Do youth soccer players with different tactical behaviour also perform differently in decision-making and visual search strategies?

João Vítor de Assis, Sixto González-Víllora, Filipe Manuel Clemente, Felippe Cardoso & Israel Teoldo

To cite this article: João Vítor de Assis, Sixto González-Víllora, Filipe Manuel Clemente, Felippe Cardoso & Israel Teoldo (2020): Do youth soccer players with different tactical behaviour also perform differently in decision-making and visual search strategies?, International Journal of Performance Analysis in Sport, DOI: 10.1080/24748668.2020.1838784

To link to this article: https://doi.org/10.1080/24748668.2020.1838784

Published online: 27 Oct 2020.
Do youth soccer players with different tactical behaviour also perform differently in decision-making and visual search strategies?

João Vitor de Assis, Sixto González-Villora, Filipe Manuel Clemente, Felippe Cardoso and Israel Teoldo

ABSTRACT
The study aimed to compare the decision-making and visual search strategies of young soccer players between two groups based on the results on-field specific tactical test. Ninety youth male soccer players (14.0 ± 1.06 years) affiliated to regional Brazilian clubs participated in this study (U-15 years). The tactical behaviour was assessed using the FUT-SAT assessment tool and players were grouped into two groups of tactical skill level: more skilled and less skilled. Video-based tests were used to assess decision-making, while visual search strategies were performed using the Mobile Eye-XG®. The results indicated that the more skilled showed better decision-making scores compared to the less skilled (p= 0.035, d= 0.57). The more skilled also performed a higher mean number of fixations per trial (p= 0.002; d= 0.99); and had a lower mean duration of fixation (p= 0.020; d= 0.73). No differences were found between groups in terms the percentage viewing time per locations. The results suggest that young soccer players who are more tactically skilled were also those with better decision-making and performed visual search strategies with more visual fixations of shorter duration in comparison to less skilled.

1. Introduction

Decision-making in sports refers to the ability to perceive relevant information about the environment, to interpret this information correctly, and to select an appropriate motor response (Baker et al., 2003). In invasion team sports such as soccer, decision-making is constrained by time and space in an unpredictable and complex environment, which demands players to respond with quick and efficient motor actions (Roca et al., 2013; Williams et al., 2004).

Hence, over the years, sports scientists have devoted their efforts to investigate the mechanisms underlying decision-making in soccer players (Roca et al., 2011, 2020;
Vaeyens et al., 2007a). These investigations have shown that decision-making is supported by acquired knowledge and the ability to retrieve information stored in long-term memory (Ericsson & Kintsch, 1995), as well as by dynamic interaction between different perceptual-cognitive skills (Roca & Williams, 2016; Williams & Ward, 2007). For example, expert soccer players demonstrate faster sensory and cognitive processing compared to novice and non-athletes (Mann et al., 2007). Expert soccer players are also better at recognising and recalling game patterns (Williams et al., 2012); at classifying situational probabilities (Ward & Williams, 2003); and at employing more efficient visual search strategies (Roca et al., 2011).

Although these studies have presented significant progress in the interaction between different perceptual-cognitive skills (Roca & Williams, 2016; Ward & Williams, 2003), some important investigations in soccer have sought to describe visual search strategies underlying decision-making (Roca et al., 2013, 2011; Vaeyens et al., 2007b; Williams & Davids, 1998). Maarseveen et al. (2018) reported that one of the possible ways to describe decision-making in complex situations and time pressure is by investigating their visual search strategies. Visual search strategies refer to the way players make use of their visual perception to search for relevant information in the environment with the aim to decide what action to perform (Williams & Davids, 1998). Additionally, visual search strategies are indicative of improved selective attention process for specific structures and tasks (Henderson, 2003). For instance, expert soccer players can use visual search strategies to identify patterns and information during the game (Williams & Ericsson, 2007; Williams et al., 2004). This specific information in soccer includes the movements of the ball and players, and the free space (McGuckian et al., 2018; Roca et al., 2018).

