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# The gaze behaviours and defensive tactical performance of football players during small-sided games: A pilot study.

**KEYWORDS:**
Soccer, Decision-making. Perceptual-cognitive skills. Tactical performance. Small-sided perceptual games.

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## ABSTRACT

A novel in-situ approach is developed to examine perceptual-cognitive of football players. The aim of the present study was to analyze the gaze behaviors, perception of effort and defensive tactical performance during game sequences involving 2 vs 1 + goalkeeper. Ten university-level players were evaluated and at the end of each playing sequence, participants indicated their perceived effort on the task using the Rate Scale Mental Effort and Borg Scales. The defensive tactical behaviour was evaluated based on defensive tactical principles of football. Visual search behavior was recorded using Tobii Pro eye-movement registration glasses. We evaluate the gaze variables defined as number of fixations, fixation duration, number of fixations per location, percentage of viewing time per location, namely playerball, ball, spaceplayer, space and undefined. Participants showed poorer defensive tactical values from the first to the second game sequence. Also, they indicated higher perceived effort during the second game sequence. Moreover, participants presented changes in picking up specific information from both times for spaceplayerball and space. Our results demonstrated that players searched for cues on space of player in possession of the ball and spaces to avoid a worsening in the defensive tactical throughout the game. The novel approach proposed could provide to the scientific and coaches communities new methodological and training avenues for improvement the decision-making abilities of football players.

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# Os comportamentos visuais e a performance tática defensiva dos futebolistas durante os jogos reduzidos: Estudo piloto.

03


**RESUMO**

Uma nova abordagem in-situ foi desenvolvida para avaliar as habilidades percetivo-cognitivas dos futebolistas. O objetivo do estudo foi analisar os comportamentos visuais, a percepção de esforço e a performance tática defensiva durante ações de jogo envolvendo 2 vs 1 + guarda-redes. A amostra foi constituída por dez jogadores universitários, em que no final de cada ação de jogo os participantes indicaram a sua percepção de esforço através da escala mental de esforço e da escala de Borg. O comportamento tático defensivo foi avaliado tendo como referência os princípios de jogo defensivos do Futebol. O comportamento da procura visual foi obtido através da utilização do sistema portátil de óculos da marca Tobii Pro. Os indicadores visuais avaliados foram definidos como o número de fixações, a duração da fixação, o número de fixações por local, a percentagem do tempo de fixação por local, nomeadamente o jogador com bola, a bola, o espaço do jogador com bola, espaço e não definido. Os participantes apresentaram uma redução da performance tática defensiva da primeira para a segunda ação de jogo. Também, eles indicaram uma maior percepção do esforço durante a segunda ação de jogo. Ademais, os participantes apresentaram alterações na captura de informação visual específica entre as ações de jogo para os indicadores espaço jogador com bola e espaço. Os nossos resultados evidenciaram que os jogadores de futebol procuram os indicadores visuais espaço do jogador com bola e o espaço como os indicadores visuais mais relevantes para evitarem um decréscimo no seu desempenho tático defensivo ao longo das ações de jogo. A nova abordagem apresentada providenciará à comunidade científica e técnica novas vias metodológicas e de treino para desenvolver a tomada de decisão dos futebolistas.



**PALAVRAS CHAVE:**

Futebol. Tomada de decisão. Habilidades percetivo-cognitivas. Performance tática. Jogos perceptivos reduzidos.

## INTRODUCTION

The dynamic nature of football has researchers to adopt distinct theoretical and practical frameworks for investigating superior performance, particularly the perceptual-cognitive skills (Williams & Ericsson, 2005; Williams et al., 2011). Traditionally, perceptual-cognitive skills have been defined as the ability to detect and process environmental information, and to integrate them with pre-existing knowledge and motor capabilities, to select and to execute suitable actions (Marteniuk, 1976). These skills have been examined a wide variety of methods and research designs involving several tasks ranging from penalty kick up to 11 vs. 11 game situations in the first-person and/or third-person perspectives (Roca et al., 2013; Savelsbergh et al., 2005; Vaeyens et al., 2007).

