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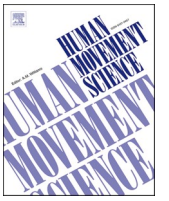

How many creatives are enough? Exploring how manipulating the number of creative players in the opposing team impacts footballers' performance during small-sided games

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ABSTRACT

This study explored how varying the number of creative opponents affects youth players' performance during football small-sided games (SSGs). Initially, 60 players from 3 different age groups with $n = 20$ in each (under-9, U9; under-11, U11; and under-13, U13) were tested during SSGs to rank them according to their creative potential. Based on these rankings, four players shown to possess with a medium creative potential were assigned to the intermediate team for each age group. This team competed against a team on which players with high creative potential were progressively included (from one to finally all four players, 1C to 4C) during a 4-a-side plus goalkeeper SSG. The results showed that U9 players increased the individual space explored when facing more creative opponents ($p = .012$), while the U11 ($p = .026$) and U13 ($p < .001$) only increased when facing 2C and 3C. Playing against more creative opponents induced more variability in the distance to own ($p = .046$) and the opponent team's centroid ($p = .046$) in the U9, regularity in the U11 (team centroid, $p < .001$; opponents' centroid, $p = .001$) and lower regularity in the U13 (team centroid, $p = .013$ opponents' centroid, $p = .009$). These distinct movement patterns seemed to reflect the differences in players' perceptual and motor skills. A higher creative score was found against 1C (vs 2C and 4C, $p = .006$) and 3C (vs 4C, $p = .006$) in the U9. The results from the effect sizes indicated higher values on the players' attempts, fluency and versatility when facing 1C to 3C, whereas a clear decrease was observed against 4C for all age groups. Hence, moderate and high demanding scenarios prompt the emergence of new behaviours while extremely high demanding scenarios (i.e. 4C) seem to constrain all the creativity components. Overall, adding creative players mostly impacts the team's collective behaviour rather than the players' creativity-related skills.

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1. Introduction

In association football, creative behaviour is paramount for achieving high performance (Memmert, 2015b). Despite that the concept of creativity is not consensual and may entail a broader scope of application in football (Fardilha & Allen, 2019), creative behaviour has been extensively described as a search process for generating several solutions to solve a game/training problem in a feasible, unexpected and authentic way under appropriate environmental conditions (Memmert, 2015b; Santos & Monteiro, 2021). In this regard, creativity should be understood as the process of perceiving, exploring, and generating novel opportunities for action within a given context (Rasmussen, Østergaard, & Glăveanu, 2019). Driven by the practical goal of building a creativity-supportive learning environment, a few proposals regarding comprehensive frameworks have emerged, such as the Tactical Creativity Approach (Memmert, 2015a, 2015b) and the Creativity Developmental Framework (Santos, Memmert, Sampaio, & Leite, 2016), which encompasses the Skills4Genius sports-based training program (Santos, Jiménez, Sampaio, & Leite, 2017). This latest, encourages football coaches to nurture personal creativity expression (*P-type*) in their training routines. The *P-type* expression is internal to the player since it is associated with the self-exploration process of employing new techniques and discovering novel solutions. Indeed, most of the players' actions and decisions are neither novel for society nor team but are instead new only to themselves (Boden, 1994), and thus, differ from the *historical type (H-type)* that relates to the creation of something new to the society. To trigger the *P-Type*, it is essential to design enriching environments that foster players' creative components, namely fluency, flexibility or versatility, attempts and originality (Coutinho et al., 2018; Santos et al., 2017; Santos et al., 2018), as adapted from Guilford's (1950) classical research. From this perspective, fluency consists of the number of successful actions performed by players or team to overcome a game problem. The second component, flexibility or versatility, refers to the variety of actions that a player or team are likely to produce. Finally, originality covers the production of novel and rare behavioural solutions (Santos et al., 2017; Santos et al., 2018). To value the players' efforts to perform new actions from their available repertoire, even non-successful ones, their attempts have been measured according to the above components by several authors (Coutinho et al., 2018; Santos et al., 2017; Santos et al., 2018). Targeting these components during training sessions will contribute to the development of players' ability to explore, readapt, and create new personal movement patterns, thus contributing to *P-type* expression. However, the development of these components seems to be dependent upon the type of boundary conditions used, i.e. the rules applied during the training tasks may amplify the available opportunities for action, consequently guiding the players to search for new movement behaviours (Torrents, Balagué, Ric, & Hristovski, 2020a). It should be noted that, while some boundary conditions may enhance the movement exploration contributing to the improvement of the creative components, and consequently the player' *P-expression*, others may be too restrictive and narrow their exploration (Torrents et al., 2020a). Further research is necessary to better address which manipulations release or limit the players' creative behaviour.

Research related to constraints-based coaching by the means of Small-Sided Games (SSGs), which are often played in smaller spaces, with fewer players and according to rules adapted to those elements in comparison to the formal game (Sampaio, Lago, Gonçalves, Macas, & Leite, 2014), have been adopted to explore how players' acutely adjust their behaviour according to different game scenarios. Typically, SSGs are less structured and more enjoyable and promote higher motivation levels (Caso & van der Kamp, 2020). They are designed through the manipulation of task boundary conditions and seem to be an effective method to enhance specific physical (Gonçalves et al., 2017), technical (Santos et al., 2020) and tactical behaviours (Coutinho et al., 2019; Gonçalves, Marcelino, Torres-Ronda, Torrents, & Sampaio, 2016). This training approach allows players to develop and adapt their movement patterns due to the available information and therefore, promotes coupling between perception and action that contributes to a better game understanding (Travassos et al., 2013). In fact, training interventions grounded in the use of SSGs have been shown to improve the performance of players exposed to SSGs over periods lasting two to five months (Coutinho et al., 2018; Sampaio & Maçãs, 2012; Santos et al., 2018). The extent to whether these improvements were derived from a specific improvement is unknown, i.e. a precise understanding of whether the improvements of technical and physical performance contributed to the enhancement of tactical behaviour or vice-versa during these interventions remains unclear. However, studies examining the acute effects demonstrated that modifying specific task boundary conditions contributes to changes in the available information that guide the players towards specific movement patterns (Coutinho et al., 2019; Coutinho et al., 2020). For example, a recent study explored the effects of a pitch's external lines (i.e. having the pitch marked with a) full lines, b) dashed lines or c) having only markers in the corners) and found that having continuous lines (i.e. full or dashed condition) contributed to a lower team dispersion and higher movement synchronization (tactical perspective) while placing lower physical demands on the players and an emphasis on the use of the dribble (Coutinho et al., 2020). From a holistic perspective, it is likely that if players are more synchronized, they will be guided towards more collective movements that decrease physical effort. However, on the same team, this higher compactness together with the presence of the lines may have afforded the players the opportunity to adopt the dribble to create space. In contrast, the condition with markers on the corner led to higher dispersion, which may possibly be due to a lack of external references to guide their positioning, resulting in passes being made more often (Coutinho et al., 2020). Therefore, different manipulations lead to changes in the environmental information that consequently guide the players towards more adaptive movement patterns. Similarly, it may be expected that the manipulation of constraints creates limitations on the exploration of certain action possibilities, thus contributing to galvanising the creative components and consequently, the creativity of the players (Caso & van der Kamp, 2020; Torrents et al., 2016).

A narrative review supports the conclusion that boundary conditions can be used to aid players in expressing their in-game creativity and achieving specific learning goals (Torrents, Balagué, Ric, & Hristovski, 2020b). Hence, the interaction between the conditions facilitates the discovery and exploration of players' novel behavioural solutions (Torrents et al., 2020b). In football, one of the most studied task manipulations is the number of players (Gonçalves et al., 2016), which involves exploring how the behaviour of the players is modified during balanced formats (e.g., 5vs5, 6vs6, 7vs7, and 11vs11) (Caso & van der Kamp, 2020) and unbalanced formats (e.g., 3vs4, 5vs4, and 7vs4) (Gonçalves et al., 2016; Ric, Torrents, Goncalves, Sampaio, & Hristovski, 2016; Torrents et al.,

2016) of confronting teams. Exposing the players to different levels of opposition may trigger different movement patterns as a result of the perceptual and motor difficulties presented by the task. For example, according to Torrents et al. (2016), football players adopt more predictable and fewer varied actions when they face less demanding scenarios (e.g., playing in numerical superiority in a 3vs4 format). However, they appear to explore different behaviours when facing more challenging scenarios (e.g., playing in numerical inferiority during a 5vs4). This study provides key practical insight indicating that coaches should carefully design the type of practices because certain conditions may foster the creative potential of players. For instance, moderate levels of difficulty elicit creative behaviours, whereas extremely difficult or negligibly demanding scenarios seem to inhibit such behaviours (Torrents et al., 2020b). Apart from exposing the players to superiority and inferiority situations, coaches may also vary the composition criteria of the teams using balanced formats (i.e., the same number of players) to amplify or constrain opportunities for action. For example, Praça et al. (2017) ranked players according to: (a) tactical knowledge measured using notational analysis methods during SSG; (b) aerobic power, measured using the Yo-Yo Intermittent Recovery Test Level 2; and (c) speed ability, measured using the 20 m sprint test. These rankings allowed them to create teams based on the competence of the players along these three dimensions (i.e. tactical knowledge, aerobic power and speed ability). Using a 3-a-side SSG they found that the highest number of offensive and defensive coverages emerged when grouping teams based on tactical knowledge, while organising teams based on aerobic power leans towards principles related to offensive unity and compactness. Finally, grouping the players based on speed ability appears to emphasise the principle of mobility (Praça et al., 2017). Thus, grouping players according to specific ranks may produce goal-directed behaviours. In this regard, it is reasonable to surmise that ranking players according to their creative potential may also steer them towards distinct opportunities for action. However, further research is required to confirm this premise.

