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Establishing National Peripheral Vision Norm for Vietnamese Shooters

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KEYWORDS

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ABSTRACT:

Peripheral vision, the ability to see outside your central focus, isn't just a neat evolutionary trick. For shooters, it's a game-changer. This wider field of view grants several advantages. Shooters can detect threats or targets approaching from the periphery, crucial in dynamic situations. Spotting a target with peripheral vision allows for a quick shift in focus for a precise shot, leading to faster reactions and smoother target transitions. Additionally, peripheral vision helps prevent tunnel vision, where intense focus narrows your awareness. By staying aware of their surroundings, shooters can make better decisions and ultimately improve their performance. This study investigated the peripheral vision (PV) of elite Vietnamese shooters. The primary goal was to assess their level of PV, while the secondary objective was to establish a baseline for future evaluations within this population. The researchers employed the Peripheral Perception Reaction (PP-R) test from the Vienna Test System to gauge the shooters' visual capabilities. The results were positive, revealing that both male and female participants possessed a Field of Vision (FOV) considered desirable for international shooting competitions. A wider FOV offers significant advantages in various sports, particularly those that demand quick reactions and precise target acquisition. In shooting, a high FOV allows competitors to see a larger portion of the range, facilitating faster target detection and smoother tracking. This study establishes a reference norm for FOV specifically in Vietnamese shooters. While the findings are promising, further research is needed to determine if these results are generalizable to shooters from other countries.

Introduction

Field of Vision, also known as visual span or peripheral awareness, refers to the total area an individual can perceive without moving their eyes. In sport psychology, Field of Vision is recognized as a crucial aspect of athletic performance, particularly in sports that demand a high degree of situational awareness and rapid processing of visual information (Mann, Williams, & Ward, 2009).

Athletes with a larger Field of Vision can detect peripheral threats or opportunities quicker, allowing for faster reaction times (McMorris & Sproule, 2001). It also can track multiple moving objects simultaneously, which is beneficial in sports like soccer, basketball, or martial arts (Vielva et al., 2014). Additionally, the athletes with a larger Field of Vison are able to maintain focus on a central target while being aware of peripheral cues, important for sports like shooting or archery (Liu et al., 2018).

Several studies have explored the relationship between Field of Vision and performance in various sports. For example, research has shown that athletes with a larger Field of Vision tend to perform better in tasks requiring quick decision-making and anticipation, such as cricketers judging the trajectory of a ball (McMorris & Sproule, 2001).

Training programs that incorporate exercises to improve Field of Vision have also shown promise. Athletes who

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engage in peripheral awareness drills or specific video game training can potentially expand their visual span and enhance their performance (Mann et al., 2009).

Importance of Field of Vision to Elite Shooters

Field of Vision, encompassing the entire area an individual perceives without eye movement, plays a critical role in the performance of elite shooters during both training and competition (Liu et al., 2018). Here's how a broader visual span translates to enhanced shooting proficiency: a) Enhanced Situational Awareness whereby with a wider Field of Vision allows shooters to detect peripheral cues, such as wind changes or movements from competitors, that might influence their shot (McMorris & Sproule, 2001). This heightened awareness can aid in adjusting strategy and shot placement accordingly.

Broader field of vision also able to improve target tracking. Shooters often need to track moving targets, especially in fast-paced shooting disciplines like skeet shooting. A larger Field of Vision enables them to maintain focus on the target while remaining aware of its trajectory and potential background distractions (Vielva et al., 2014). Also, it can optimize focus and peripheral cues. Elite shooters require exceptional focus on the front sight and target alignment. An extensive Field of Vision allows them to maintain this focus while simultaneously registering peripheral information, like their posture or breathing, crucial for maintaining proper form (Liu et al., 2018). As such, training programs that incorporate exercises designed to improve Field of Vision can be beneficial for elite shooters. Peripheral awareness drills or specific video game training can potentially expand their visual span and lead to performance improvements (Mann et al., 2009).

