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Research Article

Adaptive perceptual-motor behavior and performance in football (soccer): The role of peripheral vision

MATS N. VAN DER WEEL[1]

[1] Sao Paulo State University (UNESP), Post-graduate Program in Movement Sciences, Department of Physical Education, School of Sciences, Bauru, SP, Brazil

Correspondence to: Mats Nikko van der Weel.
Laboratório de Informação, Visão e Ação (LIVIA). Av. Eng. Luiz Edmundo Carrijo Coube, 14-01 - Vargem Limpa Bauru/SP - CEP 17033-360.
ORCID: 0009-0000-1123-5014
email: Mats.weel@unesp.br
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HIGHLIGHTS
- Restricted PV disrupts perceptual-motor behavior and performance in football.
- Head turn frequency, response time, and decision-making worsened with PV restriction.
- Protective headgear might interfere with natural scanning and on-field performance.

ABBREVIATIONS

HTE	Head Turn Excursion
HTF	Head Turn Frequency
IMU	Inertial Measurement Units
PV	Peripheral vision
RP	Retinitis pigmentosa
RT	Response Time
SD	Standard deviation

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BACKGROUND: The restriction of peripheral vision (PV), such as when athletes wear protective gear that limits their field of view, can significantly impair performance in fast-paced sports like football. This study investigated how restricting PV affects exploratory behaviors, specifically head movements, and subsequent performance outcomes in football.
AIM: By examining these factors, we aimed to understand how PV mediates the connection between perception and action in dynamic sports environments.
METHODS: Ten intermediate level male football players participated in a simulated receiving-passing task. They were required to quickly determine the direction of a pass to one of four surrounding targets immediately after gaining simulated possession of the ball. The frequency and excursion of head movement were recorded before and during ball possession, as well as the pass response time and the correct identification of a team player. Specialized tunnel vision goggles restricting PV were used to investigate differences between normal and restricted vision.
RESULTS: Paired t-tests revealed that participants made significantly fewer head turns, responded significantly slower, and performed significantly worse when wearing goggles, indicating that restricting PV altered exploratory behavior and negatively impacted performance.
INTERPRETATION: These findings highlight the role of PV in facilitating efficient environmental scanning and effective decision-making in dynamic sports contexts, underscoring its contribution to enhancing athletes' perceptual-motor performance in football. We conclude that the use of equipment that restricts PV, such as certain protective gear or face masks, may adversely affect athletes' situational awareness and overall performance on the field.

KEYWORDS: Peripheral Vision | Football | Soccer | Affordance perception | Sport | Motor Performance

INTRODUCTION

During the UEFA EURO 2024, French football (soccer) forward Kylian Mbappé—winner of the 2018 FIFA World Cup and top goal scorer in multiple domestic and international competitions [1] —sustained a nasal fracture in a match against Austria, which forced him to wear a protective face mask for the remainder of the tournament. Following his injury, both Mbappé and France's head coach Didier Deschamps publicly commented on how the protective face mask significantly affected his performance [2]. Mbappé described playing with the mask as "horrible", highlighting the restricted field of vision and discomfort it caused. Deschamps remarked, "It's tenths of a second, but it's important," underscoring how even minimal perceptual delays can have meaningful impacts at the highest levels of play. This example illustrates how lived experience on the pitch can echo core principles in perceptual science, offering a natural entry point for bridging theoretical understanding with the realities of elite athletic performance. It draws attention to a broader principle in dynamic sports like football: a wide and continuous perception of the environment plays an essential role for players to rapidly pick up spatial information, monitor the positions and movements of multiple teammates and opponents, and make fast, effective decisions under pressure [3–9]. Yet, despite its apparent importance for real-time decision-making and spatial awareness, the role of **peripheral vision (PV)** remains surprisingly under-researched in football [10,11]. Building on this context, the present study set out to examine how the presence or absence of PV influences exploratory behaviors, such as head movements, and their subsequent impact on performance. By investigating these factors, we aimed to shed light on how PV mediates the coupling of perception and action in dynamic, fast-paced sporting situations—where the ability to rapidly gather and act on spatial information is thought to be critical.

In such dynamic environments, expert performance is thought to rely on the precise integration of perception, action, and decision-making [12–15]. From an ecological psychology perspective, such performance is characterized by individuals engaging directly and instantaneously with their environment, constantly perceiving and acting upon affordances—opportunities for action—present in their surroundings [16–20]. This dynamic is particularly evident in football where athletes must navigate a landscape filled with affordances that emerge and vanish rapidly, requiring continuous adaptation and situational awareness [8,21,22]. Through goal-directed movements of the head, eyes, and body—termed "exploration"—athletes frequently move their heads to attune to information sources and perform successfully [6,23,24]. These information sources define the relevant properties of affordances via various sensory modalities [25]. Within this sensory spectrum, DeCouto and colleagues3 highlighted PV as an important component for making informed decisions in dynamic environments.