The amount of research focusing on perceptual-cognitive skills has increased markedly in recent decades, but the original work dates back to the early 1990s (Helsen & Pauwels, 1993; Williams et al., 1994). Helsen and Pauwels (1993) compared the perceptual-cognitive skills of expert and novice football players. They were evaluated in a variety of offensive tasks using slides and video simulations, which required tactical decision-making in small-sided games and 'set-play' conditions (e.g., free-kicks). The authors concluded that expert players were more accurate in their decisions and showed faster responses, presenting higher efficiency in gaze behaviors.

Since then most researchers have tried to represent the reality of the game by using some technological tools (cf. McGuckian et al., 2017). Published reports suggested that researchers have employed a wide range of methods (e.g., either video-based or *in-situ* conditions) and techniques (i.e., occlusion and point-light-display) to identify the perceptual-cognitive skills underlying anticipation and decision-making abilities (Andrade et al., 2020; Williams et al., 2011). Process-tracing measures have been recorded such as eye movements and verbal reports (Mann et al, 2007; Williams et al., 2011). Roca et al. (2011) proposed a novel representative task method to evaluate the perceptual-cognitive skills through two investigations based on multidimensional approach in football (Roca et al., 2013). Authors applied scenarios in the first-person perspective, which simulated the far and near task-constraints situations with a movement-based response like the real-game settings (Roca et al., 2013).

Regarding small-sided games, researchers have presented scenarios using several video perspectives (e.g., aerial and players actions on-field) to manipulate a variety of task constraints during performance in football (Mann et al., 2009; Vaeyens et al., 2007). Recently, *in-situ* simulations (e.g., penalty tasks) has been used to create the most realistic test settings (Dicks et al., 2010; Timmis et al., 2014). Oppici et al. (2017) carried out an *in-situ* experiment to compare football and futsal players' perceptual-cognitive skills under domain-specific task constraints involving offensive sequences. The authors concluded that the differences in performance were aligned with the variations in domain-specific practice. Furthermore, they highlighted the need to examine how the importance of different perceptual-cognitive

skills changes as a function of task constraints (cf. Newell, 1986; Williams et al., 2004). Notwithstanding, there are important methodological issues that need to be addressed when developing study designs to evaluate perceptual-cognitive skills during *in-situ* conditions, particularly those related with variables control (Andrade et al., 2020; Causer et al., 2014).

Players' performance during *in-situ* tasks are influenced by multiple interrelated constraints (Roca & Williams, 2016). Therefore, we proposed the term "small-sided perceptual games" because: (a) players are submitted to stressful physical demands presenting higher physiological stress in workload/min of the game (Casamichana et al., 2012; Hill-Haas et al., 2011); (b) it is well-known that the perceptual-cognitive skills underpinning players' performance are influenced by different physical intensities (Casanova et al., 2013); (c) when these constraints were manipulated during small-sided games, they influenced the intensity of play demanding from players different physical workloads and adequate tactical-technical skills, while performing decisions under pressure and fatigue (Kunrath et al., 2020); and (d) Kunrath et al. (2020) suggested that mental effort narrowed players' visual field, impairing them to maintain their cognitive and tactical behaviors.

In this context, we proposed to analyze the visual search behaviors of defending players and their cognitive effort (rating perception of effort) spent during defensive tactical performance in a 2 vs 1 + goalkeeper small-sided perceptual games (2 vs 1 + goalkeeper) across two sequences of play. We expected that the players could present higher perceived effort in the second sequence of play due to accumulation of stress effort throughout tasks and time of practice (Casamichana et al., 2012; Kunrath et al., 2020), and the players' tactical performance may decrease from the first to the second game sequence (Badin et al., 2016; Kunrath et al., 2018). However, we do not hypothesize the characteristics of areas of interest due to a lack of consensus in the available literature.

## METHODS

### PARTICIPANTS

Ten male university-level football players (25 ± 3.50 years, 75.56 ± 9.29 kg and 179.56 ± 3.88 cm) without professional experience participated in this experiment. Participants reported normal or corrected to normal levels of visual function. The methodological procedures were presented and detailed to the participants, who consented and agreed with the procedures applied in the research. The study was approved by the Ethics Committee of the host University (protocol number CEFADE.02.2019) and all procedures conducted in accordance with the Declaration of Helsinki.

