# Manipulation of Task Constraints and Tactical Behaviour in Football Small-Sided Games: A Contemporary Perspective

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## ABSTRACT

Small-sided games (SSG) are widely used in football training to develop tactical behaviour; however, existing reviews have predominantly focused on physiological and technical outcomes rather than tactical adaptations. This narrative review critically synthesises evidence on how individual and collective tactical behaviours are influenced by manipulating four categories of task constraints: player numbers, pitch dimensions and relative area per player, numerical (im)balance between teams, and game rules. Evidence is organised by constraint type to allow comparison of tactical, technical, and physical responses across SSG configurations. Interpreted through an ecological dynamics framework, the findings indicate that reducing player numbers and relative playing area modifies spatial and temporal constraints, influencing decision-making, interpersonal coordination, and collective team organisation, including team width, length, and surface area. Numerical imbalance alters opportunities for ball circulation, attacking support, and defensive compactness, while game rule modifications direct players towards specific tactical objectives and movement patterns, although evidence on the tactical effects of rule manipulations, such as touch limits and scoring conditions, remains comparatively limited. Advances in positional tracking, network analysis, and machine-learning-based pass classification have improved the objective assessment of tactical behaviour and interpersonal coordination. Nevertheless, the evidence reveals substantial methodological inconsistencies and a continued emphasis on physiological and technical indicators, with few studies examining tactical variability and adaptive behaviour across task constraints. The review also compares constraint effects across age groups, skill levels and competitive standards, discusses representative learning design and nonlinear pedagogy as practical frameworks for manipulating task constraints, and provides illustrative examples of how coaches can combine constraints to target specific tactical objectives. Future research should prioritise standardised tactical measurements, longitudinal intervention designs, and integrated analyses of technical, physical, and tactical outcomes within representative training environments to strengthen the translation of SSG research into evidence-based coaching practice.

**Keywords:** Ecological dynamics; football; small-sided games; tactical behaviour; task constraints

## INTRODUCTION

Small-sided games (SSG) are among the most popular training methods in football, as they allow for the simultaneous development of technical, tactical, physical, and perceptual-cognitive factors in highly representative environments (Clemente et al., 2022; Coito et al., 2022; Hill-Haas et al., 2011). Manipulating task constraints such as pitch size, number of players, scoring rules and the number of permitted ball touches allows coaches to replicate the competitive demands of match play while promoting creativity and guided discovery (Davids et al., 2013; Travassos et al., 2013).

Traditionally, research on SSG in football has been guided primarily by physiological and technical outcomes such as heart rate and blood lactate responses, distance covered, or number of passes and shots (Aguiar et al., 2012; Hill-Haas et al., 2011; Impellizzeri et al., 2006; Rampinini et al., 2007). More recently, a systematic review examining between- and within-session variability of SSG outcomes across 24 studies found that 16 examined internal load, 13 examined external load, and only two examined variability in tactical behaviours (Clemente et al., 2022). As such, the relationship between constraint manipulations and tactical behaviours is still under-examined relative to other SSG outcome measures.

Earlier reviews of SSG in football have mostly been organised around physiological and physical outcomes or around theoretical concepts such as ecological dynamics, affordances and representative learning design. Fewer have been organised around the specific constraint being manipulated, and those that have tend to address a single constraint, such as pitch size (Clemente et al., 2023) or numerical imbalance (Rumpf, Jäger, Lloyd, et al., 2026), or to catalogue which constraints tactical studies have manipulated (Ometto et al., 2018). Building on this work, the present review is structured around four constraint categories: manipulations of (i) player numbers, (ii) pitch dimensions and relative area per player, (iii) numerical (im)balance between teams, and (iv) game rules, specifying for each the tactical variables found to be affected and the direction of the effect. The aim of this narrative review is to examine critically, constraint by constraint, how manipulating player numbers, pitch dimensions, relative area per player, numerical (im)balance, and game rules influences tactical behaviours of individuals and teams in SSG in football through the theoretical lens of ecological dynamics. The review also discusses the implications of representative learning design for training, compares constraint effects across age groups, skill levels and competitive standards, and outlines the technological and statistical techniques now used to measure tactical outcomes in SSG, such as positional tracking, network analysis and machine learning.