Peripheral Vision

PV refers to the ability to detect and respond to visual stimuli located outside the small central area of the visual field (i.e., the fovea) and is especially sensitive to motion and acceleration—qualities critical for quickly identifying and responding to changes in a fast-paced game [4,26,27]. As demonstrated by DeCouto's team [3], PV enables athletes to attune to multiple affordances simultaneously by discovering information across different viewing eccentricities, thereby facilitating a wider, more integrated perception of the environment. While research on PV in sport remains limited, its contributions could be significant, particularly in high-speed sports like football, where rapid and accurate environmental attunement could decisively impact gameplay outcomes [11]. To fully understand the extent to which PV plays a role in sports situations, we first need to understand how it functions. For example, in instances where PV is limited or absent, such as in tunnel vision conditions like retinitis pigmentosa, studies have highlighted compensatory strategies or altered behavior. For example, it has been reported that the eye movements of individuals with limited PV demonstrated a more active visual search pattern during level walking and obstacle crossing, looking at more areas on the ground compared to those with normal vision [28]. This suggests that PV could play an important role in perceiving affordances and maintaining spatial awareness without needing extensive direct observation or eye fixations. Corroborating to this point, in an 11 vs. 11 real-game football environment using mobile eye-tracking technology, it was reported that only 2.3% of the players' scans included fixations [7]. This implies that players, when performing scans during match-play, do not need to foveally fixate on surrounding information to obtain sufficient information for performing their football actions. Football players might leverage PV to detect key affordances on the field, such as spotting a teammate making a run or tracking the ball's position while maintaining broader situational awareness with their head up [11].

Exploratory Behavior

Jordet and colleagues [24] investigated how "scanning" through exploratory head movements impacts performance in elite football. Analyzing 21 matches and 9,574 ball possessions, they found that increased scanning frequency was positively correlated with completing successful passes. Similarly, McGuckian et al. [6] studied head rotations within 10 seconds of receiving the ball among 32 semi-elite players in 11 vs. 11 matches, using wearable tech and notational analysis. Their findings showed that more frequent and extensive head movements led to successful actions like effective turns and strategic passes. More recent studies reinforced this link [23,29], showing that in youth players, greater scanning frequency enhances pass success. When 1,686 attacking plays from the U17 and U19 Championship semi-finals and finals were analyzed, U19 players had higher scanning rates than U17 players [23]. Additionally, a positive relationship between scan frequency and pass success was found, indicating that more frequent scanning correlates with better passing outcomes. Similarly, when examining 239 players in 17 matches, it was confirmed that frequent scanning supports successful passing [29].

The above evidence collectively points to a significant relationship: players who engage more frequently in exploratory head movements tend to perform better in executing successful actions with the ball, reinforcing the role of head movements in enhancing on-field performance. This study will investigate the extent to which PV plays a role in shaping these exploratory behaviors.

The current study

Exploratory behaviors such as head movements are thought to play a significant role in how athletes perceive, act upon affordances, and perform. However, the potential influence of PV on the perception-action coupling in sport is not well understood. By replicating a dynamic, three-dimensional football setting, we examined how the presence or absence of PV influences both head-movement patterns and performance outcomes — highlighting the role that PV plays in shaping exploratory behavior and success.

METHODS

Ethical Considerations and Approvals

In accordance with established ethical principles for research, the study design underwent a review by the Australian Human Research Ethics Committee and received its approval (2017-154H), and participants were free to withdraw at any stage.

Participants

Ten participants were recruited for the study, all of whom actively engaged in the experiment. Due to technical issues with measurement units, comprehensive data were extracted and analyzed from seven male football players, playing at an intermediate level, all of whom are members of the ACU Sport (Australian level: FQPL 6) football team. The participants (Mean age = 22.57 years, SD = 1.72) all had normal vision and did not require corrective measures such as glasses or contact lenses. All participants had a minimum of 8 years of competitive playing experience and trained approximately three times per week, averaging 90-minute training sessions.

Experimental Setup

The experiment, which closely followed the procedures of McGuckian et al. [21], employed the same experimental setup, including the monitor specifications, setup distances, visual angles (degrees), and overall task procedure. However, it differed in the number and identity of participants and included an additional condition introducing PV restriction. It aimed to yield results applicable to genuine scenarios by employing dynamic stimulus presentation and mimicking authentic response dynamics [30]. The primary task required players to receive a football pass from a player displayed on a computer screen in front of them and then identify one of the four screens behind them that showed a free, unmarked teammate.

The visual stimuli were displayed using a custom-made PsychoPy script [31] executed on a 15-inch Apple laptop. This device interfaced with four 22-inch Dell 2209WA monitors with a screen resolution of 1680 x 1050 pixels, which were arranged in portrait orientation and set atop 75-cm-tall tables, as depicted in Figure 1. Positioned 3 m from the participant, they were oriented at angles of 100 degrees and 150 degrees to the participant's forward-facing position. Directly ahead, the participant faced "screen 0", situated 1 m away on another 75-cm table. Corresponding with each display, four 22-cm sports cones were positioned 1 m from the participant. When observed from this distance, each monitor's vertical size equated to a visual angle resembling that of a player (180 cm tall) standing 11.5 meters away on a football pitch. All the visuals used in the experiment were shot on a real football field using a high-quality camera (Sony RX100 IV, Tokyo, Japan) from a height of 1.75 m. All the clips were trimmed to last 6 seconds.