However, studies in the literature have demonstrated that visual search strategies may differ according to task demands and requirements (Klostermann et al., 2020; Williams et al., 2004). In a study conducted by Roca et al. (2011), it was found that expert soccer players employed a greater number visual fixations of shorter duration in open situations (11vs.11) and first-person view of a central defender. The expert players had a more significant visual gaze on attackers, defenders and free spaces compared to the novice players. These visual search strategies helped expert soccer players to perceive essential information of the game to make better decisions (Roca et al., 2011; Williams & Davids, 1998).

In another study, Vaeyens et al. (2007a) investigated the visual search strategies and decision-making in soccer players through categorised groups based on the performance of the decision-making test. The researchers identified that more skilled soccer players on the decision-making test in offensive scenes performed different visual search strategies in all game configurations (e.g., 2 vs 1, 3 vs 1, 3 vs 2, 4 vs 3 and 5 vs 3). The more skilled players showed a higher number of fixations with shorter duration in open situations compared to the less skilled players. However, both groups performed visual search strategies with a greater number of fixations of shorter duration in situations with numerous players (e.g. 4 vs 3 and 5 vs 3); while in situations of reduced number of players (e.g., 2 vs 1 and 3 vs 1), both groups used less fixations but of longer duration time.

Eventually, studies with experts and novices have significantly contributed to differentiating visual search strategies involved in the decision-making process between soccer players of different levels of expertise (Roca et al., 2013, 2011); age levels (Machado et al.,
Nevertheless, the state of knowledge on the behaviour in decision-making and visual search strategies in soccer players who are playing at the same competitive level remains somewhat limited. The only few studies that categorised different groups of players who play at same competitive level used criteria to reduce variability in that same playing level (Roca et al., 2018; Vaeyens et al., 2007a). However, these studies categorised participants based on cognitive test performance rather than on-field tactical performance tests.

Thus, there is still a gap in the literature in the application of a group categorisation criterion which has a bias associated to the specific tactical behaviour of the soccer game (Williams & Ericsson, 2005). Categorising by tactical behaviour becomes relevant because it represents the result of the complex interaction of underlying cognitive processes which subsidise the players’ decision-making in the game (Teoldo et al., 2017). Among these underlying processes, visual search strategies have great relevance as the perceived information can support the decision-making process in the field and, consequently, can reflect on the execution of tactical actions (Williams & Ericsson, 2007). Furthermore, investigations about the tactical behaviour have shown its importance as an essential feature in performing players and teams (Clemente et al., 2019; González-Villora et al., 2013; Silva et al., 2019) by the larger interaction between tactical and cognitive aspects (McPherson, 1994; Padilha et al., 2017; Williams & Ericsson, 2005).

Therefore, our study differs from previous ones precisely by dividing the groups of players based on their tactical behaviour. Thus, the study aimed to compare the decision-making and visual search strategies of young soccer players between two groups based on the results on-field specific tactical test.

2. Method

2.1. Participants

A total of 90 U-15 male soccer players (14.00 ± 1.06 years old) affiliated to three regional Brazilian clubs participated in the study. The test was applied separately and at different times in each club. All players had experience in soccer for an average of 5.12 ± 2.70 years, participated in regional competitions, and trained for a minimum of three weekly-organised sessions of 90 minutes. The legal guardians attested that the soccer players had no vision problems. Legal guardians also signed the informed consent, authorising the young soccer players to participate in the study. The study was approved by the Ethics Committee in research with human beings with the code No. 43.585.115.1.0000.5153. All procedures were conducted according to the norms established by the Resolution of the National Health Council (466/2012) and by the Helsinki Ethics Treaty (1996) for human research.

2.2. Experimental approach to the problem

The tactical behaviour scores obtained on the FUT-SAT (Teoldo et al., 2011) were used to create two groups from a larger sample of soccer players: one group more tactically skilled players and another group less tactically skilled. We subsequently compared the performance between the groups in the specific video-based test for decision-making in
soccer. The eye movement investigation was used to verify the mediating visual search strategies underlying decision-making between the more skilled and the less skilled groups.