Vienna Test System for Sport Psychology

The Vienna Test System (Demoulin et al.) is a computerized assessment tool widely used in various fields, including sport psychology. It offers a battery of interactive tests designed to evaluate various cognitive skills relevant to athletic performance (Schuhfried, 2013). The VTS contributes to the understanding and development of athletes by a comprehensive assessment. VTS provides a multifaceted approach, measuring aspects like attention, reaction time, processing speed, motor skills, and coordination (Ong, 2015). This allows sport psychologists to identify athletes' strengths and weaknesses across a range of cognitive functions crucial for success. The main objective measures with VTS offers standardized and objective assessments, minimizing subjectivity compared to traditional self-report measures (Schuhfried, 2013). This allows for more reliable comparisons between athletes and tracking progress over time.

While VTS offers a general battery, specific subtests can be chosen to target skills relevant to different sports. For example, tests focusing on visual attention might be prioritized for marksmanship sports, while reaction time tests might be crucial for athletes in fast-paced sports (Ong, 2015). In sport, VTS can be used to identify potential athletes by assessing their baseline cognitive skills and comparing them to established norms or successful athletes in their sport. VTS data can guide the development of targeted training programs to improve specific cognitive functions deemed crucial for performance (Mann et al., 2009). Also, it can be monitoring progress, repeated VTS assessments can track progress over time, allowing sport psychologists and athletes to gauge the effectiveness of training interventions.

This is the gold standard for clinical assessment of Field of Vision. It uses a computerized device that presents light stimuli at various locations within the Field of Vision. Automated perimetry holds potential value in evaluating elite shooter performance. Here's how it might be connected are: a) Identifying field of vision deficits whereby automated perimetry can detect scotomas (blind spots) or areas of reduced sensitivity within the Field of Vision. These deficits can hinder a shooter's ability to detect targets or track their movement, impacting performance (Allsop, Lawrence, Gray, & Khan, 2017). Also, it can be used in monitoring field of vision changes, regular perimetry testing can track Field of Vision changes over time. This allows for early detection of potential issues like glaucoma, which can progressively affect Field of Vision and require vision correction strategies for optimal shooting (Fogt & Fogt, 2023). On top of that, it also helps in optimizing training techniques. Perimetry results can

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inform training programs. For example, shooters with slightly reduced peripheral vision might benefit from drills that emphasize central target focus while maintaining some awareness of peripheral cues (Mann et al., 2009).

Peripheral Perception Sub-Tests with Vienna Test System (Demoulin et al.)

The Vienna Test System (Demoulin et al.) offers a Peripheral Perception (PP) sub-test designed to assess an individual's ability to detect stimuli presented in their peripheral vision (Schuhfried et al., 2019). This sub-test utilizes an LED matrix positioned on either side of the participant's field of view. The VTS software controls the presentation of light stimuli, varying their location from the center to the periphery of the Field of Vision. An ultrasound distance measurement system ensures the participant maintains proper head positioning throughout the test.

The PP sub-test is believed to be a valuable tool in evaluating visual attention, particularly in tasks that require individuals to monitor stimuli outside their central field of vision. This can be relevant in various domains, including athletics, driving performance, and occupations demanding high levels of situational awareness (Liu et al., 2017).

Gaps of this study

There's a clear gap in the existing literature regarding Field of Vision and its relationship to performance in elite shooters, specifically Vietnamese shooters. Here's how this study can address this gap: a) Limited Researchin this area. A search of the scientific literature reveals a scarcity of studies directly investigating Field of Vision in elite shooters. Most existing research focuses on Field of Vision and athletic performance in general, without specifically targeting elite shooters (Oudejans, Koeduker, Bleuendaal, & Bakker, 2005); b) Specificity to Elite Shooters. Studies exploring Field of Vision and performance often involve athletes from various sports (e.g., cricket bowlers, soccer players). However, the visual demands of shooting, particularly for accuracy and target tracking, might be distinct, necessitating a dedicated investigation in elite shooters (Vielva et al., 2014); and c) Focus on Vietnamese Shooters. Research on Field of Vision and elite shooters has likely been conducted with athletes from various geographic regions. This study has the potential to contribute valuable insights specific to Vietnamese elite shooters, potentially revealing unique characteristics or training strategies relevant to the population (McMorris & Sproule, 2001).

