is guided or disrupted by several, smaller sub-systems (i.e., 4 vs 4 or 2 vs 1) of attackers and defenders interacting under constraints.

In SSCGs, for example, due to space and time constraints, players' functional behaviours depend on their ability to attend to the informational variables needed to regulate their movements (Araújo et al., 2006; Araújo et al., 2019). Previous analysis of the coaching literature in basketball reveals that, a potential control parameter in 1v1 dyad could be the interpersonal distance between the attacker and defender (Araújo et al., 2004). While, Passos et al. (2008) highlighted that, in rugby union, the relation between interpersonal distance and relative velocity can best influence patterns forming dynamics in dyadic system behaviour. Similarly, Duarte and colleagues (2010) advocated these findings in their study on 1v1 in association football by showing a clear tendency in interpersonal coordination during phase transitions (i.e. movement in a dyad that lead to changes in and out of state of organization). According to Travassos and colleagues (2012), these studies indicates that, based on the dynamics of the spatiotemporal interactions between the players, decision-making had emerge. However, these views are understood as the physical terms. In relation to this, their study measured the visual information from the movement flow based on the use of high order variables such as tau or time-to-contact (the time of closing motion gap between attacker and defender) to explain performer movement behaviours and pattern forming dynamics between attacker-defender dyads (Correia et al., 2011; Davids et al., 2006; Travassos et al., 2012). This body of work has suggested that, SSCGs can simulate specific sub-phases of team games (i.e. 1v1, 2v2 or4v2) and regulate player's behaviour, since they play in small numbers of players and there would be many interactions between them.

An argument, based on these findings, is that, the best way for learners to use information on the time-to-contact with opponents in team games performance is to allow them to experience in SSCGs during practice. Previous research on team sports, has analysed inter- and intra-team interactions, identifying different stable emergent patterns of play (Passos, Davids, et al., 2010). The main findings of these studies suggest that the number of interactions between team members result in varied intra-team coordination patterns of play, differentiating between successful and unsuccessful performance outcomes (Passos, Davids, et al., 2010). Passos et al. (2010) stated that, in practice, the various forms of SSCGs training should be structured so that it can increase the number of interactions afforded during each game sub-phase and players will be able to interact with each other key players.

Previous research on decision-making and skill acquisition in ecological dynamics approach suggests that interpersonal interaction is an important key factor for the behaviours to emerge that benefits team sports (Davids et al., 2013; Davids et al., 2015). Moreover, it also showed that movement coordination emerges from interacting constraints, which harness motor system dynamics during goal directed behaviour (Araújo et al., 2023; Araújo et al., 2004). Therefore, it needs to be understood whether the process of skill acquisition in team games can be enhanced through SSCGs, especially in children, so that they can be used to help learners gain experience in picking up information on interpersonal interactions. In physical education, teaching approaches that emphasise children's exploratory learning within SSCGs have been increasingly accepted (Chow et al., 2007). During goal directed behaviour, learners need to be able to identify specific information so that they can become attuned to this important information and use it to regulate behaviour. The principal of information-movement coupling has been used in Nonlinear Pedagogy as a theoretical framework to guide the design of learning environments

(Araújo & Davids, 2009). Nonlinear Pedagogy has been predicated as emergence of performance and decision-making behaviour among children involving manipulating key constraints (Chow et al., 2007). In this next section, this review will outline the basis used in SSCGs and its implications in sport pedagogy and physical education as learning tools in acquiring and developing skills.

Nonlinear Pedagogy for Skill Acquisition

Over the years, physical education has developed new levels of understanding and ideas concerning teaching and learning processes (Chow et al., 2009; Chow et al., 2007; Davids, Chow, et al., 2005; Davies et al., 2023). During the learning process, physical educators and sport pedagogues need to plan extensive programs that meet the needs of children to develop their physical skills and provide a foundation for lifelong learning in sport and other activities (Renshaw, 2010). It is very important to know what type of activities or sports can motivate people to be physically active in order to encourage an active lifestyle. For example, according to Dishman et al. (2005), the key predictor of physical activity participation and devotion in a young population is enjoyment. Usually, physical educators tend to optimize a small area such as the hall or gymnasium for children without compromising their participation and enjoyment (Toh et al., 2011). However, Toh and colleague's (2011) finding showed that, when children involved in physical activity, in the form of game alike, they achieve higher levels of enjoyment and participation. Moreover, during training or competitions, children's involvement can be optimized when fewer players are playing on a small pitch, which can result in an increase in energy expenditure and enjoyment of the games (Toh et al., 2011).