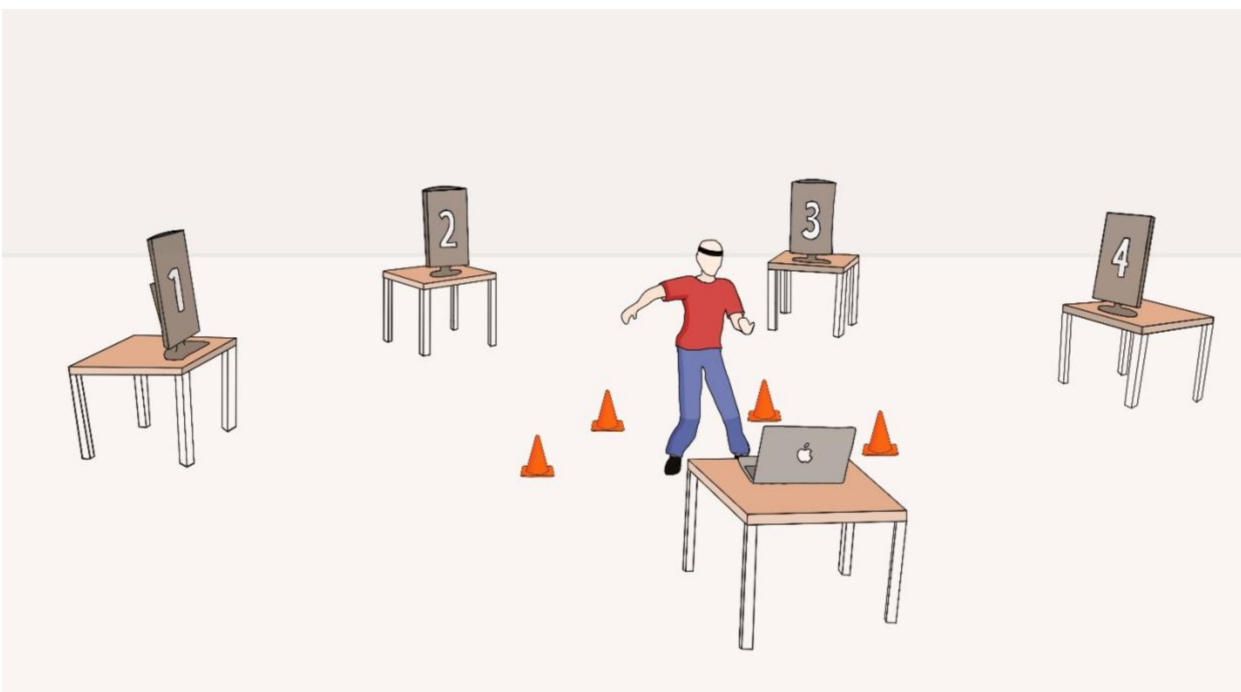

Figure 1. A schematic representing the experimental setup used during data collection. Laptop on table: Screen 0. Screens positioned behind subject: 1-4.

Exploratory behavior was captured through measuring head movement in the yaw axis. The Bluethunder (Vicon), consisting of 9-DOF Inertial Measurement Units (IMU), was housed within an elastic headband over their occipital protuberance (see figure 1). Data were collected at a frequency of 250 Hz and stored directly on the IMU's memory card. Following each session, the recorded data were transferred for in-depth analysis, with the IMU controlled remotely by a master device connected to a smart phone.

A notable addition from the procedures described in McGuckian et al. [21] was the use of PV restricting goggles (see Figure 2). In Condition 1, participants had normal, unobstructed vision, while in Condition 2, participants wore goggles that restricted PV, reducing the visual field to 20 degrees to simulate tunnel vision [32] (see Figure 3 for a football scenario illustration). The goggles used was a commercially available device (Fork in the Road Low Vision Simulators, LLC, USA).