## LITERATURE SEARCH

To identify relevant articles and reviews, a structured literature search was conducted using PubMed, SPORTDiscus, Scopus, and Google Scholar, covering publications from database inception to August 2026. The search focused on studies examining the manipulation of task constraints and their influence on individual and collective tactical behaviour in football small-sided games (SSGs) and small-sided and conditioned games (SSCGs).

Search terms included "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". These terms were combined using Boolean operators (AND and OR) and truncation symbols (*) where supported by the respective databases. An example search string, adapted to the syntax of each database, was: ("small-sided game*" OR "small-sided and conditioned game*" OR "conditioned game*") AND (football OR soccer) AND (tactic* OR "collective behavio*" OR "team behavio*" OR "positional data" OR coordination) AND (constraint* OR "pitch size" OR "number of players" OR "numerical superiority" OR "numerical inferiority" OR rule* OR touch*). The search was organised around four categories of task constraints: (1) player numbers, (2) pitch dimensions and relative area per player, (3) numerical (im)balance between teams, and (4) game rules. These categories provided a framework for identifying and comparing relevant findings concerning individual and collective tactical behaviour. As this was a narrative review, the search strategy was intended to identify relevant literature across these categories rather than provide an exhaustive systematic retrieval of all available publications.

Empirical studies were considered relevant if they: (1) examined football SSGs or SSCGs; (2) investigated the effects of task constraint manipulation on tactical, technical, behavioural, or collective performance outcomes; (3) provided findings relevant to the objectives of this review; and (4) were published in English. In addition, relevant review articles, theoretical publications, and methodological studies were considered to support the interpretation of empirical findings within the frameworks of ecological dynamics, nonlinear pedagogy, and representative learning design.

Studies were excluded from the empirical synthesis if they: (1) did not examine football SSGs or relevant task constraint manipulations; (2) provided insufficient information regarding tactical or behavioural outcomes; or

(3) lacked sufficient methodological detail to support meaningful interpretation. No restrictions were imposed on participants' age, sex, competitive level, or geographical location to allow consideration of evidence across different playing populations. Relevant theoretical and methodological publications from related sporting contexts were considered where they contributed to the conceptual interpretation of football-specific findings.

Relevant publications were screened based on their titles and abstracts, followed by full-text examination where necessary to determine their relevance to the review objectives. Additional publications were identified through the reference lists of relevant review articles and empirical studies. Particular attention was given to studies reporting individual and collective tactical variables, including team width, team length, team surface area, interpersonal coordination, and positional behaviour. Studies were selected purposively according to their relevance to the four categories of task constraints, methodological contribution, and ability to illustrate how different constraint manipulations influence tactical behaviour.

As this review adopted a narrative rather than a systematic approach, a formal PRISMA-based screening process, dual-reviewer screening, and formal methodological quality appraisal were not undertaken. Instead, the literature was selected purposively to provide a critical synthesis of relevant empirical, theoretical, and methodological contributions. Consequently, comprehensive records of the initial database retrieval and screening counts were not maintained, and the review does not claim exhaustive coverage of the available literature. The findings should therefore be interpreted as a structured critical synthesis of selected evidence rather than a systematic or quantitatively pooled assessment of all available studies.

**Ecological Dynamics: A Framework for Task Constraints**

Ecological dynamics describes the emergence of individual and collective behaviours in complex adaptive systems such as team sports, incorporating the theory of ecological psychology (Gibson, 1979), dynamical systems theory (Kelso, 1995), and the constraints-led approach (Davids et al., 2008). Football performance can be conceptualised as a complex system in which the behaviours of players and teams emerge through self-organisation (Duarte et al., 2010; Vilar, Araújo, Davids, & Button, 2012), under interacting constraints (Davids et al., 2013; Davids et al., 2008). Newell (1986) grouped these constraints into three categories: individual (e.g. physical, technical, psychological), environmental (e.g. pitch surface, weather, home/away), and task (e.g. rules, aim of the task, number of players, pitch size), the latter of which are most accessible for coaches to manipulate in football training sessions. In this context, perception and action are coupled, and players perceive affordances, or possibilities for action relative to their own characteristics and those of their environment (Fajen et al., 2009; Gibson, 1979), such as a pass, a space to dribble into, or a local numerical advantage. Manipulation of task constraints modifies the available affordances; for example, reducing pitch size limits time and space to make decisions and increases defensive pressure, while increasing relative area per player facilitates team dispersion and longer possessions.