Our hypothesis was that more tactically skilled soccer players would present better results in decision-making scores and specific visual search strategies, providing support for understanding decision-making in young soccer players of the same competitive level (Cardoso et al., 2019; Gonzaga et al., 2014). More specifically, it was expected that the more skilled players would employ higher mean number of fixation and shorter mean fixation time compared to the less skilled soccer players. We also predicted that more skilled players would employ visual search strategies in locations that differ to the ones where less skilled soccer player would employ them (Roca et al., 2011; Vaeyens et al., 2007a).

2.3. Instruments and procedure

2.3.1. Tactical behaviour

The System of Tactical Assessment in Soccer (FUT-SAT) (Teoldo et al., 2011) was used to assess players’ tactical behaviour based on the analysis of their tactical actions, both with and without the ball. The instrument was previously validated and tested for its reliability (Teoldo et al., 2011). FUT-SAT assesses tactical principles of soccer, taking into account five principles of the defensive phase (Delay, Defensive Coverage, Balance, Concentration and Defensive Unity), and five principles of the offensive phase (Penetration, Offensive Coverage, Width and Length, Depth Mobility and Offensive Unity) of the game (for a review, see Teoldo et al., 2017). For the field test, participants were grouped into teams of three soccer players and one goalkeeper (GK+3 vs. 3+ GK). The goalkeepers were not evaluated based on tactical principles as their actions differ from those of other players. The soccer players were selected to compose the teams according to respect to their positional roles (defenders, midfielders and forwards).

The field test was performed in an area of 27 m x 36 m for four minutes and played according to the official rules of soccer. The testing was filmed from the same diagonal perspective according to the test protocol (Figure 1) (Teoldo et al., 2011). Thirty seconds of play were given to help them become familiar with the test prior to the 4 minutes of assessment. The filming was carried out with a SONY HDR-XR100* digital camera. The video material was inserted into a laptop computer (DELL Inspiron® N4030 Intel Core™ i3 processor) and converted into “avi.” files by Prism Video Converter Inc. software. The Soccer Analyser® software program was used for video processing and data analysis. The efficiency of tactical behaviour performed by the soccer players was used to measure the tactical behaviour (for a review, see Teoldo et al., 2011).

The soccer players reported their experience in soccer through a sample characterisation questionnaire.

2.3.2. Decision-making and visual search strategies

Decision-Making: The same participants performed the decision-making test the day after FUT-SAT test. The video-based decision-making test used was proposed according to the study by Larkin et al. (for a review, see Larkin et al., 2015). It was composed of 20 video scenes of soccer matches, with offensive plays (11 vs. 11) of 5 to 10 seconds of
duration each in the third-person perspective with an in-depth viewing angle. The test was performed with two participants at a time in a controlled lab, sitting side-by-side at a distance of 2.00 m. Contact between them was not allowed. The video scenes were presented to the participants by an HD projector (Toshiba® TDP-s20) with XGA resolution of 2.50 m X 2.00 m. The participants were positioned three metres away from the screen in front view. The players were presented three extra trials prior to starting the test for familiarisation purposes. Each familiarisation trial had 5 to 10 seconds of duration each. Participants could ask questions during the familiarisation and the trials could be repeated for better understanding.

Each scene was occluded 120 milliseconds before the player in the possession of the ball would perform an action. The task for the participants was to respond what they would do if they were the player in possession of the ball, and to determine the technical action and direction of this action. The options were: a) pass; b) run with the ball; or c) shoot at the goal. The image of the last video frame was provided to participants through an Apple iPad®, version 8.2 (12D508). The image on the Apple iPad® was presented through the Xodo® app, so that they were able to indicate the player’s technical action on the image by writing the corresponding initial letter (P, pass; R, run with the ball or S, shoot at the goal), and demonstrating the action direction by drawing an arrow. The participants had a five-second interval to provide each answer. Both the initial letter (P, R or S) and the arrow were checked and assessed according the guideline proposed by the study by Larkin et al. (2015).