In recent years, coaches have come to consider creativity a much sought-after feature because creative players seem to bring the unforeseeable into the game and disrupt the game plan of the opposing team due to the unpredictability of their behaviours (Furley & Memmert, 2015; Memmert, 2015b). According to Hopsicker (2011), these players are incredible innovators capable of executing novel techniques and tactics, developing ingenious strategies, and anticipating challenging situations. Hence, adding a creative player to the team significantly increases game demands and requires considerable adjustments in the individual and collective behaviour of the opposing team. In this regard, varying the proficiency of the opposing team has been shown to be effective for capturing how the team adapt and self-organises (Folgado, Duarte, Fernandes, & Sampaio, 2014; Gonçalves et al., 2019). In fact, previous reports from Gk + 10vs10 + Gk competitive matches have shown that facing teams of superior quality (i.e. based on the teams ranking) contributes to lower ball possession (Lago, 2009), higher distance covered, and higher movement synchronization (Folgado, Duarte, et al., 2014) compared to matches against weaker opponents. Notwithstanding the balanced scenarios in terms of the numerical situation (i.e., each team has ten field players and a goalkeeper), the differences in their tactical, technical and physical performance may contribute to identifiable differences in player performance between conditions. Thus, changing the quality of the opposing team may be a suitable strategy during the pre-season, as the adaptative movement patterns that result from facing opponents of varying proficiency levels can contribute to better preparing the players for the competition. Preparing players for competition demands may also be implemented during training sessions, and coaches may change the task difficulty by varying the proficiency level of the opposition through the inclusion of more creative players under balanced scenarios (i.e., the same number of players between teams). Nevertheless, to the best of our knowledge, no research has addressed the impact of gradually increase the number of creative players in the opposing team.

Providing different difficulty levels may foster player exploration and boost the adoption of new strategies to tackle these scenarios. Although some variables may remain stable, others are more likely to change because of the imposed conditions. These changes may reflect the ability of the players to explore and adapt to the dynamic configurations of play that emerge from several constraints manipulation (Torrents et al., 2020b). Evidence from previous studies shows that there are distinct frequencies in the principles of play resulting from grouping players based on their tactical awareness or physical performance (Praça et al., 2017). Thus, it is reasonable to surmise that varying the proficiency level of the opposing team based on creativity would not only impact how players explore different opportunities for action (such as the frequency of the creative component), but also how they adjust their positioning. Therefore, advancing this field of practice may help coaches design proper training tasks, that may engender the emergence of specific creative and tactical behaviours. Notwithstanding, it is crucial to note that players of different age groups interact differently with pressing constraints, while players with low levels of sports experience are more strongly affected by task boundary conditions due to a high degree of focus on the ball (Coutinho et al., 2021; Travassos, Coutinho, Gonçalves, Pedroso, & Sampaio, 2018). Therefore, the purpose of this study is to identify the creative and tactical effects of playing against a varying number of creative opponents of different age groups (U9, U11 and U13) during youth football SSG. It was hypothesised that player manipulation affects creative behaviour and team behaviour differently taking into consideration distinct age groups due to a self-organising process. Hypothetically, younger players would be affected more significantly by the variation in the number of opposing creative opponent's rather than more experienced players as a result of a stronger individual approach focused on ball movement (Coutinho et al., 2021; Travassos et al., 2018). In addition, it is expected that playing against a team filled with creative opponents will decrease the expression of players' creative components.

2. Methods

2.1. First phase – Ranking players according to creativity-related components

2.1.1. Participants (First phase)

In the first phase, participants comprised 60 players of three different age groups: under-9 (U9), $n = 20$; under-11 (U11), n = 20; and under-13 (U13), $n = 20$. These players were members of a football academy in the North Region of Portugal that competes at the

regional level. The sample also included goalkeepers who participated in the data collection; however, considering the specificity of their positioning, data on the goalkeepers were not considered in the analysis. All players engaged in two to four training sessions per week (90 to 105 min per session) and participated in a match during the weekend. Written informed consent was provided by the coaches, players, parents, and the club before data collection commenced. All participants were notified that they could withdraw from the study at any time. The study protocol adhered to the guidelines of the ethics committee of the local university and the recommendations of the Declaration of Helsinki.

2.1.2. Procedures – Identifying players' creative profile (First phase)

The aim of this phase was to rank the players of each age group (U9, U11 and U13) according to their creative profile. For this purpose, the players performed a 4-a-side plus goalkeeper SSG on a 40 × 30 m artificial turf pitch (length × width, 150 m^2 relative playing space per player). Each game comprised four bouts of 6 min interspersed with 3 min rest between each repetition (Fig. 1a), which were performed over five testing sessions. Thus, players in each age group performed a total of 20 SSG bouts, each of 6 min, to rank the players according to their individual creative potential during the SSG. For each of these sessions, the head coach selected eight players and two goalkeepers to participate in the SSG. The criteria used to specify team formation were as follows: (i) balanced teams, (ii) each player participates in at least two test sessions, and (iii) each player plays with at least four different teammates to ensure that the data generated has a high level of generalisability. Each day, four teams (A, B, C, and D) were created, and each team played against one other team two bouts. There was then another two bouts during which each team played against two other teams (e.g., Bout 1: Team A vs Team B, Bout 2: Team A vs Team B, Bout 3: Team C vs Team D, Bout 4: Team C vs Team D). To allow for a proper analysis of the creative profiles of the players that takes creative components (attempts, fluency, versatility and originality) into account, each player performed at least four SSG bouts over five testing sessions. After completion of data collection on all four age groups, the video footages were analysed to assign scores for in-game individual creative behaviour (see data collection section).