## FIELD-TEST TASK CONSTRAINT

The task involving performing in game sequences for 1 min and 40 s in 2 vs 1 + goalkeeper small-sided perceptual games situation with field dimensions of 27 m x 20 m (FIGURE 1). The standardization of the field measures used in the small-sided perceptual games was based on the number of players involved in the activity (Halson, 2014). The field area was determined by calculating the game space ratio used by football players according to the maximum length and width dimensions, established by the International Football Association Board for international games (Hughes, 1994; Silva et al., 2015).

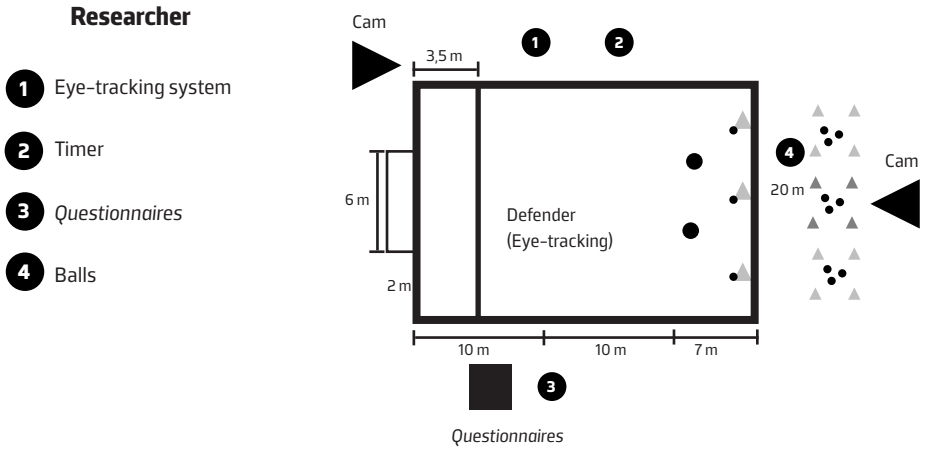



**FIGURE 1.** The experimental trial, pitch dimensions and its representativeness task (2 vs. 1 + goalkeeper).

## APPARATUS

The Tobii Pro Glasses 2® eye-movement registration system was worn by participants for the whole duration of the field task and used for recording the visual search behavior of each participant. The system records the point-of-gaze onto a video image of the binocular corneal reflection with respect to an integrated cameras and measures the relative position of the pupil and corneal reflection. The recording process was done through Tobii Glasses Controller Software running on a tablet. The image is transferred to a computer and analyzed by running Tobii Glasses Analysis Software. System accuracy was recorded at 0.5º in both horizontal and vertical directions.

## PROCEDURES

The procedures were carefully explained before the beginning of the experiment, and the eye-movement system was fitted onto the defender´s head. To calibrate the Tobii eye-movement system the participant had to focus on the center of the calibration card held in

front of him for 5 s. To ensure the players' familiarity with the test procedure, they practiced three trials on the field (Williams & Davids, 1998). In the field test, two sequences of play were performed lasting 1 min and 40 s each, interspersed by a rest interval of same duration. The players restarted a new trial only at the signal of the researcher. The trial finished when: (a) the defender recovered the ball possession; (b) attackers shot at the goal and scored/outlined; or (c) a fault was marked. To begin a new trial, the attacking players had to return to the starting point to pick up the ball. All the trials were performed according to the official laws of the game (FIFA, 2021).

The defending players only performed defensive actions (e.g., disarm, interception and tackle), whereas two attacking players performed offensive actions (e.g., pass, reception, dribble). To control possible learning biases by the defender, four attacking players participated in the design for counterbalancing. They played alternating pairs for each sequence (trial). The trials performed by the players for the first and second games sequences were 11.4 ± 4.55 and 10.6 ± 1.84, respectively.

The defender was requested to indicate the perceived effort demanded at the end of each trial. The rate of perceived exertion scale was used, which contained the rating scale mental effort and the Borg Scale categories. For verifying the rating scale for mental effort, the researcher asked the participants the following question: "How mentally demanding did you perceive the task?" Players estimated their mental effort states by drawing a line through a vertical scale from 0 (*Not at all effortful*) to 150 (*Very effortful*). For the Borg scale players were asked: "how do you classify the physical effort in the task from 6 (*Minimum effort*) to 20 (*Maximum effort*)?".