Since affordances are specific to the constraint configuration, manipulation of task constraints does not simply scale behaviours linearly, which is why this review examines the findings for each constraint type separately. More recently, theorists have extended this perspective on individual affordance perception to team decision-making in football, describing how the shared affordances accessible to and perceived by groups of players in a sub-phase give rise to collective tactical behaviour (Araújo et al., 2023). This view supports the team-level constraint manipulations that are common in football SSG, and again justifies considering player number, pitch dimensions, numerical (im)balance, and specific rule manipulations independently, as separate categories of constraint.

**Manipulation of Player Numbers**

Player number is among the most frequently manipulated constraints in SSG research and training practice, ranging from 1v1 subphases up to 7v7 or larger formats. As the number of players on each team increases, so does the space each team must collectively defend and occupy. A recent systematic review synthesising evidence on numerical superiority and inferiority across physiological, physical, technical, and tactical domains found that numerically superior teams consistently display greater spatial dispersion and expanded playing length and width, while numerically inferior teams tend to compensate with reduced exploratory behaviour and a stronger

emphasis on defensive organisation (Rumpf, Jäger, Lloyd, et al., 2026). Notably, comparable changes in team shape can also emerge from structural changes alone, independent of player number or pitch size: in 7-a-side youth SSGs, altering the tactical formation significantly changed the opposing team's length, surface area and stretch index even though player numbers and pitch dimensions remained constant (González-Rodenas et al., 2024).

Smaller formats promote more frequent 1v1 and 2v2 interactions, faster transitions, and a higher rate of technical involvement per player, whereas larger formats increasingly resemble full-sided matches in collective behaviour. Manipulating the number of teammates and opponents directly shapes this trade-off. Increasing the number of opponents increases the frequency of ball controls, while increasing the number of teammates shifts play toward more defensively focused, possession-protecting behaviour, with numerical advantage generally reducing players' exploratory behavioural variety (Torrents et al., 2016). At the level of individual space occupation, the playing area available per player scales systematically with numerical relations, age group, and pitch zone, converging toward the patterns observed in full-sided competition as format size increases (Coito et al., 2022).

At the collective level, team centroid position and surface area oscillate during attacking and defending phases, with attacking periods in general characterised by increased width, length, and surface area as teams try to create space to break through the defence, and defensive periods associated with increased team synchronisation and minimisation of distance between players, contraction, and reduced surface area (Frencken et al., 2011). These oscillations show that tactical behaviour does not simply scale with format but emerges from the interaction between player number and phase of play.

Player number also interacts with ability level to influence interpersonal coordination between opposing players. Silva, Travassos, et al. (2014) showed, in youth small-sided games with numerical imbalance (5v5, 5v4 and 5v3), that team positioning and compactness were shaped by numerical relations and also differed between national-level and regional-level players. This result illustrates a more general point: the level of the players being trained should be considered when manipulating constraints, because constraint effects may differ, or even reverse, depending on ability.

**Manipulation of Pitch Dimensions and Relative Area per Player**

Pitch size and area per player are closely related constraints, and their effects are best interpreted together, because changing pitch size without changing player numbers also changes the area available to each player. Clemente et al. (2023) conducted a meta-analytical comparison of physiological, physical, technical and tactical SSG outcomes across pitch sizes and found systematic, predictable effects, with larger pitches eliciting greater physical output and greater team expansion and dispersion. As one of the most comprehensive quantitative syntheses for this constraint category, it provides stronger evidence than the individual studies cited elsewhere in this section. Area per player has similarly clear effects on physical and technical demands, and manipulating it allows these elements of gameplay to be adjusted systematically (Azli et al., 2015). Riboli et al. (2023) examined a wide range of area-per-player manipulations in elite male players and reported that about 243 m² per player was required to replicate the technical demands of match play. Locomotor variables (total, high-speed and very-high-speed running distance) correlated strongly and positively with area per player, whereas technical demands correlated negatively: as area per player increased, physical output rose but technical involvement fell.