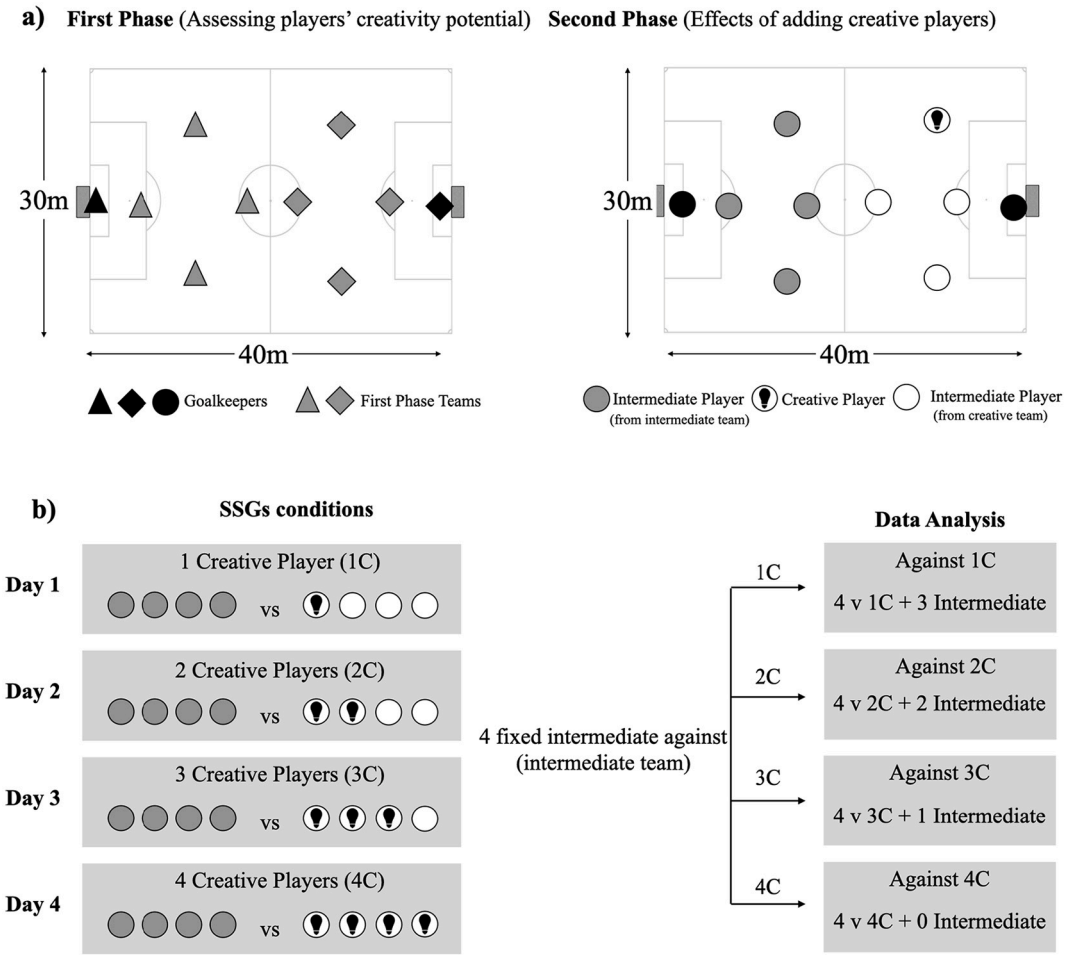

Fig. 1. a) Representation of data collection phases; b) Team's composition and data analysis process based on the intermediate team performance against different number of creative opponents.

2.1.3. Data collection and processing (First phase)

2.1.3.1. Creativity-related variables – Defining the players' creative behaviour score. The SGG were recorded using a digital video camera (a Panasonic NV-GS230) fixed at a 2-m height and aligned with the midfield section of the pitch. Individual creative behaviour was measured using a computerised notational analysis performed using the LongoMatch software, version 1.3.7 (LongoMatch, Fluendo, Barcelona, Spain). Following the analysis, the data were organised in a preprepared spreadsheet (Excel for Windows®) labelled Creative Behaviour Assessment in Team Sports (CBATS) (Santos et al., 2017). This instrument was developed to measure players' creativity with ball possession in game-based scenarios (Santos et al., 2017). For that purpose, it measured the following four creative components: (a) attempts, (b) fluency, (c) versatility and (d) originality. The differences between these components are sustained to its success (i.e., for successful actions, fluency, versatility, and originality were considered, while unsuccessful actions were considered attempts) and whether they were standard actions or not. In essence, standardised actions referred to any common passing, dribbling or shooting action according to the following criteria: (a) pass performed with the inside of the foot, (b) dribble to the right or left by just touching the ball to one side with either the inside or outside of the foot, (c) shooting with the inside of the foot. In contrast, non-standardised actions referred to any pass, dribble or shot different from the standardised ones. Concomitantly, the four components were analysed according to the following: (a) Attempts: related to any pass, dribble or shot performed in a non-standardised way that is unsuccessful (e.g., trying to do the Ronaldinho dribble, which comprises an outside and inside cut, but the ball is tackled) (Coutinho et al., 2018; Santos et al., 2017; Santos et al., 2018; Santos et al., 2020). This variable is distinguished from the fails included in this study, as fails refer to any standard pass, dribble or shot that is unsuccessful but performed in a standardised manner (e.g., passing with the inside of the foot, dribbling to the right or the left by just touching the ball, or shooting into the target with the inside of the foot). It is essential to note that fails are not considered as creative components but as one variable for understanding whether the number of unsuccessful actions by a player decreases or increases as a function of training intervention or the manipulation of boundary conditions (Santos et al., 2018); (b) Fluency: comprises any pass, dribble or shot performed in a standardised way, and is successful (e.g., a pass with the inside of the foot) (Coutinho et al., 2018; Santos et al., 2017; Santos et al., 2018; Santos et al., 2020); (c) Versatility or flexibility: covers any pass, dribble or shot that is non-standardised but successful (e.g., performing a pass with the back during a high ball, using the elastic from Ronaldinho, or taking a shot towards the goal with a bicycle kick); (d) Originality: considers the novelty and rareness of the action (Coutinho et al., 2018; Santos et al., 2017; Santos et al., 2018; Santos et al., 2020). The main difference between versatility and originality is that versatility counts for every action, while originality is applicable only for actions whose frequency of occurrence is clearly low (i.e., actions performed by approximately 5% of players or all original actions) (Santos et al., 2016). Therefore, originality was classified by considering the infrequency of actions performed among the broad range of actions performed by the players during the SSG (Coutinho et al., 2018; Kleinmintz, Goldstein, Mayseless, Abecasis, & Shamay-Tsoory, 2014; Santos et al., 2018). The sum of these components comprises the creativity score, which allows a ranking of the players (Santos et al., 2017). All videos were analysed by an expert football performance analyst (i.e., ~6 years of experience measuring players' creative behaviour using CBATS and over 10 years of experience developing notational analysis). Data reliability was evaluated by retesting 25% of the sample one week later; this was performed by the same performance analyst, following the procedures used in previous studies (Coutinho et al., 2018; Santos et al., 2017; Santos et al., 2018). Intraclass correlation was deemed as high (>0.86) (O'Donoghue, 2010).

2.2. Second phase – Effects of competing against additional creative opponents

2.2.1. Participants (Second phase)

In the second phase, 11 players per age group were selected from among the 60 players. The 11 comprised the four most highly creative players (i.e., the four players with the highest creative score) and seven intermediate players per age group (i.e., from the 7th to 14th position by creative score). This selection utilised the ranking of the creative potential of the players based on the 20 SSG bouts. The team under analysis (intermediate team) was composed of four intermediate players (i.e., the 7th, 9th, 11th, and 13th) that were kept constant across the data collection (see Table 1). This team competed against a team in which the number of creative opponents was manipulated (from a pool comprising the remaining four creatives: 1st, 2nd, 3rd and 4th on the creative score ranking, and three intermediates: 8th, 10th and 12th ranking). The creative team was not considered in the data analysis. The goalkeepers were also excluded from the analysis because their positioning is particularly restricted to a specific area of the pitch, and their game dynamics are completely different from those of outfield players. Written informed consent was provided to the coaches, players, parents, and the club before the data collection commenced. All participants were notified that they could withdraw from the study at any time. The

Table 1
Participant characteristics according to the age groups.

Participants characterization	Experimental Group		
	Under-9 (U9) (mean ± SD)	Under-11 (U11) (mean ± SD)	Under-13 (U13) (mean ± SD)
N (number of players)	11	11	11
Age (years)	8.1 ± 0.9	10.3 ± 0.6	12.0 ± 0.6
Body mass (kg)	29.8 ± 9.8	56.0 ± 8.47	38.9 ± 6.4
Height (cm)	128.1 ± 7.0	143.7 ± 8.1	147.1 ± 7.8
Playing experience (years)	3.3 ± 1.3	4.4 ± 1.4	6.1 ± 1.4

study protocol followed the guidelines of the ethics committee of the local University and the recommendations of the Declaration of Helsinki.

2.2.2. Experimental task – Progressive increase in the number of creative opponents (Second phase)

Following the attribution of the players' creative profiles, two teams were created. The intermediate team was composed of only intermediate players who possessed a medium level of creative potential and were kept constant throughout the data collection (Fig. 1b). This team competed against varying numbers of creative opponents in several SSG (4-a-side plus goalkeeper) scenarios: 1C: playing against one creative player and three intermediate players; (b) 2C: two creative players and against two intermediates; (c) 3C: against three creative players and one intermediate; and ultimately, (d) 4C: against four creative players. Therefore, to analyse the effects of performing against a team after manipulating the player characteristics, four testing sessions were performed. In each testing session, the players' performed a 15-min warm-up involving low-intensity running, ball possession exercises (4-a-side without goals), and dynamic stretching exercises. Following the warm-up, the SSG was performed with three bouts of 6 min, interspersed with 3 min of passive rest on a 40 × 30 m artificial turf pitch. The players were encouraged to hydrate with water before the SSG and between bouts. During SSG, several balls were placed around the field to ensure quick ball replacement, decreasing the time the ball was out of play. SSG was played according to official FIFA rules, except for off-side and restarting of the game. Every time the ball went out of play (i.e., throw-ins, corners, goals), the goalkeeper of the team assigned ball possession would play the ball from his goal. No coach feedback or encouragement was allowed to avoid externalinfluences on the performance of the players.