## ANALYSIS METHODS

### Defensive tactical performance accuracy

The player´s defensive tactical performance accuracy was assessed based on core tactical principles of football (Teoldo et al., 2022). The tactical principles had been consistently evaluated, which reported reliability values over .81 in the analysis of actions (Hughes, 1994). It encompasses ten tactical principles (i.e., five defensive and five offensive principles) which are defined from the analysis and identification of the players' efficiency in performing.

We evaluated actions related with the defensive tactical principles. The assessment was performed based on the System of Tactical Assessment in Soccer (FUT-SAT) developed by Teoldo et al. (2011) . Thus, were considered the quality of principle performance criterion, once the scores were calculated considering negative and positive actions, once negative was classified with five points and positive action was considered ten points.

The rating scale for mental effort was used to evaluate and to compare the invested mental effort perceived by the defenders during both sequences of play. This scale required participants to indicate the level of effort demanded during the task, indicating the amount

of processing resources employed. The rating scale of mental effort ranges from 0-150, with three verbal anchors corresponding to 0, 75 and 150 (not at all, moderately and very effortful, respectively; Zijlstra, 1993). The rating of perceived physical exertion was used with verbal anchors (rate of perceived exertion), which comprehended a 15-grade scale ranging from 6 (minimum effort) to 20 (maximum effort) (Borg, 1982).

**Visual search rate**

The total duration of fixations was analyzed per location from the onset of each game sequence. A fixation was defined as the period of 100 ms when the eye remained stationary within 0.5º of movement tolerance (Vater et al., 2016). Three measures were recorded to provide an indication of the search rate: the mean number of visual fixations; the mean fixation duration; and the total number of fixation locations.

**Percentage of viewing time**

The percentage of viewing time was defined as the proportion of time spent fixating on each of five areas of interest: (a) ball; (b) free space on the pitch (space); (c) space of player in ball possession (i.e., space around player and between legs; spaceplayer); (d) player in possession of the ball (i.e., body parts; playerball); and (e) undefined. The undefined category was excluded.

**Mean of duration fixation**

The mean of duration fixation was defined as the mean time spent fixating on each area of interest.

## RELIABILITY ANALYSIS

Test-retest reliability for the observations comprised of a 21 days interval for reanalysis to avoid any potential familiarity effects with the task (Robinson & O'Donoghue, 2007). Internal consistence reliability between observers was tested by using the Cronbach's Alpha. Inter and intra-observer analysis for defensive tactical performance showed an agreement above 90%, and for visual search data were above 85%.

## STATISTICAL ANALYSIS

Repeated measures t-test was conducted to compare the rating scales for perception efforts (i.e., rating scale for mental effort and Borg), tactical performance and visual search measures according to number of fixations, fixation duration, number of fixations per location were classified as dependent variables. We analyzed Separate Factorial Two-way ANOVA with game sequences (i.e., first and second sequence) as the between-participants factor for the percentage of viewing time and mean of duration fixation per areas of interest (that were the within-participants factors). Additionally, we performed two-way ANOVA with areas of

interest as between-participants and sequence as within participants. Any significant main and interaction effects were followed up using Bonferroni-corrected pairwise comparisons and Bonferroni post hoc tests, respectively. Alpha level of significance was set at $p < .05$.

## RESULTS

The defensive tactical performance accuracy decreased significantly between the first and second game sequence ($t_{(9)} = 2.312$, $p = .046$; TABLE 1).

The data revealed significant differences between sequences for rating scale for mental effort and Borg scale, with participants indicating higher scores for rating scale for mental effort in the second sequence when compared with the first one ($t_{(9)} = 3.156$, $p = .012$; $t_{(9)} = 5.127$, $p = .001$; TABLE 1).