These guidelines of correct answers was determined by a panel of experts elite level youth coaches (n = 5). The correct answers had 100% agreement by the coaches (for
a review, see Larkin et al., 2015). After their response, the participant should confirm and move on to the next image. They should answer only when they watched the end of the scene.

**Visual Search Strategies:** All participants wore the Mobile Eye Tracking-XG* (Applied Science Laboratories – Bedford, MA, USA) for data collection regarding visual search strategies during the video-based decision-making test. The initial moment of analysis was considered when the scene started to move, and the final moment when the scene was frozen. The Mobile Eye Tracking-XG* assesses subjects’ visual search strategies through tracking their central vision through a system of cameras mounted on a pair of glasses. This equipment performs periodic measurements (every 40 ms) providing the location to where the individual is looking (Duchowski, 2007). The participants used the Mobile Eye Tracking-XG* during the familiarisation trials. Mobile Eye Tracking-XG* calibration of 9 points was performed before and after the three familiarisation trials. The calibration consisted of looking at the specific points requested by the researcher to calibrate the equipment. The test was performed in a closed environment with controlled luminosity varying between 150 and 500 lux. The entire test lasted approximately 25 minutes for every two participants.

The subsequent measures for the analysis of visual search strategies were: i) Visual search rate; and ii) Percentage viewing time.

**Visual Search Rate:** Measures related to the central view of the visual search rate in this experiment were carried out following the procedures of previous studies (Roca et al., 2011; Vaeyens et al., 2007a). The data analysis included: i) Mean number of fixations per trial; and ii) Mean fixation time (in milliseconds). Visual fixation was defined as the condition in which the eye remained stationary at approximately 1.5 degrees for a period equal to or greater than 120 ms (Roca et al., 2020).

**Percentage viewing time:** The percentage fixation location time employed by the individual on predefined locations during the scenes was measured by six specific predefined locations according to previous studies (Machado et al., 2017; Roca et al., 2011): i) player in possession of the ball (PiP); ii) ball (ball flight); iii) attackers (teammates); iv) defenders (opponents); v) space (i.e. areas of free space); and we added vi) other location (“unclassified locations”).

### 2.4. Statistical procedures

#### 2.4.1. Tactical behaviour

The tactical behaviour test values were demonstrated in percentages ranging from 0% to 100% scores for tactical behaviour. These were used (total, z-value) to rank and differentiate the 90 participants into quartiles according to the mean values obtained on the FUT-SAT test. We classified three groups: low, intermediate and high, according to previous studies (Roca et al., 2020; Vaeyens et al., 2007a). The low group (n = 22) included the players who scored ≤25%, while the high group (n = 22) included those who scored ≥75% tactical behaviour scores (Gonzaga et al., 2014; Roca et al., 2018). In order to compare the really distinct groups, the intermediate group (n = 46) who scored >25% and <75% was excluded from the sample, according to previous studies (Roca et al., 2018, 2020). For classification purposes, the low group will be called “less skilled” and the high group will be called “more skilled”.
Table 1. Descriptive and inferential values of tactical behaviour.

<table>
<thead>
<tr>
<th></th>
<th>Less skilled (n = 22)</th>
<th>More skilled (n = 22)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tactical Behaviour (%)</strong></td>
<td>71.91 ± 3.20 (70.49–73.33)</td>
<td>91.08 ± 2.06 (90.16–91.99)</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

* Significance level p< 0.05; SD = standard deviation; CI = Confidence Interval (95 %)

Data distribution was analysed by the Kolmogorov–Smirnov test, which indicated a non-normal distribution. The comparison between the less skilled and more skilled groups was verified by the Mann–Whitney test for independent samples. There was a significant difference between groups ($z = -5.681; p < 0.001; d = 7.12$). Table 1 shows the means, standard deviation and confidence interval of the tactical behaviour. The effect size was evaluated by Cohen’s d, and the reference values were: ($\leq 0.19$) insignificant values; between (0.20 and 0.49) low; between (0.50 and 0.79) average; between (0.80 and 1.29) high; ($\geq 1.30$) very high (Cohen, 1988).