This trade-off is directly relevant to practitioners when setting pitch size and area per player to suit training objectives, depending on whether technical, physical or tactical outcomes are the priority. Basing pitch area on match-derived values, rather than on absolute dimensions, appears to be important for tactical representativeness. In elite youth players, Olthof et al. (2018) showed that, compared with a traditional small pitch, a match-derived relative pitch area (the area per player available in the official match, about 320 m²) increased physical performance and produced larger inter- and intra-team distances in 4v4 games. Olthof et al. (2019) then found that SSGs played on this match-derived area produced team distances similar to those of the official match across different player numbers. Together, these findings support representative design as a governing principle when setting pitch size, rather than treating pitch dimensions as an isolated training variable.

**Numerical (Im)Balance Between Teams**

Numerical imbalance between teams (e.g., 4v3, 5v4) is one of the most common SSG manipulations used in day-to-day coaching practice. Comparing GK+4v4+GK with GK+4v3+GK games, Travassos, Vilar, et al. (2014) found that unequal numbers produced stronger coupling between defending players and between the defending team and the ball, shorter distances from players to their team's geometric centre, smaller team surface areas and greater distances between the two teams' centres. These findings are consistent with the view that numerical superiority affords ball circulation and penetration, whereas numerical inferiority calls for compact, tightly coordinated defending. Consistent with this, in small-sided games from 4v2 to 4v6, numerical inferiority elicited more sprinting and more individual tactical actions, whereas numerical superiority elicited more walking (Nunes et al., 2020).

Positional-data analysis of an 11-a-side competitive match showed that teams consistently allocated more players than their opponents to the sub-areas of play closest to their own goal, consistent with a predominantly defensive strategy (Vilar, Araújo, Davids, & Bar-Yam, 2013). In SSGs, Silva, Travassos, et al. (2014) similarly found that numerically inferior teams contracted and retreated towards their own goal. This sub-area-specific pattern suggests that practitioners should consider not only whole-pitch numerical imbalance but also constraints that create zone-specific imbalances suited to the goals of the session (e.g., numerical superiority in the defending third to practise building out from the back against a high press, or in midfield to develop passing options for counter-attacks).

**Game Rules and Task Conditions**

Game-rule modifications, such as restricting the number of touches, imposing conditions on how goals may be scored, adding extra goals, or limiting time in possession, act as direct regulatory mechanisms of players' actions, independently of pitch size, player number, or relative area per player. Adding extra goals to an SSG directed attacking play towards the additional targets (e.g., encouraging attacks through the wings rather than through the centre) and modified the teams' collective tactical behaviour (Travassos, Gonçalves, et al., 2014), demonstrating the potential for practitioners to redirect collective tactical behaviour through rule changes alone. However, compared with manipulations of player number, pitch dimensions, and numerical imbalance, the body of literature examining constraints set by game rules from the perspective of collective tactical actions (as opposed to technical or physical/physiological outcomes) is limited. This is an important observation in itself, because rule manipulation is one of the most accessible SSG tools for practitioners, yet it is the least represented constraint category in the tactical-behaviour literature included in this review. The same imbalance is evident in the systematic review by Ometto et al. (2018), in which most of the 24 included studies manipulated pitch dimensions and/or player numbers, whereas fewer manipulated scoring targets.

From an ecological dynamics perspective, rule modifications can be grouped by how they change the information and action possibilities available to players. Touch restrictions limit the time a player can hold the ball and therefore shape the speed of circulation and the need for nearby support options. Scoring conditions and extra targets (Travassos, Gonçalves, et al., 2014) redefine where and how attacking affordances are located. Possession and time constraints alter the temporal demands of the task, and transition conditions change the pressure and space available immediately after a turnover. Because these rules act through different mechanisms, they can be combined with, or used in place of, spatial and numerical constraints.

Empirical evidence on touch restrictions has grown in recent years. In under-15 national-level players, a two-touch rule increased the frequency of off-the-ball width-and-length actions, depth mobility, concentration and defensive unity compared with free play, and produced denser and more clustered passing networks (Brito e Sousa et al., 2019). Across six youth age groups (under-9 to under-19), limiting players to one or two touches had little effect on inter-player distances, but it altered longitudinal synchronisation in different directions depending on age, increased successful passing in some age groups and increased unsuccessful actions overall (Coutinho et al., 2022). A recent review of studies with adult players concluded that one- and two-touch play also raises intensity, perceived exertion and technical engagement (Rumpf et al., 2025). Scoring conditions have likewise been examined: in youth players, 'two touches' and 'four passes to score' rules changed teams' offensive performance compared with free play (Almeida et al., 2012). Defensive rules such as man-marking, compulsory

pressure on the ball and the offside rule have also been reviewed recently across physiological, physical, technical and tactical outcomes; man-marking, for example, appeared to increase physiological load (Rumpf, Jäger, Uthoff, et al., 2026).