**Table 1**. Mean (*m*) and standard deviation (± *sd*) for percentage defensive tactical performance accuracy, for rating scale of mental effort (RSME) and Borg scales (Borg) of rate perception exertion (RPE), and for fixation duration (FD), number of fixations (NF) and number of fixations per location (NFL) of visual search during both game sequences.

| | First Sequence | | Second Sequence | |
|---|---|---|---|---|
| **Variables** | *m* | ± *sd* | *m* | ± *sd* |
| Percentage defensive tactical performance accuracy* | 81.40 | 08.87 | 69.50 | 18.93 |
| **RPE** | | | | |
| RSME* | 95.50 | 11.89 | 104.30 | 19.10 |
| Borg* | 13.90 | 2.92 | 15.45 | 3.44 |
| **Visual search measures** | | | | |
| FD | .261 | 0.057 | .253 | 0.053 |
| NF | 12.92 | 5.56 | 11.02 | 5.03 |
| NFL | 2.58 | 1.11 | 2.20 | 1.01 |

* Significant differences between both game sequences ($p < .05$).

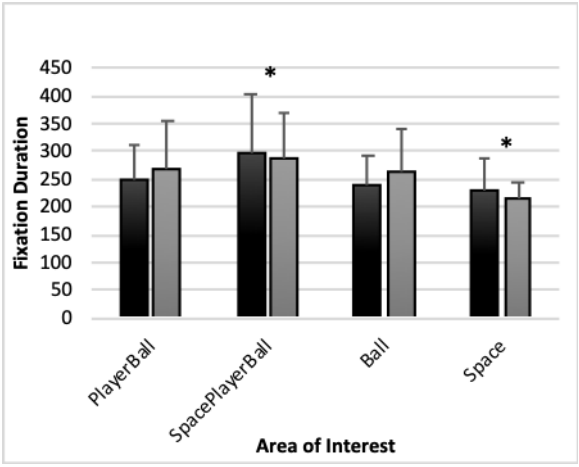
Although visual search measures had displayed changes between sequences, the statistical analysis showed no significant differences for fixation duration ($t_{(9)} = .838$, $p = .424$); number of fixations ($t_{(9)} = 1.270$, $p = .236$); and number of fixations per location between each sequence ($t_{(9)} = 1.270$, $p = .236$; TABLE 1).

The results revealed significant differences for percentage of viewing time on areas of interest ($F_{3,72.} = 2.856$; $p = .043$), but they did not displayed differences between the sequences. In addition, we did not found differences between areas of interest when verified within sequences, as well as when compared each one from the first to the second sequence

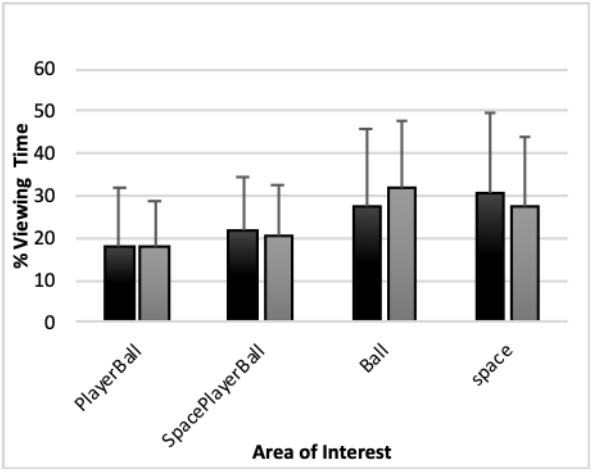
(FIGURE 2a). Regarding the mean of duration fixation, we have verified main effects for areas of interest ($F_{3,72}$ = .364; $p$ = .027), evidencing that the players spent more time fixating on the spaceplayerball rather than spaces available ($p$ = .017). In contrast, there were no main effects for both sequences. Moreover, we did not find significant differences for areas of interest within and between sequences (FIGURE 2b).

**Figure 2 (a, b).** Percentage viewing time for each area of interest across both game sequences and mean of fixation duration spent for each fixation on the areas of interest across both game sequences (left and right panels). * Difference among areas of interest ($p$ < .05).

**(2a)**




**(2b)**



## DISCUSSION



This study aimed to examine the visual search behavior of defending players and their cognitive effort during defensive tactical performance in a 2 vs 1 + goalkeeper task constraint, across two game sequences. We presume that, contrarily to the conditions found in laboratory settings, *in-situ* designs such as playing in small-sided perceptual games may significantly influence the players' behaviors due to the complexity of constraints inherent to these performance environments (McGuckian et al., 2017).