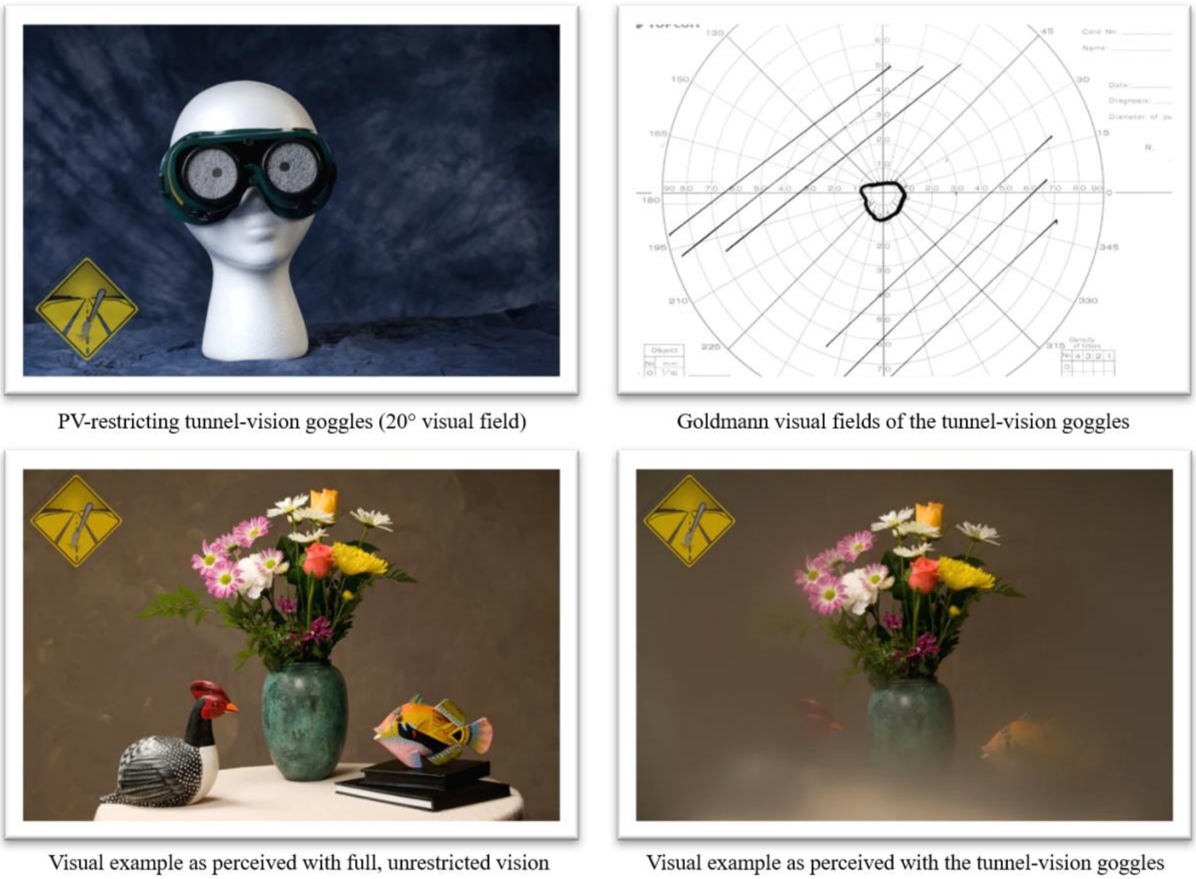

Figure 2. The Glaucoma and retinitis pigmentosa (RP) 20-degree visual field simulator ("tunnel-vision goggles") placed on a mannequin (top left). Goldmann visual fields of the simulator (top right). Side-by-side comparison of a normal visual field (bottom left) with the restricted visual field induced by the tunnel-vision goggles (bottom right). Images reproduced with permission from Fork in the Road Low Vision Simulators, LLC, 2025 [33].

Figure 3. Football scenario illustration emphasizing the extent of visual field loss with the tunnel-vision goggles (illustrative; rather than being blacked out, peripheral areas are blurred, unsharp and imperceptible - just like in the bottom right image in Figure 2).

Procedures

Upon arrival at the testing facility, participants were briefed on the procedure and fitted with an IMU at the external occipital protuberance using an elastic headband. After five practice trials to familiarize themselves with the task, they completed two blocks of 24 trials each, separated by a 5-minute break. The first block involved normal vision, and the second restricted PV. Participants were informed that the experiment simulated a game-like passing scenario, where they would receive a pass from one teammate and pass to an unmarked teammate in red.

Facing Screen 0 (as shown in Figure 1), participants initiated each trial by pressing the spacebar, which triggered a beep signaling them to prepare. After a randomized delay of 1-4 seconds, videos began playing on all five screens as shown in Figure 4. The video of the actor with the ball (Figure 4a) showed a player receiving a pass, taking one touch, and kicking the ball toward the camera. It displayed one of six pass-videos featuring either a left- or right-footed pass with a delay of 1, 2, or 3 seconds, which created varying passing scenarios to more accurately simulate real-world conditions. The interval from the ball strike to frame exit was 410 ms.

The surrounding screens behind the participant presented different video contexts: a marked teammate closely defended by an opponent (Figure 4b), an opponent model in a blue shirt defending on the spot (Figure 4c), an empty football pitch (Figure 4d), and an unmarked teammate in red ready to receive a pass (Figure 4e). To further mimic real-game scenarios, target videos included dynamic elements, such as actors entering or leaving the frame. For instance, a clip might start with an open teammate and, after 2 seconds, introduce an opponent, converting it into a guarded teammate scenario. Videos transitioned between clear space, opponent, unmarked teammate, and guarded teammate, creating an evolving, unpredictable environment to encourage constant exploration. The actors, similar in age to the participants, were experienced football players.