Methods

Participants

Current study recruited a total of 61 elite Vietnamese National shooters, with a balanced representation of genders (31 females and 30 males). This sample size allows for robust statistical analysis and potentially generalizable findings. To ensure ethical research practices, informed consent was obtained from all relevant parties involved in the study are: a) Vietnamese Shooting Association. Securing consent from the governing body demonstrates respect for their oversight and facilitates broader dissemination of research findings within the Vietnamese shooting community.; b) Coaches in obtaining coach consent is crucial if the study involves interaction with the athletes during their training sessions or requires coach input; c) The athletes - Informed consent from each participating athlete is paramount, ensuring their understanding of the study procedures and their right to withdraw at any time.

This study was conducted during the competition preparation phase. This specific timing offers valuable insights for several reasons: a) Competition Relevance - Measuring Field of Vision capacity during this crucial period allows for a direct link between the results and athletes' performance capabilities relevant to upcoming competitions (Liu et al., 2018); b) Training Optimization - Understanding individual Field of Vision capacities during competition preparation allows coaches and athletes to tailor training programs. Exercises or strategies can be implemented to maximize the utilization of Field of Vision capacity for optimal performance (Mann et al., 2009); c) Monitoring and Adjustment - Field of Vision might fluctuate slightly over time. Assessing it during competition preparation allows for potential adjustments and monitoring throughout the preparation phase to maintain peak performance levels.

Data Collection Procedures

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The current study employed the Peripheral Perception Reaction (PP-R) test from the Vienna Test System (Demoulin et al.) as figure 1 to assess the visual abilities of the shooters (Schuhfried et al., 2019). The PP-R test is a widely used tool in various applied psychology domains, including sports psychology, human resources, aviation, and traffic psychology (Schuhfried et al., 2019). This computerized test utilizes automated equipment to deliver precise measurements of visual perception through key variables: a) Field of Vision (FOV) - Measures the total area an individual can see without moving their head; b) Visual Angel Left (VAL) and Visual Angel Right (VAR) - Assess the extent of vision in the left and right visual fields, respectively; c) Peripheral Reaction (PR) - Evaluates an individual's ability to detect and respond to stimuli presented in their peripheral vision, measured by the number of button presses required upon detecting a critical signal.

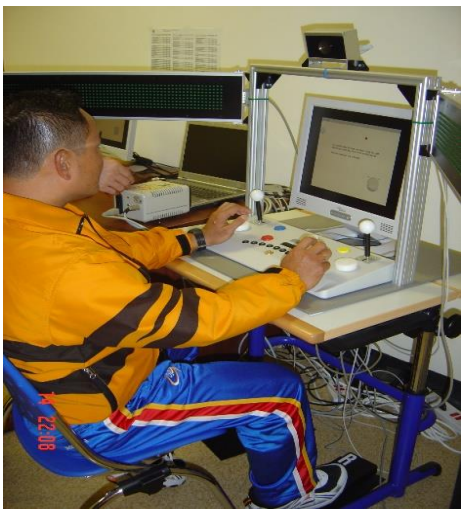

Figure 1: Peripheral Perception Reaction (PP-R) Test

The Field of Vision (FOV) of athletes was assessed using a standardized test consisting of 84 total signals (APA citation needed for specific test details). Half of the signals (28) were presented to the left visual field, and the other half (28) were presented to the right visual field. This design evaluates the athlete's ability to detect and respond quickly to visual stimuli across their entire horizontal field of view. Additionally, 28 non-target stimuli were included to assess for false positives.

Standardized testing procedures were employed to ensure consistency. Athletes maintained a seated position with their head centered as determined by a sensor bar. The minimum distance between the head and the sensor bar was 20 centimeters, with a maximum distance of 45 centimeters from the center of the screen. The total test execution time, including instructions, was 15 minutes.