The main findings of our study revealed that players decreased their accuracy on the defensive tactical performance from the first to second game sequences, while they presented higher scores of perceived efforts (i.e., rating scale of mental effort and Borg scales – rate of perceived exertion) when compared both sequences. Moreover, there were no significant differences between sequences when the visual search measures were considered. In addition, despite players having displayed changes in their visual search strategies and tracking differences for different areas of interest, there were no significant differences between both game sequences. However, participants also showed main effects for areas of interest in percentage of viewing time and mean of duration fixation.

The defending players presented a decreased in the defensive tactical performance accuracy from the first to the second game sequence, contracting with an increased in the rate of perceived exertion between both game sequences. While rating scale of mental effort gives insights into the amount of processing resources spent on the task (Williams et al., 2002), the Borg scale is considered to be a psychophysical estimated effort (Borg, 1982). In this sense, the current task of 2 vs 1 + goalkeeper demanded from players specific cognitive efforts for maintaining their concentration (i.e., attentional control) in making fast and accurate decisions, due to the information processing required in dynamic and complex environments (Andrade et al., 2020; Walsh, 2014).

Moreover, when the players were more mentally tired, particularly during the second game sequence, aiming to anticipate the opponent's intention and to adapt their movement according to their defensive actions, the process of picking-up relevant sources of information and information-processing during it can prove to be more difficult. Consequently, this impairs their technical-tactical performances in numerical inferiority 2 vs 1 (Badin et al., 2016; Kunrath et al., 2020; Smith et al., 2016).

Looking at the increase of the Borg scale between game sequences, it seems that it is linked with the task characteristics since players performed the 2 vs 1 task constraint throughout many trials. Such demands during the task tend to follow an intermittent exercise (Hill-Haas et al., 2011). Moreover, although previous studies have suggested that mental fatigue increases rate of perceived exertion, it has little impact on high-intensity and short-duration exercises (Martin et al., 2015; Smith et al., 2015; Smith et al., 2016a, 2016b).

Albeit the results obtained in the visual measures did not demonstrate any statistical difference, the participants tended to change their gaze strategies between both game sequences. Eysenck and Calvo (1992) postulated that there is a link between the effort performed on the task and the effectiveness of performance, which may be ascertained by changes in indirect measures, such as the gaze behaviour and rating of mental efforts, such as displayed in our results from the defensive tactical performance accuracy and rate of perceived exertion results. Therefore, it should not be disregarded the impact of mental and physical fatigue on tactical performance during *in-situ* settings, which might affect the players' ability of management and control the spaces on-field (Kunrath et al., 2020). Notwithstanding, one of the main issues of our results concerns to players' skill-level and physical conditions since we invited university football players. However, other studies highlighted those elite players can adapt their visual search under stress and have not displayed high reductions in their performance (Casanova et al., 2013).

Thereby, such stress that could influence gaze behaviour, mental effort or processing resources, may be manipulated, for instance, through implementation of an intermittent exercise protocol and workload demand, as applied by Casanova et al. (2013) in football, and by Vickers and Williams (2007) in biathlon, respectively. Unlike the current study performed *in-situ* condition, previous ones had applied their designs into laboratory conditions.

When we focus on the percentage of viewing time, our results displayed main effects for areas of interest, however, players displayed no differences when verified the spent of time fixating amongst areas of interest. Although previous research had applied 2 vs. 1 task constraint in laboratory conditions, researchers claimed that players' visual search behaviour varies according to their decision-making level. Successful players spend more time fixating on the player in ball-possession and switching their visual search more frequently between the player and any other area (Vaeyens et al., 2007). In this study players decreased their defensive tactical performance accuracy, as well as changed their gaze strategies.

Considering the fixation duration per areas of interest there were no significant differences between and within game sequences. Nonetheless, players spent more time fixating on the space of the player in ball-possession, rather than in free space on the pitch, in the 2 vs. 1 task constraint. Since football is characterized by time and motion management, it is worth mentioning for players searching cues on space of playerball and spaces support them to manage the defensive distances, avoiding decreasing the tactical performance under effort demands during the game (Kunrath et al., 2020). Therefore, when the defenders are capable to manage the spaces on-field, controlling the distance between him and the opponents with and without the ball, they could comprise key information clues to anticipate the opponent's actions (Williams et al., 2017).