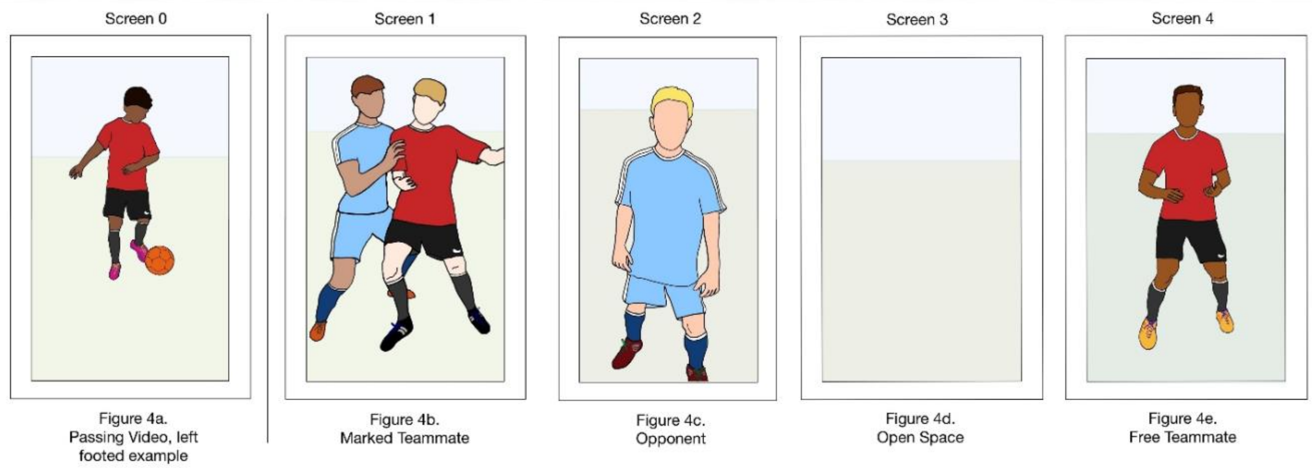

Figure 4. Visual Overview of Interface Screens. (a) Laptop "Screen 0" displays one of six passing videos (either a left-footed or right-footed pass). (b-e) Examples of the following four screens (Screens 1 to 4) that show what participants see behind them. Here, Screen 4 represents the "correct" choice.

Once the videos began, participants could explore freely without specific directives. When the ball on Screen 0 left the frame, participants simulated receiving it and then chose a pass direction to the unmarked player by kicking a cone aligned with the selected screen. They were encouraged to make this pass quickly. Each trial ended when a cone was kicked, after which they pressed the spacebar to prepare for the next trial. The experiment, lasting around 40 minutes, was recorded on a Sony RX100 IV at 50 Hz.

Experimental conditions and measurement variables

The trial recordings were synchronized with each player's IMU data to allow manual coding of actions and the calculation of variables used for statistical analysis.

Normal and Restricted Vision

The experiment was divided into two blocks of trials. In the first block, participants completed the trials with normal vision. In the second block, they wore goggles restricting PV (see Figures 2 and 3). Always starting with normal vision allowed participants to familiarize themselves with the task, thereby ensuring that any changes observed in the second block could more confidently be attributed to the restriction of PV, and not to unfamiliarity with the task itself.

Head Turn Frequency (HTF)

Firstly, a head turn was defined as a distinct movement of the head about the longitudinal axis that resulted in an angular velocity that exceeded 125 degrees/s [34]. This threshold, consistently used in prior research [21], distinguishes significant, game-relevant head movements from minor adjustments, aligning with the rapid and dynamic nature of decision-making in football. The exact moments of each head turn were extracted from the head mounted IMU data and metrics included the number of head turns before and during ball possession. HTF was determined by dividing the number of head turns by the duration of each trial (see Figure 5).

Head Turn Excursion (HTE)

HTE, quantified in degrees, refers to the total radial distance covered by a head turn. In the present study, HTE was determined by dividing the total amount of head turns per trial by the corresponding exploration time of 1, 2, or 3 s. Figure 5 depicts an example of HTE calculation for a trial with an exploration time of 3 s.

Response Time (RT)

RT, measured in seconds, represented the time taken from when the ball disappeared from the passing video to the moment participants completed their "pass" (initial contact with the cone, participant pass). A detailed examination of the video was conducted to pinpoint the exact moment of foot-to-cone contact.