Since then, many types of teaching methods and models have evolved and, generally, there has been a change from a teacher-based approach to a more student-based approach. The student-based approach is a learning process where students are urged to develop their problem-solving skills, critical thinking and autonomy of thought (Richard & Wallian, 2005) in contrast to the teacher-based approach, which directly uses an instructional approach (command method) (Davids, Chow, et al., 2005). In physical education, some of the schools that use the student-based approach as the learning vehicle teach both tactics and skills in small-games and conceptualizes students as active learners like in the Teaching Games for Understanding (TGfU) and others model, as mentioned earlier in the introduction. However, all these programmes have conceptualized teachers as facilitators, with student needs and learning tools in physical education. In physical education, SSCGs represents constrained games that have been manipulated from a full version games (e.g. football, basketball, rugby) and can be considered to engage learners physically, cognitively and emotionally (Davids, Chow, et al., 2005).

For the past 20 years, the TGfU framework has become the most popular model for a student-based approach in physical education. This model had been developed because of dissatisfaction of some practitioners with the previous teaching model in understanding how it can be used with learners at different skill levels (Chow et al., 2007). Bunker and Thorpe (1982) who conceptualized this TGfU model have criticised the weaknesses of the traditional or teacher-based approach because of more technique dominated (e.g. training part by part). The TGfU model in pedagogical practice has grown its popularity and emphasizes the limitations of traditional approaches in learning that highlighted poor decision-making ability, isolation when practicing skills and lack of transfer skills in competitive match play (Davids et al., 2008). Furthermore, TGfU emphasized that the tactical aspects of learning through playing modified games involving manipulating constraints such as the playing areas, equipment use, rules of the games and number of players in play can enhance the awareness and understanding of the learners in the full version of the games (Chow et al., 2006). However, there are some studies that have less support on TGfU theoretical framework recommended by Bunker and Thorpe (1982) regarding its efficacy as a pedagogical approach (see Mitchell et al., 1995). Therefore, there are numbers of alternative explanations regarding the efficacy of TGfU and there is one approach called Nonlinear Pedagogy (Chow et al., 2007) that has the potential to provide researchers and physical educators with an understanding of the theoretical and practicable work on TGfU.

A Nonlinear Pedagogy approach has been introduced as a method to facilitate the emergence of decision-making behaviours and functional movement patterns by interactions between players' and environment constraints (Chow et al., 2006; Chow et al., 2007; Davies et al., 2023). This is based on the ecological dynamics framework through which the manipulation of important variables such as practice structure and equipment used during learning are the keys to understand skill acquisition and the emergence of decision-making behaviours. Task constraints manipulated in the learning environment also help to shape the emergence of novice learner behaviours (Dicks & Chow, 2010). Moreover, task constraints have a powerful role to play for physical educators and differ in the nature of playing surface, the number of players involved, playing area dimensions, rules, the time span of matches, and properties of the ball (Davids et al., 2008). For example, in team games such as football, coaches usually modify the size of pitches during practice to allow learners to develop decision-making skills in offensive and defensive situations (Williams & Hodges, 2005). However, in physical education, physical educators can manipulate the rules of the football games instead of playing full-sided games on the large pitch; children playing SSCGs such as 3v3 or 3v1 sub-phases of the game on a small pitch allow more touches and dribbling which may develop retention skills (Davids, Chow, et al., 2005). It has been suggested that manipulating these characteristics of football can enhance the quality of ball control in children, as long as they are already at the control stage of skill acquisition (Renshaw, 2010). Further, it also can simplify the amount of time spent in playful and enjoyment activities by allowing the children to try out skills by themselves.