2.2.3. Data collection and processing

2.2.3.1. Creativity-related variables (Second phase). The procedures adopted to analyse the creative behaviour of the players were the same as those described in the data collection and processing *(first phase)* section. The game was recorded, and then using the LongoMatch software, version 1.3.7 (LongoMatch, Fluendo, Barcelona, Spain), the frequency of each creative component was measured: (a) attempts, (b) fluency, (c) versatility or flexibility, and (d) originality (Santos et al., 2017). In addition, the fails were included and the creative score was derived from the sum of the previous four creative components, following procedures described earlier (Santos et al., 2017). The data generated on creative components were then collated in the CBATS spreadsheet (Santos et al., 2017). The analyses were performed by an expert football performance analyst with ~6 years of experience measuring the creative behaviour of players using CBATS. One week later, 25% of the sample was retested to evaluate data reliability (Coutinho et al., 2018; Santos et al., 2017; Santos et al., 2018). Intraclass correlation was deemed as high (>0.88) (O'Donoghue, 2010).

2.2.3.2. Tactical variables (Second phase). Positional data during SSG were gathered using 5 Hz global positioning system (GPS) units (SPI-PRO, GPSports, Canberra, ACT, Australia). The units were placed in suitable elastic harnesses located on the upper back of each participant. The latitude and longitude coordinates of the player obtained via the GPS units were resampled to remove potential data gaps to synchronise all the individual data. Afterwards, the data were converted to meters using the Universal Transverse Mercator (UTM) coordinate system, together with a rotational matrix for adjusting the players' displacement data, pitch length, and width to the appropriate x and y-axis. This procedure was performed using data retrieved from four GPS units placed at each corner of the pitch (Folgado, Duarte, et al., 2014).

The positional data of the players were used to determine the following variables: (i) spatial exploration index (SEI) (for ref. please see Gonçalves et al., 2017), which provides information regarding how much space a player covered (if a player moves across several pitch zones, a high SEI value is likely) (Coutinho et al., 2018; Gonçalves et al., 2017); (ii) the distance between the team and opponent team centroids expressed as absolute values (m), variability in these distances is expressed as a coefficient of variation (CV), and regularity is expressed as the approximate entropy (ApEn) (Gonçalves et al., 2016). The absolute vales provide the mean distance between the players and the centroids of both teams (i.e., the geometrical centre representing the mean position of all players). CV provides information on the magnitude of the variance in this distance during the game and can support rationales explaining the functional movement behaviour of the players (Coutinho et al., 2022). ApEn has been used to assess the regularity of the movement behaviour of players (Santos et al., 2018; Santos et al., 2020), and has values ranging from 0 to 2 (arbitrary units). This variable is used to identify the probability that a data segment from a certain time series can be used to predict other data segments from the same time series. Hence, it may provide information on players' tactical behaviour. From a practical point of view, for the distance to the nearest teammate/opponent, values closest to 0 indicate reliably regular and predictable distances during the time-series. In this study, values close to 0 when facing 4C compared to a value close to 1 when facing 1C would mean that players had a higher regularity maintaining their distance to the team centroid. The input values used to process the ApEn were 2 for vector length (m) and 0.2*SD for tolerance (r) (Pincus, 1991; Yentes et al., 2013).

2.3. Statistical analysis

A descriptive analysis was developed based on the mean and standard deviations. Evaluation for outliers and assumptions of normality was performed using the Shapiro–Wilk test on all the data collected, i.e., creativity-related variables based on absolute values (fails, attempts, fluency, versatility, and originality) and tactical-related variables expressed as (i) absolute values for the SEI and distance to the centroid of both the team and the opponent team, (ii) variability in the distance to the centroids of both teams' centroids expressed in terms of variability as CV, and (iii) regularity in these distances expressed as the approximate entropy. Based on

Table 2
Descriptive and inferential statistics from the effects of playing against additional creatives (1C; 2C; 3C; and 4C) in the tactical variables for the different age groups.

Tactical variables	Against 1C	Against 2C	Against 3C	Against 4C	Difference in means (raw; ±95% CL)						*P*
	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	1C vs 2C	1C vs 3C	1C vs 4C	2C vs 3C	2C vs 4C	3C vs 4C	
Under-9											
Spatial Exploration Index (SEI, m)	7.53 ± 0.82	7.87 ± 1.31	8.81 ± 0.83	8.51 ± 1.82	0.34; ±0.48	1.28; ±0.60	0.98; ±0.74	0.94; ±0.64	0.64; ±0.54	−0.30; ±0.86	**0.012**[b,c]
Dist. Team Centroid (m)	5.62 ± 1.88	5.61 ± 1.70	5.11 ± 1.03	5.57 ± 1.61	−0.01; ±0.74	−0.51; ±1.26	−0.05; ±0.64	−0.50; ±1.03	−0.04; ±0.87	0.46; ±1.00	0.656
Dist. Team Centroid CV (%)	48.17 ± 10.76	50.98 ± 12.81	53.61 ± 8.68	55.61 ± 10.83	2.81; ±3.65	5.43; ±4.83	7.44; ±5.41	2.63; ±4.26	4.64; ±4.86	2.01; ±4.46	**0.046**[c]
Dist. Team Centroid ApEn (a.u.)	0.21 ± 0.04	0.20 ± 0.03	0.21 ± 0.05	0.18 ± 0.04	−0.01; ±0.02	0.00; ±0.04	−0.04; ±0.02	0.01; ±0.04	−0.03; ±0.02	−0.04; ±0.03	0.157
Dist. Opponent Team Centroid (m)	6.50 ± 2.67	6.64 ± 1.74	5.84 ± 1.20	6.53 ± 1.78	0.14; ±0.78	−0.65; ±1.96	0.04; ±0.86	−0.79; ±1.47	−0.10; ±0.61	0.69; ±1.45	0.825
Dist. Opp. Team Centroid CV (%)	46.06 ± 13.27	50.54 ± 12.46	54.7 ± 8.65	57.87 ± 11.71	4.48; ±4.02	8.64; ±6.97	11.81; ±7.49	4.16; ±6.01	7.33; ±7.22	3.17; ±5.71	**0.044**[c]
Dist. Opp. Team Centroid ApEn (a.u.)	0.26 ± 0.07	0.22 ± 0.04	0.24 ± 0.07	0.21 ± 0.06	−0.04; ±0.04	−0.02; ±0.06	−0.04; ±0.03	0.02; ±0.05	0.00; ±0.04	−0.02; ±0.05	0.339
Under-11											
Spatial Exploration Index (SEI, m)	7.35 ± 1.31	8.10 ± 1.13	7.56 ± 1.26	6.81 ± 0.84	0.74; ±0.76	0.21; ±1.02	−0.55; ±0.92	−0.53; ±0.55	−1.29; ±0.42	−0.75; ±0.43	**0.026**[e]
Dist. Team Centroid (m)	5.17 ± 0.75	5.63 ± 0.79	5.74 ± 1.44	5.46 ± 1.08	0.46; ±0.67	0.56; ±0.98	0.29; ±0.37	0.1; ±0.97	−0.17; ±0.83	−0.28; ±1.02	0.641
Dist. Team Centroid CV (%)	41.48 ± 8.6	38.38 ± 6.8	45.48 ± 7.2	43.51 ± 8.87	−3.10; ±5.51	4.00; ±6.89	2.03; ±3.39	7.1; ±5.2	5.13; ±5.40	−1.97; ±6.12	0.142
Dist. Team Centroid ApEn (a.u.)	0.31 ± 0.04	0.33 ± 0.05	0.24 ± 0.04	0.27 ± 0.04	0.02; ±0.03	−0.07; ±0.03	−0.04; ±0.03	−0.09; ±0.03	−0.06; ±0.04	0.03; ±0.03	**<0.001**[b,d,e]
Dist. Opponent Team Centroid (m)	5.81 ± 1.36	6.42 ± 0.84	6.57 ± 1.47	6.50 ± 1.92	0.60; ±0.53	0.75; ±1.15	0.69; ±1.48	0.15; ±0.68	0.09; ±1.07	−0.06; ±0.55	0.753
Dist. Opp. Team Centroid CV (%)	44.42 ± 10.08	41.94 ± 6.9	47.21 ± 5.8	44.69 ± 8.81	−2.48; ±4.98	2.79; ±6.36	0.27; ±8.4	5.27; ±4.51	2.75; ±5.98	−2.53; ±4.53	0.479
Dist. Opp. Team Centroid ApEn (a.u.)	0.33 ± 0.05	0.34 ± 0.05	0.26 ± 0.05	0.29 ± 0.08	0.01; ±0.03	−0.07; ±0.04	−0.04; ±0.05	−0.08; ±0.03	−0.05; ±0.05	0.03; ±0.04	**0.002**[b,d,e]
Under-13											
Spatial Exploration Index (SEI, m)	7.64 ± 0.96	8.34 ± 0.70	7.75 ± 0.77	7.25 ± 1.29	0.64; ±0.81	0.11; ±0.53	−0.39; ±0.75	−0.94; ±0.35	−1.81; ±0.47	−0.5; ±0.45	**<0.001**[c,d,e,]
Dist. Team Centroid (m)	6.12 ± 0.99	5.64 ± 0.77	5.76 ± 1.13	5.86 ± 1.39	−0.07; ±0.38	−0.36; ±0.54	−0.26; ±0.65	−0.17; ±0.19	0.22; ±0.70	0.11; ±0.52	0.654
Dist. Team Centroid CV (%)	41.15 ± 6.74	44.94 ± 7.99	42.83 ± 5.77	39.81 ± 8.81	3.1; ±6.47	1.68; ±3.31	−1.33; ±5.13	−1.61; ±4.62	−6.74; ±6.83	−3.01; ±4.6	0.223
Dist. Team Centroid ApEn (a.u.)	0.26 ± 0.03	0.26 ± 0.04	0.30 ± 0.03	0.29 ± 0.03	0.00; ±0.04	0.05; ±0.02	0.04; ±0.02	0.06; ±0.03	0.04; ±0.03	−0.01; ±0.02	**0.009**[b,c,d,e]
Dist. Opponent Team Centroid (m)	6.85 ± 0.96	7.14 ± 1.04	6.65 ± 1.26	6.90 ± 1.13	0.62; ±0.49	−0.2; ±0.44	0.05; ±0.67	−0.76; ±0.53	−0.38; ±0.92	0.24; ±0.85	0.260