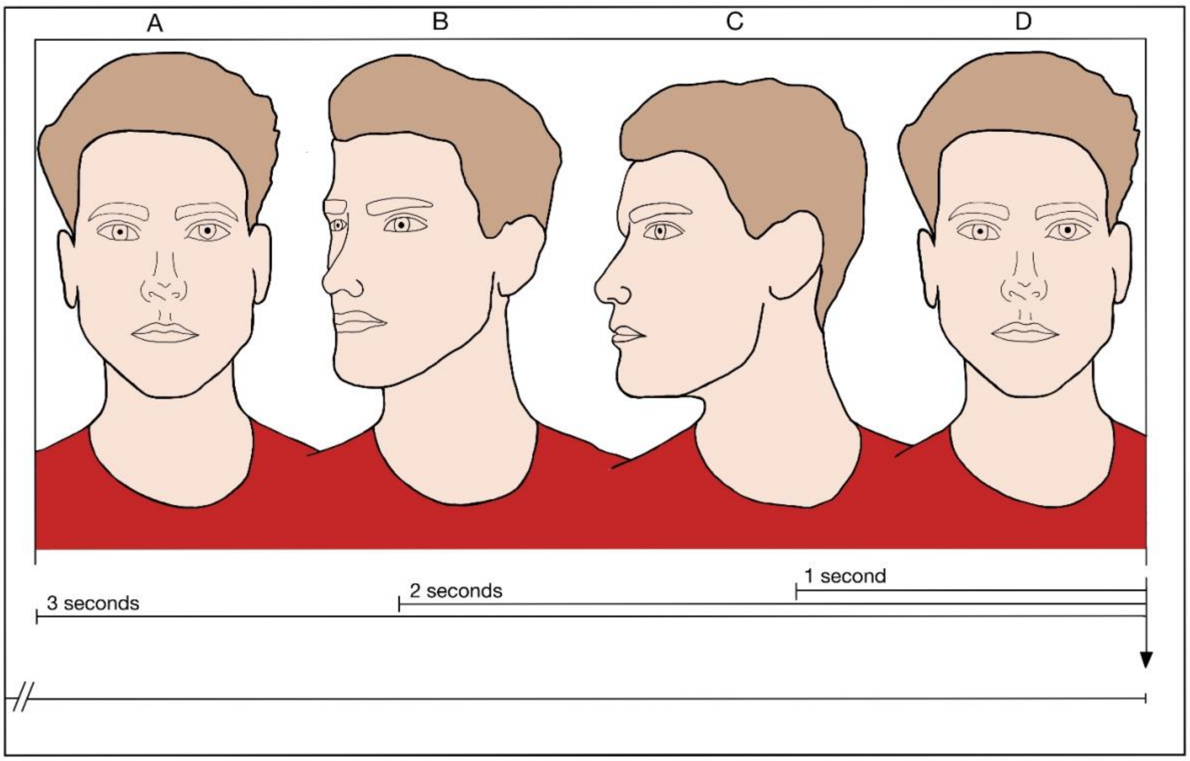

Figure 5. An example of three head turns during a 3 s period before possession: One head-turn from A to B (approx. 45 degrees), one head-turn from B to C (approx. 45 degrees), and one head-turn from C to D (approx. 90 degrees). For this 3 s period, head turn frequency equals 1.0 (3 turns/3 s) and head turn excursion equals 60 degrees/s (180 degrees/3 s).

Correct Screen Chosen

In each trial, participants were instructed to identify the free teammate displayed on one of the screens behind them. They indicated their choice by kicking the cone associated with the corresponding screen in a football-realistic manner. Correct screen chosen served as performance measure, and the total number of correct selections was tallied with a maximum possible score of 24 per experimental condition.

Statistical analysis

A priori power analysis was conducted using G*Power (version 3.1.9.3) for a two-tailed paired-samples t-test, assuming a medium effect size (Cohen's d = 0.5) based on conventional standards [35], an alpha level of 0.05, and a desired power of 0.80. This analysis indicated that a minimum sample size of 34 participants would be required to detect a medium effect. Due to practical constraints, data were collected from seven participants. This sample achieved 80% power to detect very large effects (Cohen's d ≈ 1.27), which are above conventional thresholds; therefore, only effects of this magnitude or larger could be reliably detected. Data were first screened for completeness and accuracy, followed by assessments for outliers and normality. Outliers were evaluated using boxplot inspection, and the Shapiro-Wilk test was used to assess normality. All statistical analyses were performed in SPSS (Version 29.0.0), with the significance level set at $p < 0.05$.

RESULTS

In total, each of the 7 participants contributed with 24 trials without and 24 trials with goggles, resulting in a grand total of 336 trials for analysis. Figure 6 shows average outcomes across the four variables of interest for the seven participants.