Similarly, Vaeyens et al. (2007) conducted a quasi-experimental study to investigate whether youth football players' visual search behaviour would present differences according

to numerical relations. Notwithstanding, the authors had assessed players in laboratory conditions, and the results have showed that their visual search behaviour varies according to the number of players involved in the activity. Such results may be associated with the aerial perspective of the video-simulated and the areas of interest defined.

In the present study, we considered the areas of interest closer to each other due to *in-situ* conditions analysis (e.g., space of the player and player in ball-possession), and its implicit and specific-domain task constraints from the real environment. For example, for analyzing the gaze behavior during *in-situ* conditions, we had considered as areas of interest the space of the player in ball-possession (i.e., space around player and between legs), while in other studies this area was not analyzed, most likely because authors had applied the task in video conditions on third-person perspective.

Such changes in visual search behaviour may have been influenced by task complexity and, consequently, by the cognitive load demanded during players' performance throughout the trials, showed by the rate of perceived exertion results obtained. In agreement with our study, Badin et al. (2016) suggested that when players are in a state of fatigue their mean of fixation duration increased during 2 vs. 1 task constraint video-conditions.

Since a specific-domain task constraint (i.e., 2 vs. 1 + goalkeeper), *in-situ* condition, was applied in this study, the ongoing and unpredictable actions displayed in these small-sided perceptual games seemed to shape players for picking-up relevant information sources from the environment, leading to an adaptation for the task being performed, throughout both sequences (Williams et al., 2004). Likewise, gaze changes exhibited throughout trials amongst areas of interest may have been influenced by a psychophysiological demand effect, probably verified by the rate of perceived exertion (assessed through rating scale of mental effort and Borg scales). Importantly, our interpretations and discussions are limited to the scarcity of studies that have applied similar task constraints *in-situ* conditions or used similar instruments.

Thus, we suggest to all the scientific community in a near future to develop more *in-situ* research to examine the influence of the perceptual-cognitive skills on technical and tactical performance on different skill-level and gender footballers by using the same methodological procedures.

Despite the results and the interpretations, this study aimed to offer possible future research avenues in examining the perceptual-cognitive skills during *in-situ* conditions. In this regard, to examine whether the physiological workload, either pre-test or between sequences, affected the tactical behaviour and visual search behaviour underpinning anticipation and decision-making performance might offers a further step in literature. In addition, it would be paramount to better understand how different complex task constraints, *in-situ*, such as 1 vs. 1 (smaller complexity), 2 vs. 2 and 3 vs. 2 (higher complexity) would promote changes in players' gaze behaviours. Moreover, we suggest experimental design studies that could determine the number of trials for each sequence and use other instruments to assess the mental effort, for example the visual analogue scale (Kunrath et al., 2020).

Finally, since this is a pilot study, we would like to address some future recommendations about using the Tobii Pro Glasses 2, namely: these device could be able to collect gaze data in real world scenarios but the researchers has to change the lengths of the glasses ('lightning lengths'), the eye tracker must be well fit to participant's face by using the correct nose adaptor and it should be provide the appropriate calibration procedure (as described in methods – procedures) to guarantee the data quality, and to analyse raw data since there is no evidence for the suitability of other filters included in the software. In sum, a balance between external validity of the experimental conditions (ecology) and the reliability of the measurements is essential (Kredel et al., 2017).

In summary, this study demonstrated how players developed their visual search strategy during small-sided perceptual games, particularly in 2 vs. 1 + goalkeeper. The effort spent by players throughout practice tends to impair the defensive tactical actions, as well as how players pick-up relevant cues on the surround once players changed their gaze strategies regarding the space of the playerball and other spaces for adjusting their performance. The methods applied in the current study may offer novel directions for future studies regarding the control and research designs applied in the investigation of the perceptual-cognitive skills evaluated directly on the pitch (small-sided perceptual games) and may induced changes in coaching methodology to improve player's perceptual-cognitive performance.

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