(*continued on next page*)

Table 2 (*continued*)

Tactical variables	Against 1C	Against 2C	Against 3C	Against 4C	Difference in means (raw; ±95% CL)						***P***
	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	1C vs 2C	1C vs 3C	1C vs 4C	2C vs 3C	2C vs 4C	3C vs 4C	
Dist. Opp. Team Centroid CV (%)	42.17 ± 6.60	46.98 ± 6.23	45.3 ± 4.96	45.31 ± 7.39	5.08; ±4.77	3.13; ±2.53	3.14; ±4.5	−2.88; ±4.17	−3.74; ±7.33	0.01; ±4.54	0.336
Dist. Opp. Team Centroid ApEn (a.u.)	0.28 ± 0.05	0.26 ± 0.05	0.31 ± 0.04	0.28 ± 0.04	−0.04; ±0.05	0.03; ±0.03	0.00; ±0.02	0.07; ±0.03	0.03; ±0.03	−0.03; ±0.02	**0.013**[d]

Ag. = Against; Dist. = distance; CV = coefficient of variation; ApEn = Approximate Entropy. N = number. The bold values mean significant differences. Letters represent differences according to the following conditions: a) 1C vs 2C; b) 1C vs 3C; c) 1C vs 4C; d) 2C vs 3C; e) 2C vs 4C; f) 3C vs 4C.

the normality of the data, two types of tests were used: repeated measures analysis of variance (ANOVA) for variables with a normal distribution and non-parametric Friedman ANOVA for variables with nonnormal distributions. Pairwise differences were assessed using the Bonferroni post hoc test, while the Durbin-Conover test (intermediate team vs X number of creatives: Against 1C vs Against 2C; Against 1C vs Against 3C; Against 1C vs Against 4C; Against 2C vs Against 3C; Against 2C vs Against 4C; Against 3C vs Against 4C) was used for nonparametric analysis. Statistical significance was set at $p < .05$ and calculations were performed using the Jamovi Project (Computer Software Version 1.2, 2020). Complementary, differences in means with 95% confidence limits (raw data) and Cohen's d as the effect size were applied to the pairwise comparison. The thresholds for effect size statistics were as the follows: 0.0–0.19 (trivial); 0.20–0.49 (small); 0.6–1.19 (moderate); 1.2–1.9 (large); and ≥2.0 (very large) (Hopkins, Marshall, Batterham, & Hanin, 2009).

3. Results

3.1. Effects of playing against additional creative players on tactical variables

The effects of playing against additional creative players on the tactical variables according to the different age groups are outlined in Table 2 and Figure 2. Statistical significances were identified for the SEI for the U9 players ($F = 5.14$; $p = .012$), U11 ($F = 3.51$; $p = .0026$), and in the U13 ($F = 11.2$; $p < .001$). For the U9 players, higher SEI values were recorded when playing against 3C [Cohen's d with 95% confidence intervals: 0.94 (0.50; 1.38); $p = .007$] and 4C [0.72 (0.18; 1.26); $p = .05$] than when playing against 1C in the U9. For U11 players, a higher SEI value was recorded when comparing the match against 2C with that against 4C [−1.04 (−1.38; −0.69); $p = .018$]. For the U13 players, there were higher SEI values for the match against 2C than that against 3C [−0.90 (−1.25; −0.56); $p = .034$] and 4C [−1.74 (−2.20; −1.29); $p < .001$], and it was also higher for the match against 3C than that against 4C [−0.49 (−0.92; −0.05); $p = .005$]. Variability in the distance to both the team centroid ($F = 3.17$; $p = .046$) and the opponent team centroid ($X^2 = 8.1$; $p = .044$) also revealed statistically significant differences between the conditions. Regarding CV, for the U9 players, the values recorded for CV of the distance to the team centroid [1.00 (0.24; 1.76); $p = .032$] and the opponent centroid [0.98 (0.45; 1.51); $p = .004$] were lower for the match against 1C than for the game played against 4C. For both the U11 and U13 players, statistically significant differences were found in the ApEn of the team centroid (U11, $F = 9.71$; $p < .001$; U13, $X^2 = 11.7$; $p = .008$) and the opponent team centroid (U11, $X^2 = 9.87$; $p = .002$; U13, $F = 4.58$; $p = .013$). For the U11 players, the values were higher for the match against 1C [−1.48 (−2.31; −0.65); $p = .026$] than for the match against 3C, as well as for the game against 2C than the match against 3C [−1.53 (−1.99; −1.08); $p = .002$], and that against 4C [−0.71 (−1.35; −0.07); $p = .038$]; this indicates that regularity is lower when playing against fewer creative players. In contrast, among the U13 players, the matches against 1C presented lower values compared to those against 3C [0.21 (−0.18; 0.60); $p = .002$] and 4C [0.18 (−0.28; 0.65); $p = .013$]. The values were also lower for the matches against 2C than for those against 3C [1.04 (0.42; 1.67); $p = .002$] and 4C [0.87 (−0.06; 1.79); $p = .013$]. When considering the ApEn of the opponent team centroid, higher ApEn were recorded among the U11 players for the match against 1C than for the match against 3C [−0.90 (−1.50; −0.29); $p = .004$]. ApEn values were also higher for the match against 2C than for the matches against [−0.67 (−1.37; 0.02); $p < .001$] and against 4C [−0.85 (−1.75; 0.05); $p = .01$]. In addition, among the U13 players, the ApEn values were lower for the match against 2C than that against 3C [1.47 (0.78; 2.16); $p = .008$).