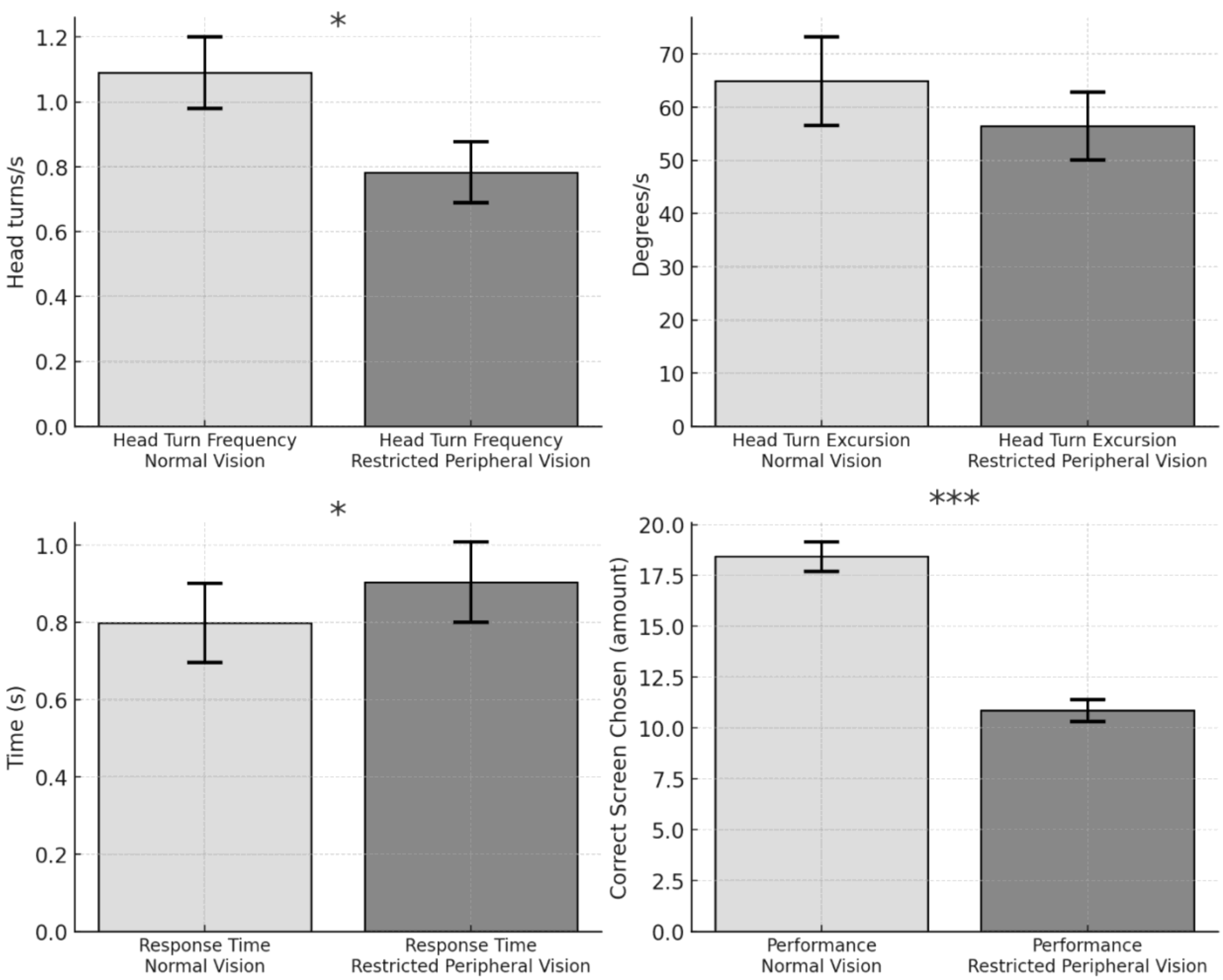

Figure 6. Differences in head turn frequency (HTF, top left), head turn excursion (HTE, top right), response time (RT, bottom left), and correct screen choices (bottom right) between normal vision and restricted peripheral vision. * $p < 0.05$; *** $p < 0.001$.

Head Turn Frequency

The data revealed a significant decrease in head turn frequency (HTF) when comparing normal vision to restricted vision. Specifically, mean HTF decreased from 1.10 head turns/s (SD=0.30) under normal vision to 0.77 head turns/s (SD = 0.25) under restricted vision (see Figure 6, top left). A paired t-test confirmed that this reduction was statistically significant, $t(6)=3.56$, $p=0.012$ (two-sided), indicating that participants turned their heads less frequently when their PV was restricted.

Head Turn Excursion

Head turn excursion (HTE) also decreased from normal to restricted vision, with mean values declining from 65.5 degrees (SD = 21.2) to 54.2 degrees (SD=16.5) (see Figure 6, top right). However, this reduction was not statistically significant, $t(6)=1.50$, $p=0.19$ (two-sided). Individual differences were notable: Participants 1 and 2 exhibited substantial reductions in HTE of 18 and 55 degrees, respectively, while Participant 3 showed a modest reduction of 7 degrees. The remaining participants displayed minimal changes in HTE when wearing goggles, with Participants 4 and 5 showing slight decreases and Participants 6 and 7 showing slight increases by just 2-3 degrees each.

Response time

Response time (RT) increased under restricted vision conditions. The mean RT rose from 0.78 s (SD=0.26) under normal vision to 0.93 s (SD=0.32) when vision was restricted (see Figure 6, bottom left). Given our directional hypothesis, a paired t-test confirmed that RT increased significantly under restricted vision, $t(6)=-2.00$, $p<0.05$ (one-sided).

Correct screen chosen

Finally, correct screen chosen, defined as the number of successful trials out of a possible 24, decreased when vision was restricted. The mean dropped from 18.4 correct screen chosen (SD= 1.9) under normal vision to 10.9 (SD=1.5) when wearing goggles. A paired t-test showed that this decrease was highly significant, $t(6)=8.50$, $p<0.001$ (two-sided) (see Figure 6, bottom right), indicating that participants performed worse under restricted vision.

DISCUSSION

The present study aimed to investigate the effects of restricting peripheral vision (PV) on adaptive perceptual-motor strategies and performance in football (soccer). The findings revealed significant reductions in both head movement behavior and task performance under PV-restricted conditions. These results support the hypothesis that PV plays a crucial role in guiding adaptive behavior and maintaining performance in dynamic sport environments, highlighting its importance for effective visual exploration and action regulation on the field.

Results showed that participants' head turn frequency (HTF) was negatively affected by restrictions to their PV. Specifically, exploratory head movements significantly decreased when PV was restricted. One possible explanation is that peripheral information that would normally be available with unimpaired vision, such as teammates, opponents, or open space, are not available when PV is restricted. Consequently, participants may be less likely to turn their heads toward these affordances, possibly contributing to the reduced frequency of head-turning behavior observed in this study. However, this contrasts with Timmis et al. [28], who found that individuals with limited PV rather demonstrated a more active visual search pattern during level walking and obstacle crossing, looking at more areas on the ground compared to those with normal vision. Considering that one of the functional properties of PV is to afford a broad field of view [4], it seems intuitive that individuals with restricted PV might compensate by increasing their scanning frequency, particularly by looking at the ground more often to attune to the position of their feet and legs while walking. This compensatory behavior differs from that of individuals with full PV, who may not need to shift their gaze as frequently due to their broader visual coverage.