However, direct evidence on how most of these rule types alter collective tactical variables such as team width, length, surface area and passing networks remains limited, and few rule-based studies report the standardised tactical measures discussed later in this review. Professional coaches nevertheless report using rule changes and other constraint adjustments deliberately to address tactical problems observed in competition (Nunes et al., 2025). This section should therefore be read as a call for research as much as a summary of evidence, and until comparable data are available the tactical effects of most rule manipulations should be treated as hypotheses.

**Comparison Across Age Groups, Skill Levels and Competitive Standards**

The effects of task constraints are not uniform across populations, and the studies reviewed here allow only a partial comparison. Skill level appears to moderate, rather than simply add to, constraint effects. In youth (under-19) players, Silva, Travassos, et al. (2014) found that numerical imbalance and skill level jointly shaped team positioning and compactness: underloaded teams contracted and retreated towards their own goal, whereas national-level players showed a more balanced division of labour and clearer inter-team effects than regional-level players. Pitch size and skill level have also been examined together as influences on tactical behaviour (Silva, Aguiar, et al., 2014), which reinforces the view that a manipulation cannot be assumed to produce equivalent coordination in novice and expert players.

Younger teams (under-9) adopted a higher length-to-width ratio than older teams (under-13) in the same SSG formats, and the variability of this ratio decreased with age, suggesting more consistent application of the width and concentration principles of play (Folgado et al., 2014). Olthof et al. (2019) found that 4v4 games played on a match-derived area produced larger interpersonal distances than the official match in under-13 to under-17 players, but not in under-19 players. Rule effects also vary with age: the same touch restriction altered team synchronisation in opposite directions in different age groups, leading Coutinho et al. (2022) to recommend two-touch rather than one-touch conditions for players aged under-9 to under-13. The playing area occupied per player scales with numerical relations, age group and pitch zone (Coito et al., 2022), and much of the evidence on team shape and passing structure comes from youth samples (Folgado et al., 2014; Gonçalves et al., 2017; González-Rodenas et al., 2024). Because match running performance in young players is related to their physical capacity, which changes with growth and maturation (Atan et al., 2023), findings from one age group should be transferred to another with caution. Competitive standard is the least balanced dimension. Quantitative benchmarks for area per player and match-derived pitch dimensions come largely from elite youth (Olthof et al., 2018, 2019) and elite adult male (Riboli et al., 2023) samples; for example, the area of about 243 $m^2$ per player needed to replicate match technical demands was derived from elite male players (Riboli et al., 2023). Such values should not be applied to recreational, sub-elite, youth or female players without testing. Within the sources reviewed here, few studies manipulated the same constraint across several age groups or competitive standards within one design, which limits firm comparative conclusions and is identified as a priority for future research.

**Representative Learning Design and Nonlinear Pedagogy: Implications for Constraint Manipulation**

The theory of representative learning design states that practice tasks should preserve the relevant informational and action constraints of competition performance in order to maintain functional perception-action coupling and support transfer to competition (Pinder et al., 2011; Pinder et al., 2009). The constraints-led evidence reviewed above gives this principle concrete meaning: using pitch dimensions scaled to match-derived relative area (Olthof et al., 2019) and controlling area-per-player to achieve specified technical or physical aims (Riboli et al., 2023) are specific, quantifiable ways of applying representativeness rather than abstract considerations.

Nonlinear pedagogy takes this further by viewing constraint variability as a tool for learning, rather than a source of extraneous noise, since different players may be able to achieve the same tactical aims with different movement solutions depending on their own affordances (Chow et al., 2021; Chow et al., 2011). Coaches are therefore encouraged to vary constraints systematically (player numbers, area per player, team balance, and rules) over a training block, rather than converging on a single “best” constraint configuration. As noted above,

professional coaches report choosing and adjusting SSG constraints intentionally in this way (Nunes et al., 2025), consistent with the constraint-by-constraint evidence synthesised above.