Results

Results of performing the Peripheral Perception Sub-Tests of Vietnamese national shooters during the professional training phase in preparation for competition.

Table 1. Field of Vision Test Results of Young Vietnamese National Shooters

Parameter	Young Female Shooters (n=31)		Young Male Shooters (n=30)		T_1
	$\bar{x}$	∂	$\bar{x}$	∂	
Field of Vision (FOV)	164.24	15.71	165.39	15.89	0.66

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(Degrees)					
Visual Angel Left (VAL) (Degrees)	84.25	9.14	87.04	8.79	2.11
Visual Angel Right (VAR) (Degrees)	79.98	7.40	78.66	8.38	1.07
Peripheral Reaction (PR) (Rajkumar)	90.97	9.61	97.65	5.70	5.38

Data from Table 1 suggests potential sex differences in Field of Vision performance among shooters tested with the Vienna Test System (Demoulin et al.) [Schubert et al., 2006]. Female shooters exhibited a mean Field of Vision (FOV) of 164.24°, mean Visual Angel Left (VAL) of 84.25°, mean Visual Angel Right (VAR) of 79.98°, and a mean Peripheral Reaction (PR) of 90.97%, with one female achieving a perfect score. In comparison, male shooters displayed a mean FOV of 165.39°, mean VAL of 87.04°, mean VAR of 78.66°, and a mean PR of 97.65%, with eight males achieving a perfect score.

Young shooters on the Vietnamese national team exhibited a wide field of view (FOV) on average, exceeding international norms. Both female (90.97%) and male athletes (97.65%) demonstrated excellent peripheral reaction times. This report suggests potential advantages in Field of Vision performance among young Vietnamese national team shooters tested with the Vienna Test System (Demoulin et al.) (Schubert et al., 2006).

Reference Norm for Classifying Field of Vision for Young Shooters for Vietnamese National Team

This study investigated the Field of Vision (FOV) of Vietnamese National Team shooters. The research aimed to establish reference norms for FOV in both female and male athletes (Table 2 and 3). The findings, detailed elsewhere, suggest that Vietnamese National Team shooters possess a wider FOV compared to established norms.

Table 2. Field of Vision Reference Norm for Female Shooters

Parameter	Norm for Female National Vietnamese Shooters									
	10	9	8	7	6	5	4	3	2	1
Field of Vision (FOV) (Degrees)	204	196	188	180	172	164	156	149	141	133
Visual Angel Left (VAL) (Degrees)	107	103	98	93	89	84	80	75	71	66
Visual Angel Right (VAR) (Degrees)	98	95	91	87	84	80	76	73	69	65
Peripheral Reaction (PR)	115	110	105	101	96	91	86	81	77	72

Table 3. Field of Vision Reference Norm for Male Shooters

Parameter	Norm for Male National Vietnamese Shooters									
	10	9	8	7	6	5	4	3	2	1
Field of Vision (FOV) (Degrees)	205	197	189	181	173	165	157	150	142	134
Visual Angel Left (VAL) (Degrees)	109	105	100	96	91	87	83	78	74	69

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Visual Angel Right (VAR) (Degrees)	100	95	91	87	83	79	74	70	66	62
Peripheral Reaction (PR) (Rajkumar)	112	109	106	103	101	98	95	92	89	86

Field of Vision (FOV) of Vietnamese National Team shooters. The reference norm is based on four key parameters: a) Field of Vision (degrees); b) Visual Angel Left (degrees); c) Visual Angel Right (degrees); and d) Peripheral Reaction (Rajkumar). A scale of 10 (best) to 1 (worst) was developed to classify FOV based on the combined scores achieved in these parameters.

Discussion

This study investigated the peripheral vision (PV) of elite Vietnamese shooters preparing for competition. The focus was to determine the level of PV this group possesses. Peripheral vision is crucial for athletes to detect and react to stimuli in their periphery, which is essential for success in many sports. The second objective of this study was to establish a reference norm for evaluating peripheral vision (PV) in Vietnamese shooters. This reference norm will provide a standardized framework to assess the PV of future Vietnamese shooters and potentially identify individuals with exceptional capabilities.