Analysis of data reliability was performed by five evaluators (Robinson & O’Donoghue, 2007). The Cohen’s Kappa test was performed and 13% of the tactical actions of the study sample were reassessed, constituting a higher value (10%) than indicated by literature (Tabachnick & Fidell, 2007). The reliability values ranged between 0.818 ± 0.054 and 1.000 ± 0.000, for intra-rater reliability, and 0.828 ± 0.065 and 1.000 ± 0.000, for inter-rater reliability.

2.4.2. Decision-making and visual search strategies

**Decision-Making**: The following measure was applied for decision-making: decision-making score, calculated by the sum of responses (actions and directions correct). The scoring in each scene was as follows: 2 points, with 1 point for the correct action and 1 point for the correct direction (for review, see Larkin et al., 2015). The decision-making score values were converted to a percentage ranging from 0% to 100%. The Mann–Whitney test was performed to compare the two groups.

**Visual Search Strategies**: Data distribution was analysed through the Kolmogorov–Smirnov test, which showed a normal distribution.

**Visual Search Rate**: We used the t-test for independent samples to compare the less and more skilled groups.

**Percentage viewing time**: A factorial two-way ANOVA with Group (more skilled and less skilled) was employed as the between-participant factor and Fixation Location, as within-participant factors was conducted to analyse the percentage viewing time. Thus, the effect size was obtained through the partial eta squared ($\eta^2$), $< 0.05$, for low values; between 0.06 and 0.13, intermediate values; and $> 0.14$, high values (Cohen, 1988). The Greenhouse–Geisser correction was employed in the case of violations of Mauchly’s sphericity test. Bonferroni post hocs were performed to verify significant differences.

A reliability analysis was performed by five evaluators (Robinson & O’Donoghue, 2007). The Cohen’s Kappa test was used and 11% of the fixations of the study sample were reassessed, which resulted in a higher value (10%) than indicated by literature (Tabachnick & Fidell, 2007). Reliability values regarding the evaluations were 92.1% for the intra and 89.5% for the inter-evaluator.
Table 2. Descriptive and inferential values of decision-making and visual search rate.

<table>
<thead>
<tr>
<th></th>
<th>Less skilled (n = 22)</th>
<th>More skilled (n = 22)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision-making</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Decision-making score</td>
<td>74.66 ± 7.29</td>
<td>79.32 ± 8.94</td>
<td>0.035*</td>
</tr>
<tr>
<td>Visual Search Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean number of fixation (per trial)</td>
<td>7.31 ± 2.09</td>
<td>9.53 ± 2.36</td>
<td>0.002*</td>
</tr>
<tr>
<td>Mean fixation time (milliseconds)</td>
<td>1000.71 ± 364.2</td>
<td>757.63 ± 297.39</td>
<td>0.020*</td>
</tr>
</tbody>
</table>

* Significance level p < 0.05; SD = standard deviation; CI = Confidence Interval (95%)

3. Results

3.1. Decision-making and visual search strategies

Means, standard deviation and confidence interval for decision-making and visual search strategies according to tactical behaviour are displayed in Table 2.

Decision-Making: The results indicate significant differences between the groups for the decision-making score (z = -2.103; p = 0.035; d = 0.57). The more skilled group showed better results (79.32% ± 8.94%) in the decision-making scores compared to the less skilled group (74.66% ± 7.29%).

Visual Search Strategies: The results of the visual search rate indicate significant differences in the following measures:

Visual Search Rate: The more skilled group performed a higher mean number of fixations per trial in comparison to the less skilled group (t_{(42)} = 3.306; p = 0.002; d = 0.99). The more skilled group presented lower mean fixation time than the less skilled group (t_{(42)} = -2.425; p = 0.020; d = 0.73).