**Combining Constraints to Target Tactical Objectives**

Coaches can combine constraints to target specific tactical objectives, although the examples below extrapolate from single-constraint studies and their joint effects remain untested. Table 1 summarises these and other illustrative combinations. To encourage attacks through wide areas, a coach could place two extra small goals on the flanks and set the pitch to a match-derived relative area per player. Additional targets redirected attacking behaviour towards them in Travassos, Gonçalves, et al. (2014), and match-derived area improved tactical representativeness (Olthof et al., 2019).

To practise building out against a high press, a coach could give the build-out team a numerical advantage (for example 4v3), preferably confined to the defending third. Numerical superiority is associated with affordances for ball circulation, rotation and penetration, whereas outnumbered teams tend to contract and defend compactly (Silva, Travassos, et al., 2014; Travassos, Vilar, et al., 2014). To balance technical involvement against physical load, a coach could adjust area per player: smaller areas increased technical involvement and larger areas increased locomotor output (Clemente et al., 2023; Riboli et al., 2023), although these benchmarks come from elite male samples. To speed up ball circulation and support play, a coach could add a two-touch limit to a possession game; this rule increased off-the-ball width and length actions and passing-network density in under-15 players (Brito e Sousa et al., 2019), although one-touch conditions may be too demanding for players younger than about 13 years (Coutinho et al., 2022). Coaches should monitor the tactical outcomes of any combination and treat it as a working hypothesis.

Table 1. Illustrative combinations of task constraints for specific tactical objectives

| Tactical objective | Constraint combination | Expected tactical behaviour | Supporting evidence |
|---|---|---|---|
| Attack through wide areas | Two extra small goals on the flanks + match-derived relative pitch area (about 320 m² per player) | Attacking play redirected towards the flanks; team distances closer to those of the official match | Travassos, Gonçalves, et al. (2014); Olthof et al. (2019) |
| Build out from the back against a high press | Numerical superiority for the build-out team (e.g., 4v3), confined to the defending third | Ball circulation and penetration for the superior team; contraction and tighter coupling of the defending team | Silva, Travassos, et al. (2014); Travassos, Vilar, et al. (2014) |
| Quick ball circulation and off-the-ball support | Two-touch limit in a possession game (one-touch only for older or more skilled players) | More width and length actions off the ball and denser passing networks; more passes but also more unsuccessful actions | Brito e Sousa et al. (2019); Coutinho et al. (2022) |
| Defensive compactness when outnumbered | Numerical inferiority for the defending team (e.g., 4v5 or 4v6) | More sprinting and individual tactical actions; contraction and retreat towards own goal | Nunes et al. (2020); Silva, Travassos, et al. (2014) |
| Technical involvement vs. physical load | Small area per player for a technical emphasis; larger area per player for locomotor load | Smaller areas: more technical involvement; larger areas: more running and greater team dispersion | Clemente et al. (2023); Riboli et al. (2023) |

*Note.* Combinations are extrapolated from studies that manipulated one constraint at a time; their joint effects have not been tested and should be monitored in practice. Benchmarks for area per player derive mainly from elite samples.

**Technological and Analytical Advances in Tactical Analysis**

Positional tracking technologies (GPS, LPS, and optical tracking systems) have enabled the quantification of collective tactical variables (team width, length, surface area, centroid displacement and synchronisation indices) that underpin much of the constraint-specific evidence reviewed above (Folgado et al., 2014; Frencken et al., 2011; Rico-González et al., 2020). A recent systematic review of collective tactical behaviours assessed via positional data catalogued the growing range of such variables and also highlighted substantial methodological inconsistency across studies in how they are calculated and reported, which makes it difficult to compare constraint-manipulation studies directly (Low et al., 2020). Network and graph-theory approaches extend this by modelling passing structure directly, rather than only aggregate team shape. Passing-network analysis of youth players found that lower individual passing dependency (lower betweenness centrality) combined with well-connected intrateam passing relations (higher closeness centrality) was associated with better team outcomes (Gonçalves et al., 2017), demonstrating how network position, not just frequency of involvement, determines a player's tactical contribution. Machine-learning approaches are beginning to complement these methods by automatically classifying tactical patterns from tracking data rather than relying only on pre-specified variables.

One example, although based on 11-a-side match data rather than SSGs, is a structural framework applied to spatio-temporal tracking data from the 2022 FIFA World Cup, which derived three pass-level metrics: the Line Bypass Score, Space Gain Metric, and Structural Disruption Index. These capture distinct mechanisms through which individual passes disrupt an opponent's defensive organisation. These metrics were combined into a composite Tactical Impact Value (TIV), and unsupervised clustering of the resulting structural features identified four recurring pass archetypes, namely circulatory, destabilising, line-breaking, and space-expanding passes.