Physical educators and sport pedagogues require strong knowledge and understanding of team sport performance so that manipulation of task constraints can lead learners to discover functional coordination patterns and decision-making behaviours (Renshaw et al., 2010). Manipulation of informational task constraints by physical educators and pedagogues will lead the learners towards functional information-movement coupling to achieve goals (Davids et al., 2001; Davies et al., 2023). As mentioned before, information-movement or perception-action coupling is the use of information that is created from the movement behaviour and then used to regulate actions. It is a primary idea from ecological psychology that is essential in theorizing of goal directed behaviour on learners movement (Davids et al., 2001).

PERFORMANCE ANALYSIS IN FOOTBALL

The emergence of the key coordinative variables in performance analysis Performance analysis in team sports has emphasized the use of notational and time-motion analysis as methods to examine the movement patterns and players position during match-play and practice (Frencken & Lemmink, 2008; Frencken et al., 2013). However, these types of analysis have mainly focused on the player's motion when holding the ball (possession) and conditioning responses in individual players (e.g. player running distance and speed). Lago (2009) also stated that, in association football, the percentage of ball possession was influenced by the match variables (i.e. match status, game location and level of opponent). For example, leading team will decrease its level of ball possession while a losing team would try to increase its level of ball possession. However, some researchers have criticised this view because its fails to provide adequate information about the performance context (den Hartigh et al., 2020; Duarte et al., 2012).

In team sports, tactical movement is an important variable that can influence competitive games. Moreover, in football, tactical performance indicators can reveal the importance of player interactions, pace, fitness and movement patterns which make these methods important to understand the games patterns of play in competition (Hughes & Bartlett, 2001). However, analysis from a tactical perspective is still scarce even though it could be beneficial to sports performance analysis. Previously, performance analysis investigated team performance based on the sum of the individual player's performances. However, Frencken and Lemmink (2008) argued that studying the team as a whole has a beneficial effect and added value rather than studying the sum of all players alone.

In team sports such as football, the variability of the behaviours of individual players on the pitch, such as the interactions between teammates, opponents and the ball (Davids, Araújo, et al., 2005), makes it difficult to use performance analysis methodology because performance analysis is based on measuring the actions of individual players alone and not the actions of the whole team. Furthermore, Schöllhorn (2003) suggested the use of a holistic view of information about the relative positioning of all players in the pitch which describes the behaviours of whole teams in space and time. Recent studies have started to explore the behaviour that emerges during interaction in match play or competition between the players and teammates by using the positional data.

For example, in an exploratory study, Frencken and Lemmink (2008) investigated the patterns of two teams playing in SSCGs by analysing the collective behaviour variables such as the teams' geometric team centre and team surface area. Geometric centre is defined as the centre of the team which represents the mean value of the player distribution around the centre of each team, while the surface area defined as the covered space of the outfield players of the team or overall team position (Frencken et al., 2011). They found that, there is a natural 'rhythmic flow of attacking and defending' when they measured geometrical centre or the centroid of the team. They also determined that, these variables could best be used to describe goal scoring opportunities. Folgado (2010) investigated how tactical collective behaviours varied in age and SSCGs formats. This study used three different age groups (under-9, -11, -13 years old) playing in two different SSCGs formats. The positional variables used were the length per width ratio and the geometrical centre distance of each team. Their results concluded that, team variables analysis seems to be a useful method in understanding the emergence of tactical patterns in SSCGs, especially in football. However, these studies indicated the rhythmic flow of attackers and defender and demonstrated game dynamics but did not provide information on how this might happen in team sports performance. Analysis of how collective variables capture team performance is still lacking and is needed.

Recent studies have advocated the use of dynamic systems theory to measure players' tactical behaviours, using positional data. Olthof et al. (2019) and Azli et al. (2015) explored the players movement patterns and inter-player coordination. The study revealed that player' decision-making processes were related to teammates' positioning on the pitch. They suggested that the player's distance to the centroid is an important variable to measure, since it indicated the emergent of player movement behaviour. Therefore, this programme of work will further to investigate these centroid effects and surface area on SSCGs as suggested by previous research.

Evidence from recent studies examining movement models demonstrates that in order to maintain information-movement couplings, coaches, physical educators and sport pedagogues need to be capable in the manipulation constraint (e.g., task) so that it is representative of competitive performance situations (Araújo et al., 2006; Araújo et al., 2019; Renshaw et al., 2010). Pinder, Davids, Renshaw, & Araújo (2011b) advocated the important theoretical concept of representative task design to assist researchers or practitioners to designed training specifically based on the needs of individuals, in order to represents the competitive match play.