3.2. Effects of playing against additional creative opponents on players' creative variables

The effects of playing against additional creative opponents on the creative variables across the different age groups are outlined in Table 3 and Figure 3. Statistically significant differences were found for only the U9 creativity score ($X^2 = 12.6$; $p = .006$), with the match against 1C having higher values than the matches against 2C [−1.10 (−1.85; −0.36); $p = .005$], 3C [−0.89 (−1.93; 0.15); $p = .033$] and 4C [−1.44 (−2.27; −0.62); $p \leq 0.001$]. Although no other statistically significant differences were found, some trends can be inferred from the effect size. In general, players made fewer attempts as the number of creative opponents increased among the U9 players [1Cvs4C, −0.70 (−1.36; −0.04); 2Cvs4C, −0.47 (−1.03; 0.10); and 3Cvs4C, −0.23 (−0.65; 0.18)]; among the U11 players [2Cvs4C, −0.49 (−1.16; 0.18)]; and among the U13 players [1Cvs2C, −0.35 (−0.68; −0.02); and 1Cvs3C, −0.23 (−0.66; 0.18)]). From a similar perspective, among the younger age groups, players performed fewer fluency actions as the number of creative opponents

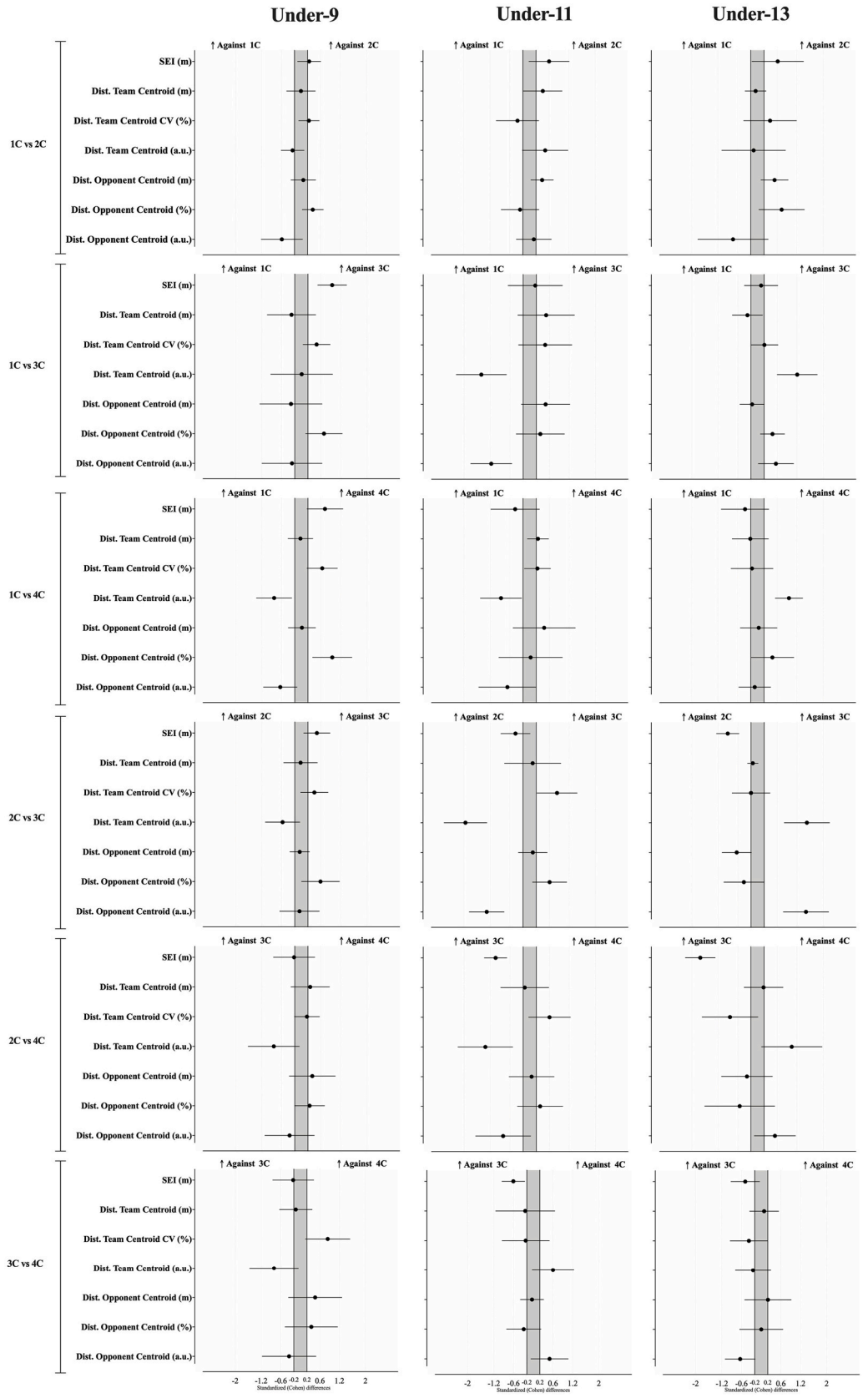

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Fig. 2. Standardised (Cohen) differences for the tactical variables according to the different age groups. Error bars indicate uncertainty in true mean changes with 95% confidence intervals.

Table 3
Descriptive and inferential statistics from the effects of playing against additional creatives (1C; 2C; 3C; and 4C) in the creative variables for the different age groups.

Technical and creative variables	Against 1C	Against 2C	Against 3C	Against 4C	Difference in means (raw; ±95% CL)						*P*
	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	1C vs 2C	1C vs 3C	1C vs 4C	2C vs 3C	2C vs 4C	3C vs 4C	
Under-9											
Creative Components											
Fails (n)	1.75 ± 1.66	1.50 ± 1.62	1.75 ± 1.06	2 ± 1.35	−0.25; ±1.02	0; ±1.17	0.25; ±1.11	0.25; ±0.86	0.5; ±0.87	0.25; ±0.7	0.655
Attempts (n)	0.25 ± 0.45	0.17 ± 0.39	0.08 ± 0.29	0.0 ± 0.0	−0.08; ±0.35	−0.17; ±0.2	−0.25; ±0.23	−0.08; ±0.27	−0.17; ±0.2	−0.08; ±0.15	0.290
Fluency (n)	2.58 ± 2.15	1.92 ± 1.31	2.17 ± 1.90	1.25 ± 1.14	−0.67; ±1.11	−0.42; ±1.66	−1.33; ±1.28	0.25; ±1.27	−0.67; ±0.84	−0.92; ±1.02	0.282
Versatility (n)	0.58 ± 0.90	0.17 ± 0.58	0.17 ± 0.39	0.08 ± 0.29	−0.42; ±0.52	−0.42; ±0.47	−0.5; ±0.52	0.00; ±0.22	−0.08; ±0.35	−0.08; ±0.27	0.168
Originality (n)	0.08 ± 0.29	0.00 ± 0.00	0.42 ± 0.90	0.00 ± 0.00	−0.08; ±0.15	0.33; ±0.51	−0.08; ±0.15	0.42; ±0.47	0.0; ±0.0	−0.42; ±0.47	0.650
Creative score (n)	5.25 ± 3.82	2.25 ± 2.01	2.83 ± 2.41	1.33 ± 1.07	−2.42; ±2.3	−3.92; ±1.83	−3.92; ±1.83	0.58; ±1.39	−0.92; ±1.02	−1.5; ±1.26	**0.006**[a, b,c]
Under-11											
Creative Components											
Fails (n)	2.17 ± 1.03	1.58 ± 1.51	2.67 ± 1.50	2.83 ± 2.08	−0.58; ±0.75	0.50; ±0.92	0.67; ±1.18	1.08; ±1.14	1.25; ±1.29	0.17; ±1.19	0.263
Attempts (n)	0.42 ± 0.79	0.50 ± 0.80	0.25 ± 0.45	0.17 ± 0.39	0.08; ±0.52	−0.17; ±0.53	−0.25; ±0.50	−0.25; ±0.45	−0.33; ±0.46	−0.08; ±0.27	0.766
Fluency (n)	3.33 ± 2.23	2.42 ± 2.11	2.17 ± 2.25	2.83 ± 1.95	−0.92; ±1.35	−1.17; ±1.45	−0.50; ±1.73	−0.25; ±1.94	0.42; ±1.51	0.67; ±1.60	0.435
Versatility (n)	0.42 ± 0.67	1.33 ± 1.44	1.00 ± 1.28	0.58 ± 1.00	0.92; ±0.75	0.58; ±0.68	0.17; ±0.73	−0.33; ±0.92	−0.75; ±0.70	−0.42; ±0.84	0.340
Originality (n)	0.50 ± 1.00	0.08 ± 0.29	0.25 ± 0.62	0.25 ± 0.45	−0.42; ±0.52	−0.25; ±0.5	−0.25; ±0.59	0.17; ±0.37	0.17; ±0.20	0.00; ±0.44	0.177
Creative score (n)	4.92 ± 2.68	4.33 ± 3.63	3.67 ± 3.55	3.83 ± 2.72	−0.58; ±1.09	−1.25; ±2.11	−1.08; ±2.14	−0.67; ±2.84	−0.5; ±2.3	0.17; ±2.25	0.635
Under-13											
Creative Components											
Fails (n)	2.33 ± 2.15	2.58 ± 1.24	1.83 ± 1.27	2.00 ± 1.04	0.25; ±1.31	−0.50; ±1.22	−0.33; ±1.30	−0.75; ±1.06	−0.58; ±0.84	0.17; ±1.15	0.648
Attempts (n)	0.67 ± 0.65	0.42 ± 0.67	0.5 ± 0.52	0.67 ± 0.78	−0.25; ±0.23	−0.17; ±0.3	0.00; ±0.44	0.08; ±0.41	0.25; ±0.45	0.17; ±0.53	0.516
Fluency (n)	3.92 ± 2.78	4.17 ± 1.80	4.67 ± 2.42	3.92 ± 2.35	0.25; ±1.36	0.75; ±1.5	0.00; ±1.90	0.50; ±1.16	−0.25; ±1.11	−0.75; ±1.31	0.869
Versatility (n)	1.25 ± 1.36	1.00 ± 0.85	1.08 ± 1.31	1.08 ± 1.31	−0.25; ±0.83	−0.17; ±0.49	−0.17; ±0.62	0.08; ±0.71	0.08; ±0.71	0.00; ±0.66	0.902
Originality (n)	0.42 ± 0.67	0.08 ± 0.29	0.25 ± 0.62	0.0 ± 0.0	−0.33; ±0.34	−0.17; ±0.37	−0.42; ±0.35	0.17; ±0.2	−0.08; ±0.15	−0.25; ±0.32	0.118
Creative score (n)	6.25 ± 4.2	5.67 ± 1.97	6.5 ± 3.03	5.67 ± 3.77	−0.58; ±1.92	0.25; ±1.78	−0.58; ±2.34	0.83; ±1.27	0; ±1.31	−0.83; ±1.38	0.916