In addition, a scoping review of technical-tactical skill assessment methods in SSG found that most existing instruments have been validated for discriminating between skill levels or age groups, but not for isolating the effects of individual task-constraint manipulations, a methodological gap that the emerging analytical approaches described above may help to close (Klingner et al., 2022). Taken together, these technological advances have not altered the theoretical explanation for why constraint manipulation affects tactical behaviour, but they have greatly improved the ability to measure that behaviour precisely, moving the field from broad claims about the impact of constraint manipulation on tactical skill towards the kind of specific, quantified findings reported in the studies reviewed above.

## CONCLUSIONS

This narrative review has critically synthesised the evidence for task constraint manipulation in football SSG by constraint type, namely player numbers, pitch dimensions and relative area per player, numerical (im)balance, and game rules, rather than by theoretical perspective, to make the tactical, technical, and physical consequences of each manipulation directly comparable. For all four constraint types, the evidence reviewed supports the ecological dynamics assumption that tactical behaviour emerges from the interaction of task, individual, and environmental constraints, rather than being pre-programmed or determined by a single constraint in isolation. The evidence is, however, thinner for game rules than for the other three categories, particularly for collective positional variables, and most of it derives from youth and elite male samples.

Several limitations of the current evidence base deserve special mention. First, tactical behaviour is still less frequently studied as an outcome than physiological or technical variables, and even in reviews intended to capture a range of SSG responses, only a small minority of included studies usually investigate tactical behaviour (Clemente et al., 2022). Second, most constraint-manipulation studies investigate acute, within-session effects, and longitudinal evidence that manipulated constraints in training lead to lasting tactical adaptation and transfer to competitive match play is almost entirely lacking. Third, methodological inconsistency in how collective tactical variables are calculated across studies, even for widely used variables such as team surface area and synchronisation indices, limits the direct comparability implied by presenting the findings of different studies side by side (Low et al., 2020). A fourth limitation concerns this review itself: as noted in the Literature Search section, this is a narrative rather than systematic review, and was not conducted using a PRISMA protocol, dual-reviewer screening, or formal quality appraisal. The four constraint categories and exemplar studies discussed

above should therefore be interpreted as an organised, critically selected synthesis rather than an exhaustive or quantitatively pooled account of the available evidence. A fifth limitation is that the evidence reviewed is drawn largely from youth and elite male samples and that non-English-language sources were excluded, so the conclusions may not generalise to other populations or to the wider literature.

**Future Research**

Future research addressing these knowledge gaps should focus on:

1. Longitudinal studies that observe tactical behaviour across a complete training block, rather than single-session comparisons, in order to determine whether constraint-manipulation effects are sustained and transferred to competition.

2. Standardised reporting of collective tactical variables, for example team width, length, surface area, and synchronisation indices, such that meta-analyses directly comparing constraint types, which the current evidence base does not support, become possible.

3. Systematic, factorial manipulation of multiple constraint types (for example, player number × area per player × numerical (im)balance in a single study), since most of the existing evidence base investigates only one constraint at a time even though constraints have been shown to interact (as shown by the interaction between numerical relations and skill level reported by Silva, Travassos, et al., 2014).

4. More research into the effects of game-rule manipulation on tactical, as opposed to technical or physical, outcomes, since the evidence for this constraint category remains limited relative to the other three, particularly for standardised positional variables (e.g., team width, length and surface area) under different touch, scoring and defensive rules.

5. Studies that compare the same constraint manipulations across age groups, skill levels and competitive standards, including female and recreational players, so that the moderating effects discussed above can be quantified.

6. Validation of machine-learning-based tactical classification methods (for example, pass archetype clustering) against existing, manually coded tactical variables to establish concurrent validity before such methods are adopted as primary outcome variables.

Progress on these fronts would enable the field to advance from observing that constraint manipulation affects tactical behaviour, which is well supported for player numbers, pitch dimensions and numerical (im)balance but remains comparatively under-examined for game rules, towards determining which configurations of which constraints lead to which tactical adaptations in which players, which is the practical level of detail required to inform training prescription.

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