Percentage viewing time: Data regarding the percentage viewing time on the locations are presented in Figure 2. Percentage viewing time data showed a significant main effect for fixation location (F (5,210) = 116.44, p < 0.001, $\eta_p^2 = 0.73$). Pairwise comparisons of all participants demonstrated more time was spent fixating on the player in possession of the ball (48.24% ± 15.37) in comparison with any other location (p < 0.001), followed by attackers (20.33% ± 7.85) when compared to other locations (p < 0.001). Participants also spent more time fixating on defenders (10.73% ± 6.10) when compared to other unclassified locations (3.37% ± 4.47) (p = 0.003). There were no significant differences between fixations on space (8.84% ± 10.99) and ball (8.49% ± 4.1) when compared to defenders and other unclassified locations (p > 0.05). ANOVA showed no significant Group × Fixation Location interaction (F (5, 210) = 0.556, p = 0.73, $\eta_p^2 = 0.01$).

4. Discussion

The current study aimed to compare the decision-making and visual search strategies of young soccer players categorised between two groups based on the results on-field specific tactical test. In contrast with previous studies on the same topic (Roca et al., 2011; Vaeyens et al., 2007a), we used a division criterion based on the efficiency of the tactical behaviour performed in the FUT-SAT field test. Based on the results, it was possible to confirm the hypothesis that the more tactically skilled soccer players performed higher scores in decision-making and different visual search rates when
compared to less skilled players. Thus, our findings contribute to the literature by identifying that young soccer players of the same competitive level presented differences in their decision-making ability.

In addition, the more skilled soccer players presented visual search strategies with more visual fixations of shorter duration than the less skilled players. These results are similar to previous studies involving players of different levels of competition (Roca et al., 2011; Vaeyens et al., 2007b) and creativity in their decisions (Roca et al., 2018, 2020). Therefore, in our study, the more skilled soccer players seemed more efficient in extracting visual information, despite all participants played in a same competitive level (Roca et al., 2018).

In contrast, no differences were found between the more and less skilled groups in relation to the percentage viewing time per location. The players of both groups presented very similar visual behaviour results. According to previous studies (Vaeyens et al., 2007a; Williams & Davids, 1998), players tend to allocate more time to viewing information on players in possession of the ball and shift their viewing to more relevant locations such as attackers and defending players because those are locations which can provide essential information for better reading of the situation. It is important to highlight that visual behaviour tends to adjust according to the specific demands and constraints of each task (Klostermann et al., 2020; Williams et al., 2004).

Since no difference was found between the more and less skilled groups in relation to the percentage of viewing time for locations, we can suggest that the more skilled players were able to extract and process visual information faster and more precisely. The more skilled players viewed the same locations but employed shorter duration visual fixations than less skilled players. Consequently, the more skilled players possibly seemed better at extracting and processing information during the task. Therefore, the way visual information that is processed can be as important as the way it is viewed (Roca et al., 2011; Vaeyens et al., 2007a). Another likely explanation was that more skilled players could

![Figure 2](image-url). Mean (SD) percentage viewing time each fixation location across groups.
make better use of peripheral vision to search other information while focusing their visual gaze on a particular location (Vaeyens et al., 2007b; Williams & Davids, 1998).

According to our study, the more skilled soccer players presented visual strategies that are similar to the ones described in expert players (Roca et al., 2011). The expert soccer players have the ability to quickly integrate contextual visual information and access similar situations in their long-term memory (Ericsson & Kintsch, 1995; Williams & Ward, 2007). Likewise, the more skilled soccer players also seemed accessing information and retrieving possible situations that they already have experienced before (Cardoso et al., 2019; Roca et al., 2018). Therefore, they could perform better decision-making skills as much as a larger repertoire of tactical actions (González-Villora et al., 2015; Roca et al., 2013).