Ag. = Against; Dist. = distance; CV = coefficient of variation; ApEn = Approximate Entropy. N = number. The bold values mean significant differences. Letters represent differences according to the following conditions: a) 1C vs 2C; b) 1C vs 3C; c) 1C vs 4C; d) 2C vs 3C; e) 2C vs 4C; f) 3C vs 4C.

increased [U9, 1Cvs4C, −0.74 (−1.45; −0.03); 2Cvs4C, −0.37 (−0.83; 0.09); 3Cvs4C, −0.51 (−1.08; 0.06); U11, 1Cvs2C, −0.40 (−0.99; 0.19); 1Cvs3C (−0.51 (−1.14; 0.12)]. Players performed more versatile actions against 1C than against 3C [1Cvs3C, −0.66 (−1.40; 0.08); 1Cvs4C, −0.79 (−1.61; 0.03)]. Specifically, among the U11 players, there were more versatile actions against 2C [1Cvs2C, 0.75 (0.14; 1.37); 2Cvs4C, −0.62 (−1.19; −0.04)] and 3C [1Cvs3C, 0.48 (−0.08; 1.04)]. Lastly, playing against 3C emphasized original actions among the U9 players [2Cvs3C, 0.82 (−0.10; 1.74), and among the U13 players while playing against 1C [1Cvs2C, −0.65 (−1.30; 0.01); 1Cvs4C, −0.81 (−1.48; −0.14)].

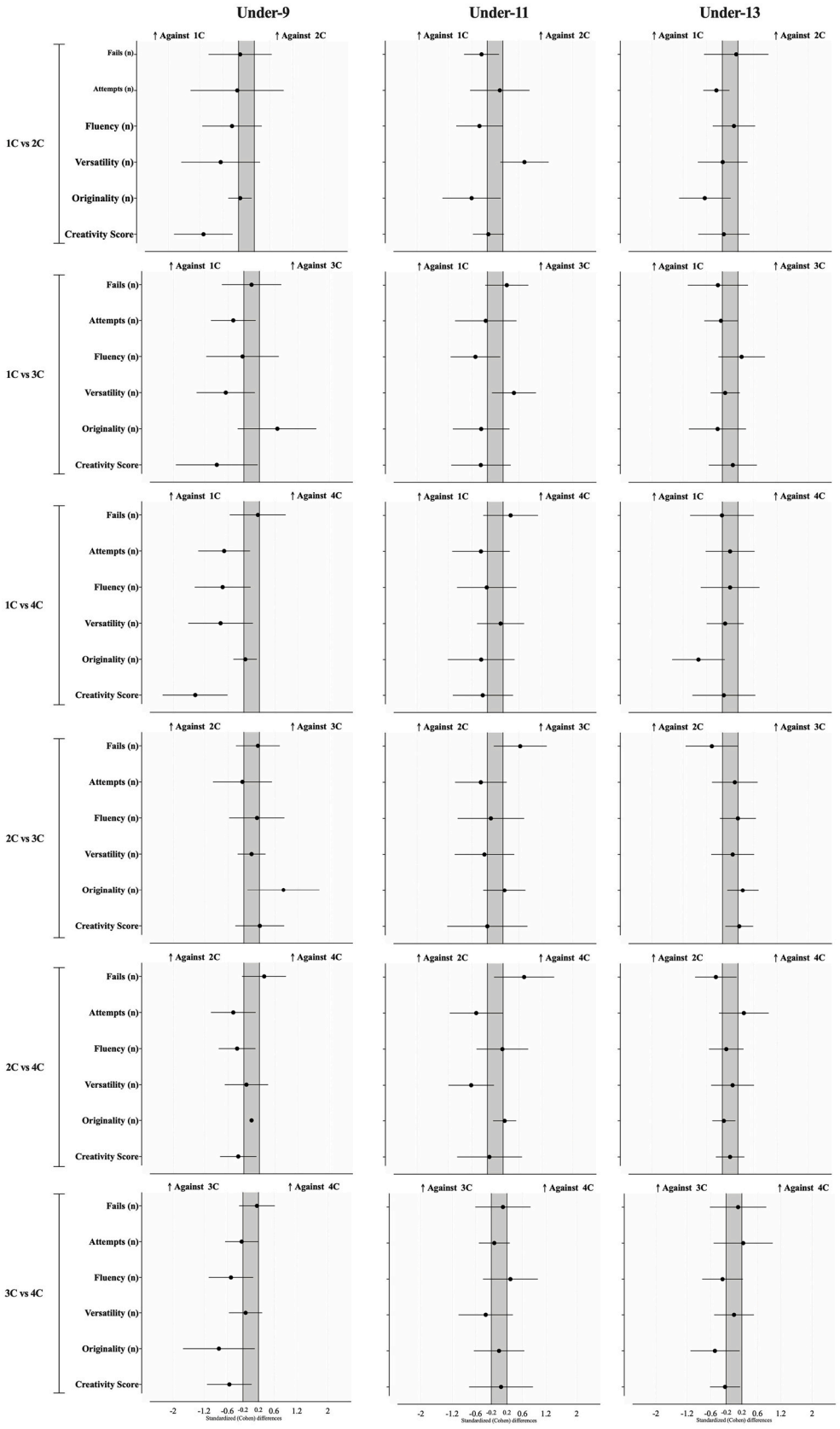

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Fig. 3. Standardised (Cohen) differences for the creative variables according the different age groups. Error bars indicate uncertainty in true mean changes with 95% confidence intervals.

4. Discussion

The purpose of this study is to identify the creative and tactical effects of playing against a varied number of creative opponents during youth football SSG of different age groups (U9, U11 and U13). Regarding tactical variables, U9 players exhibited a trend towards increasing space exploration when faced with an increasing number of creative opponents while also increasing the variability in the distance between the team and opponent's team centroid (i.e., the distance from and to both centroids varies during the game). Among the U11 players, a higher regularity (i.e., players were likely to maintain a particularly stable distance to their teammates) was recorded in the distance to the team and opponent team centroid with an increase in the number of opposing creative players. In contrast, among the U13 players, there was a decrease in the regularity for the same variables. From the analysis of creative components, there was a higher creative score for the matches against 1C (vs 2C and 4C) and 3C (vs 4C) among the U9 players. In addition, despite there being no significant differences, it was determined that moderate (i.e., playing against 1C) to high (i.e., playing against 2C and 3C) scenarios foster players' creative components, while extremely high demanding conditions (i.e., against 4C) constraint it.