However, one could argue that level walking and obstacle crossing [28] —requiring information pick-up mostly ahead of the individual—involve less complex task dynamics than football environments. In football, affordances envelop players from all directions, presenting a 360-degree array of action opportunities [6,8,21], potentially placing a higher dependency on PV. When PV is restricted within such complex environments—as in the current study—simply compensating by relying heavily on central vision might not suffice due to the demands of continuous information detection from multiple directions.

The restriction of PV drives players to rely more on central vision and direct fixations, which most likely interrupts the natural, smooth scanning of the environment [11]. In simpler tasks, an increased gaze pattern might suffice to compensate for the lack of PV. However, in complex, fast-paced football environments, the perceptual demand might exceed the capacity to adjust effectively, and players may struggle to maintain adequate situational awareness. This would explain the reduced HTF observed in the current study.

This argument is further supported by Aksum et al. [7], who found that only 2.3% of players' scans in real-world football environments involved fixations, suggesting that players rely heavily on PV rather than foveal vision to detect and attune to relevant affordances during gameplay. If PV is restricted in environments that present a high density of 360-degree affordances—like football—players may become overloaded and unable to properly attune to the demands of the game, likely leading to the observed reduction in exploratory behavior seen in this study [26]. Although we aimed to replicate real-life football scenarios as closely as possible, it could be argued that actual football gameplay presents even greater complexity compared to our experimental setup, and we expect even more pronounced effects of PV restriction in a real-game setting. The dynamic nature of the game, with rapid player movements, unpredictable events, and the necessity for split-second decision-making [12,13], may exacerbate the challenges players face when PV is limited.

Existing literature provides compelling evidence that exploratory head movements are important to perform successfully in football environments [6,8,21,23,24,29,36], and there is an established relationship between the frequency of head turns and successful outcomes in sports. If a player reduces their exploratory behavior, they may lose awareness of their surroundings, which could, in turn, limit their ability to detect opportunities for action, adapt to changing game situations, and ultimately negatively impact their performance. Given the significant decrease in scanning frequency observed when players wore PV-restricting goggles, it is highly plausible that PV is integral to how players attune to information for affordances and perform effectively in dynamic sporting environments.

Moreover, the current study demonstrated that restricting PV not only decreased scanning frequency but also led to increased response times and reduced decision accuracy—both critical variables linked to performance [30,37–39]. This highlights PV's role in enabling athletes to quickly attune to affordances and make informed decisions. Restricting PV may impair situational awareness and responsiveness, potentially impacting overall performance and successful outcomes in sports.

While more research is needed to fully understand the relationship between PV, exploration and performance, it could have immediate practical implications for designing equipment that blocks parts of PV. For instance, in sports like football, face masks that obscure even a small portion of PV could alter exploratory behavior and impact performance. Recent research reported that alpine skiers wearing both helmets and ski goggles had the slowest response times to visual stimuli [5]. Similarly, when the effects of protective American football headgear on reaction times and target detection in Division I NCAA players were investigated [40], researchers reported that players responded faster and detected targets better without any headgear, and that both the helmet alone and the helmet with an eye shield significantly impaired performance. These studies highlight the importance of designing protective gear that minimizes obstruction to PV while ensuring player safety. Future research should explore how different designs of protective equipment affect PV, exploratory behaviors, and performance, balancing safety with visual awareness.

While this study has provided valuable insights into how restricting PV impacts perceptual-motor strategies and performance in football, several limitations should be acknowledged. Most notably, the sample size was relatively small (n = 7), which, although sufficient to detect very large effects, falls short of the 34 participants recommended by a priori power analysis for detecting medium-sized effects. This limited sample size may have constrained the ability to detect more subtle but meaningful differences—such as the observed reduction in HTE, which did not reach statistical significance. Increasing the number of participants would not only improve statistical power but may also reveal effects that are currently under-detected, thereby strengthening the reliability and generalizability of the findings.

Based on the above, future research should build on the present findings by exploring the role of PV in more complex and dynamic game situations, as well as across varying skill levels. First, research should probe the distinct contributions of PV in real-world football tasks beyond controlled passing-receiving scenarios. By incorporating game-like conditions with varying levels of time pressure, opponent-interaction, and spatial complexity, future studies can assess how PV influences decision-making and performance in dynamic, unpredictable environments.

Second, leveraging eye-tracking and motion analysis technologies, future research should investigate the extent to which football players rely on PV versus foveal vision for situational awareness and performance execution. Examining players' head and body movements alongside their gaze behavior will offer a more comprehensive understanding of how they gather and utilize visual information under restricted vision conditions.

Finally, studies should manipulate the degree and type of PV restriction, such as simulating the effects of facial masks, to assess the thresholds at which PV loss begins to significantly impair performance. Gaze-contingent paradigms or simulated field-of-view restrictions could allow researchers to systematically investigate when PV alone can sustain effective play and when compensatory strategies, such as head movements or shifts in foveal vision, are necessary.

CONCLUSION

In conclusion, the findings suggest that PV is likely fundamental for supporting exploratory behavior and attunement to affordances in dynamic football environments. When PV was restricted, participants showed reduced head movement frequency and compromised performance, indicating that PV may play an important role in sustaining the perceptual coupling needed for effective action regulation. This has important practical implications for the design of protective equipment, underscoring the need to minimize unnecessary restrictions to PV.

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