In general, knowledge gathered from this study aims to help coaches to identify that differences in tactical behaviour in players of the same competitive level is tied to the way players process visual information during the decision-making. Thus, we suggest that results of tactical behaviour collected with tactical tests such as the FUT-SAT can also serve as a parameter for understanding the development of the perceptual-cognitive skills of soccer players. Thereby, the field tactic test becomes more accessible and requires less physical and financial resources for its application, which would be more cost-effective for academies and clubs.

Furthermore, the data in this study suggest transfer for practical implication for professionals involved in sports development programmes, in the organising their training sessions. After identifying the needs of the more skilled and less skilled groups, specific activities could be designed with the aim to stimulate decision-making and visual search strategies in real game situations (Vaeyens et al., 2007b). Such support could provide a foundation for coaches to improve the needs of their groups of players by modulating adequate usage of pedagogical principles to stimulate visual search strategies and decision-making during training (Roca & Ford, 2020). Thus, soccer players would be stimulated to adjust their visual search strategies, in order to optimise cognitive processing to respond to different task and contexts in the game environment, which all could be essential in their tactical decision-making (Roca et al., 2013).

Until then, this is the first study to investigate differences in visual search strategies and decision-making in soccer players at the same competitive level by applying objective group separation based on tactical behaviour. Although, one of its limitations was the use of cognitive tests with only offensive situations. Decision-making involves not only offensive situations but also defensive situations. Therefore, we recommend in future studies to create a cognitive test that assesses decision-making based on the behaviour of players in contexts and for tasks involving decisions that are both offensive and defensive.

Moreover, another limitation was the use of video-based tests with low ecological validity. The video-based tests do not simulate a real game environment with regard to cognitive requirements, even commonly used in the literature (O’Connor et al., 2016; Roca et al., 2011; Vaeyens et al., 2007a). In our study, the configuration of the video-based test has only evaluated the eye movements of the central vision of the players and thus did not assess peripheral vision and movements of the head, which can be determinant in the visual search and perception of information in real game situations (McGuckian et al., 2018). In addition, the results of the study may also have been limited because the requirement of the task in the video test did not require a physical response to decision-
making. Visual search strategies may differ when participants are required to physically move rather than standing still (Dicks et al., 2010).

Thus, we encourage that future studies about visual search strategies and tactical behaviour were replicated in tests with more representative configurations of the game context. For example, such tests could be conducted requiring simulated movements (Natsuhara et al., 2020; Roca et al., 2020) or the use of virtual reality resources with similar and perceptibly more representative environments (McGuckian et al., 2018; Tirp et al., 2015).

In conclusion, the results of the present study suggest that young soccer players who are more tactically skilled were also those with better decision-making and performed visual search strategies with more visual fixations of shorter duration in comparison to less skilled. Therefore, in order to optimise the training process of young soccer players, coaches should make use of tactical assessments to verify the specific needs cognitive development of their group. When identifying these needs, coaches must create training situations that involve the constant use of visual stimuli so that players can improve reading specific game situations and consequently make the best tactical decisions.

**Disclosure statement**

No potential conflicts of interest are reported by the authors.

**Funding**

This work was supported by SEESP-MG, FAPEMIG, CNPq, Funarbe, the Dean’s Office for Graduate and Research Studies and the Centre of Life and Health Sciences from Universidade Federal de Viçosa, Brazil. This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) - Finance Code 001.

**ORCID**

João Vítor de Assis [http://orcid.org/0000-0001-8596-4789](http://orcid.org/0000-0001-8596-4789)
Sixto González-Villora [http://orcid.org/0000-0003-2473-5223](http://orcid.org/0000-0003-2473-5223)
Filipe Manuel Clemente [http://orcid.org/0000-0001-9813-2842](http://orcid.org/0000-0001-9813-2842)
Felippe Cardoso [http://orcid.org/0000-0002-2861-6777](http://orcid.org/0000-0002-2861-6777)
Israel Teoldo [http://orcid.org/0000-0001-9780-3456](http://orcid.org/0000-0001-9780-3456)

**References**