A large and growing body of research exploring how youth players adapt their behaviours to different task boundary conditions (Machado et al., 2019; Santos et al., 2020; Travassos et al., 2018) has emerged over the last few years, guiding coaches to the adoption of more effective training environments (Folgado, Lemmink, Frencken, & Sampaio, 2014). This study investigates how players from the U9, U11 and U13 adapt their behaviour in response to varying the number of opposing creative players. For this assessment, they were exposed to a game situation (i.e., 4-a-side plus goalkeeper) in which the number of creative players in the opposing team was systematically increased (from 1 to 4), while the number of opposing intermediate players was decreased (from 3 to 0). In general, players increased the individual space explored when facing highly demanding scenarios (i.e., playing against 2C and 3C), and this decreased when they faced against extremely high demanding scenarios (i.e., playing against 4C). This variable allows capturing information on the amount of space explored by the players (Gonçalves et al., 2017). It is expected that increasing the number of creative players in the opposing team will also increase their superiority in terms of game control compared to the intermediate team, consequently impacting how players explored the available space. In this regard, increasing the individual area explored against 2C and 3C may emerge as the functional behaviour adopted to face the increasing number of creative players. However, when playing against a full team of creative players (i.e., playing against 4C), it is possible that the differences between them become highly pronounced, limiting the players on the intermediate team to a highly restricted space. Similar findings were found when considering the effects of manipulating the number of opposing players in adult amateur teams and among professional football players. Although small numerical imbalances (i.e., 4vs3, 4vs5) seemed to generate highly varied collective behaviours, the frequency of these behaviours decreases when facing high inferiority situations (i.e., 4vs7) (Torrents et al., 2016). Similarly, this study, players seem to increase the space explored when facing highly demanding scenarios (i.e., playing against 2C and 3C) and use less space when facing extremely high demanding scenarios (i.e., playing against 4C). These results were found primarily for the U11 and U13 players. Among the U9 there was a marked trend of increasing SEI as the number of creative opponents increased. It is crucial to note that players within this age group are still developing their fundamental movement and game skills (Stafford, 2005). In fact, U9 players seem to solve the game problems by adopting more individual approaches as they possess limited tactical knowledge (Folgado, Lemmink, et al., 2014). Furthermore, most of their behaviours are focused on the ball and less on their teammates (Travassos et al., 2018). Although it was not possible to track the ball in this study to analyse the players offensive and defensive behaviours, it may be reasonable to surmise that U9 players spend more time defending and chasing the ball as the number of creative opponents increases. The lower number of successful actions recorded when they faced high numbers of creative players, and the increase in variability in the distance between the team and opponents team centroid when they played against 4C, strengthens this premise. However, further research should adopt strategies that include ball action to facilitate a deeper understanding of the creativity of players in response to offensive and defensive behaviour.

Earlier research exploring the relationship between age group and players' performance revealed that older players are better able to cope with task boundary conditions (Barnabé, Volossovitch, Duarte, Ferreira, & Davids, 2016; Olthof, Frencken, & Lemmink, 2015) because of their higher perceptual and motor skills (Kannekens, Elferink-Gemser, & Visscher, 2011). Therefore, it would be expected that the U9, U11 and U13 players exhibit distinct movement behaviours under the same task manipulation conditions. In this regard, the U11 players recorded a decrease in ApEn values in the distance to both team and opponent team centroid when playing against high numbers of creatives (i.e., playing against 3C and 4C), which indicates that the players maintained a significantly regular distance to both centroids. Although high regularity has been linked to the development of players' game understanding and tactical awareness in recreational adult-level players (Sampaio & Maçãs, 2012), it may also be linked to a more collective approach (Sampaio et al., 2014). In addition, reports from previous studies also suggest that players adopt increasingly regular movement patterns when facing more demanding and complex scenarios (e.g., starting a training task losing or playing in numerical inferiority of 4vs5) (Sampaio et al., 2014). Taking this into consideration, it is plausible that the intermediate team spent more time defending as the number of creative opponents increased. Consequently, increasing regularity in the distances may emerge as a functional strategy and self-organising process to face the unpredictable profile of the opposing team. In contrast to the U11 players, the U13 players exhibited more regular distances to the team centroid when playing 1C and 2C than when playing 3C and 4C, which led to less regularity in the distances to the team centroid. In this vein, players in older age groups and highly skilled players seem more capable of using available space (Barnabé et al., 2016; Olthof et al., 2015). Older players exhibited more refined perceptual skills and tactical awareness (Kannekens

et al., 2011), which might have allowed them to adopt adaptive movement patterns that contribute to such irregularity.

The *P-type* creativity expression is internal to the player as it relates to the ability to develop new movement patterns and solutions resulting from self-exploration, which allows the player to overcome individual limitations (Boden, 1996). In this regard, the P-type is associated with developing new movement solutions, which may be novel to the player but not to society. Individual creative actions have been considered key to scoring goals and progressing towards the final stages of international football tournaments (Kempe & Memmert, 2018). Therefore, developing players' *P-type* creativity expression is considered a priority during their developmental stages, as this may lead to unique and unpredictable performances (Santos et al., 2016). To accentuate this *P-type* creativity expression, coaches should develop a suitable environment that triggers all creative components by using a broad range of boundary conditions that encourage players to explore and re-invent new action possibilities. Apparently, the lower tactical requirements of SSG, compared to formal games, inspire players to take more risks and explore new movement patterns (Caso & van der Kamp, 2020). In this study, statistically significant differences in creative behaviour scores were found only among the U9 players with higher values for 1C (vs 2C and 4C). Interestingly, in line with previous research on boundary conditions (e.g., differential learning) (Coutinho et al., 2018; Santos et al., 2018) the imposed manipulations had a greater impact on the U9 players than the other age groups. Notwithstanding that the observations on the other variables and age groups are not show statistically significant, some tendencies were found primarily among the younger age groups, which may provide additional insights for coaches when designing for creativity. Accordingly, higher values for most of the creative components across age groups were found for the matches against 1C, 2C and 3C, while clearly lower values were identified when facing 4C. This is in agreement with previous reports suggesting that designing an appropriate level of game-based scenarios will guide players more frequent exploration than when employing extremely high demanding scenarios (Machado et al., 2019; Torrents et al., 2016).

Overall, the intention of this study was to provide practical insights regarding how varying the proficiency level of the opposition by progressively increasing the number of creative opponents affects the creative and tactical performance of youth football players. Notwithstanding the critical insights derived from this study, a few limitations should be acknowledged for the benefit of future research. For instance, the small sample size and grouping the players based only on their creative potential may preclude more robust inferences on other factors such as physical performance, tactical knowledge (Praça et al., 2017), and even the players' early sports experience. In addition, the participants in this study comprised players at a low level competitive tier (i.e., youth players at a regional academy), which may have contributed to a few of the observed effects on the creative components. Because players at different levels of experience interact differently with the environment (Coutinho et al., 2021; Travassos et al., 2018), further studies may include players from other age groups (e.g., U15, U17 and U19), and different levels of experience (e.g., elite vs amateur) to investigate the possibility of measuring creativity along these various dimensions (e.g., individual vs collective; offensive vs defensive). In addition, the study design was developed from the perspective of analysing the creative and tactical changes in the intermediate team (which was kept constant across all data collection scenarios), however, it would be interesting to analyse the adaptions that occur on the creative team with the replacement of intermediate by creative players.

Nevertheless, the results suggest that increasing the number of creative players impacts the collective behaviour of the team more than it does the creativity related skills. Coaches may better grasp how players of different age groups adjust their behaviour in response to the profile of the opposing team. Indeed, a major challenge for coaches and researchers is how to uncover the role of boundary conditions in unleashing creative behaviours as a function of the players' age, previous experiences, or/and level of play. In this regard, it is necessary to develop further research that assists coaches and practitioners in identifying relevant boundary conditions that amplify opportunities for action and movement exploration, thus nurturing creative predispositions.

5. Conclusion

The findings of this study show that different behaviours emerge from the manipulation of the number of creative players on the opposing team, and these behaviours vary according to the players' age, primarily from the tactical perspective. Increasing the number of creative opponents induces more variability in the players' distances to the team's centroid among U9 players and induces more regularity among the U11 players. In contrast, it induces lower regularity among U13 SSG players. The differences in the players' perceptual and motor skills of the players may reflect the nature of these changes. From the creative behaviour analysis, statistically significant differences were found in the creative behaviour scores of the U9 players, with higher values against 1C than for the remaining conditions primarily when compared with 4C. These results indicate that this age group is more sensitive to changes in the opposing team from the creative behaviour perspective. Although no other differences were identified, it is crucial to note that players performed more creative actions in moderate-to-highly demanding scenarios (1C, 2C and 3C), whereas being exposed to extremely demanding scenarios (4C) appears to inhibit the movement exploration.

CRediT authorship contribution statement

Sara Santos: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Visualization, Project administration. **Diogo Coutinho:** Conceptualization, Methodology, Software, Formal analysis, Investigation, Resources, Data curation, Writing – original draft. **Bruno Gonçalves:** Conceptualization, Methodology, Software, Validation, Formal analysis, Resources, Data curation, Writing – original draft, Visualization. **Jaime Sampaio:** Conceptualization, Validation, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Data availability

The data that has been used is confidential.

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