REPRESENTATIVE LEARNING DESIGN

Representative Learning Design as the Structure of Training

Originating from the work of Brunswick (1956), the concept of representative task design impacts all areas of research on human performance and behaviour. This theoretical framework was designed for psychological experimentation. Representative task design can be defined as the generalization of task constraints in experimental designs to the constraints encountered in performance environments (Araújo et al., 2006). In other words, the structure and task of practice is designed specifically based on the needs of individuals, and it represents the competitive performance context in team games.

Previous research in football has examined the players' performance and how it might affect decision-making. For example, a study by McMorris (1999) applied simulated training by using game-based decision-making tasks while participants were in steady state and when exercising at designated performance thresholds. These investigations were largely limited to simulation and laboratory settings, due to the condition of precisely measuring performance data. The outcomes of the players' decision-making abilities were determined while they were stressed using these experimental designs. However, players were not in competitive situational contexts and occasionally only verbally confirmed their response. A criticism of the existing methodologies in the study of decision-making in sport is that they have failed to implement representative task design in research (Davids, 2008). This criticism relates to the benefit of the performer-environment relationship, where relevant sources of information give the potential for advantageous performance decisions to be made by the players (Araújo et al., 2006).

Pinder and colleagues (2011a) analysed the movement organization of cricket batters and they found that batters batting against a 'live' bowler displayed a significantly different movement performance compared to when they

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batted against a ball projection machine and a 'simulated batting' against video footage (i.e. a video-based simulation protocol. It could be argued that, the perception-action link is missing between the ball machine and video simulation, therefore the representative task design may have been compromised, meaning the experimental set up may not have represented the competitive situation to which the results were proposed to be generalised (Araújo et al., 2007). In sports, training needs to simulate performance environments so that it can allow players to detect affordances for action (Pinder et al., 2011a). Previous research which has simulated team games performance contexts by using SSCGs has been proposed to improve physiological adaptations (Impellizzeri et al., 2006), technical demands (Casamichana & Castellano, 2010) and motivation (Rampinini et al., 2007; Toh et al., 2011), because SSCGs replicate the movement behaviour of competitive game situations (Araújo et al., 2004; Passos et al., 2008; Riboli et al., 2023). In sport, especially football, researchers have used performance analysis to substantiate insights into team performance behaviours in full version of games or game sub-phases (McGarry, 2009). The task of this framework is to identify coordinative variables which capture a system's organization and its change over time (Vilar et al., 2012).

CONCLUSION

In conclusion, this review demonstrates that small-sided and conditioned games (SSCGs) are valuable training approaches for developing tactical behaviour, decision-making, and adaptive performance in football. The manipulation of task constraints, including player numbers, pitch dimensions, numerical superiority or inferiority, and game rules, substantially influences interpersonal coordination, spatial-temporal organisation, and collective team behaviours during practice and competition. Recent studies have shown that appropriately designed SSCGs can improve tactical adaptability and support the emergence of functional movement behaviours that closely resemble competitive match demands (Clemente et al., 2021; Sarmento et al., 2022).

From an ecological dynamics perspective, tactical behaviours emerge through continuous interactions between players, teammates, opponents, and environmental constraints rather than through isolated technical actions alone (Davids et al., 2021). In this context, representative learning design and nonlinear pedagogy provide important theoretical foundations for understanding how coaches can manipulate practice environments to enhance perception-action coupling, tactical awareness, and skill adaptability (Chow et al., 2021; Otte et al., 2023). Smaller SSCG formats generally increase technical involvement and player interactions, while larger formats and numerical imbalances encourage spatial exploration, collective organisation, and coordinated attacking and defending behaviours.

Overall, SSCGs should be viewed not only as conditioning tools but also as representative learning environments capable of facilitating tactical development in football players. Therefore, coaches and practitioners should carefully manipulate task constraints according to specific training objectives and developmental needs. Future work should aim to further the analysis of collective tactical behaviours using current positional data and performance analysis techniques as well as different SSCG formats, player age groups/competitive standards. Systematic reviews and meta-analyses should be performed to better understand the efficacy of specific task constraints for developing tactical performance, collective coordination, and decision-making.

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