The current study employed the Peripheral Perception Reaction (PP-R) test from the Vienna Test System (Demoulin et al.) to assess the visual abilities of the shooters (Schuhfried et al., 2019). The overall Visual Perception was measured through key variables: a) Field of Vision (FOV) - Measures the total area an individual can see without moving their head; b) Visual Angel Left (VAL) and Visual Angel Right (VAR) - Assess the extent of vision in the left and right visual fields, respectively; c) Peripheral Reaction (PR) - Evaluates an individual's ability to detect and respond to stimuli presented in their peripheral vision, measured by the number of button presses required upon detecting a critical signal.

This study investigated the Field of Vision (FOV) of Vietnamese shooters. The results showed that both male and female participants displayed FOV within a desirable range for international competition. The average FOV for female shooters was 164.24 degrees, while males averaged 165.39 degrees. A wide field of view (FOV) offers several advantages in various sports, potentially enhancing performance and reaction times. The key benefits are: a) Increased Situational Awareness - With a larger visual field, athletes can perceive a broader range of their surroundings. This allows them to track opponents, anticipate plays, and react more effectively to sudden changes in the game: b) Enhanced Peripheral Vision - A high FOV improves peripheral vision, which plays a crucial role in many sports. Athletes can detect subtle movements or cues in their periphery, allowing for quicker responses and improved decision-making. Also, a wider visual field facilitates smoother and more efficient visual tracking of moving objects. This is particularly advantageous in sports like tennis or baseball, where following the trajectory of a ball is critical (McLeod, 2010). But, in high-pressure situations, athletes may experience tunnel vision, narrowing their focus. A high FOV can help mitigate this by providing a broader visual landscape, allowing them to maintain awareness of their surroundings while staying focused on the primary task (Wilson, 2008).

For shooters with a wider field of view (FOV) possess several advantages that can significantly enhance their performance. The shooters able to improved target acquisition and tracking. A high FOV allows shooters to see a larger portion of the shooting range, facilitating faster target detection and smoother target tracking. This becomes crucial in dynamic shooting scenarios where targets appear and disappear quickly (Liu & Yu, 2019). Also, the shooters able to enhanced peripheral vision for situational awareness whereby a wider field of view improves peripheral vision, enabling shooters to be aware of their surroundings and potential distractions. This can help them maintain focus on the target while being mindful of other elements on the range, improving overall safety and composure (McLeod, 2010). Additionally, the shooters able to reduced tunnel

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vision under pressure. This means that in high-stress shooting situations, athletes can experience tunnel vision, narrowing their focus. A high FOV can help mitigate this by providing a broader visual landscape. Shooters can maintain awareness of the entire sight picture and surrounding environment while keeping the target in focus, leading to more precise aiming (Wilson, 2008).

At such, it is essential for shooters to improved Visual Processing and Decision-Making. With a larger visual field, shooters can gather more information about the target and its surroundings. This allows for quicker processing of visual cues and better decision-making regarding factors like windage, holdover, and shot timing (Mann et al., 2009).

In regard to Visual Angels (left and right), current findings found the Vietnamese athletes have a high Visual Angles. A wide field of view in both left and right eyes allows shooters to see a larger portion of the shooting range, facilitating faster target detection and smoother target tracking across their entire visual field. This is crucial for dynamic shooting scenarios where targets appear and disappear quickly, or when targets move laterally (Liu & Yu, 2019). Also, it can enhance situational awareness. With a strong bilateral FOV improves peripheral vision in both eyes, enabling shooters to be aware of their surroundings and potential distractions on both sides. This heightened awareness can help them maintain focus on the target while being mindful of other elements on the range, improving overall safety and composure (McLeod, 2010). Additionally, it can reduce tunnel vision under pressure. It means in high-stress shooting situations, athletes can experience tunnel vision, narrowing their focus. A strong bilateral FOV can help mitigate this by providing a broader visual landscape in both directions. Shooters can maintain awareness of the entire environment while keeping the target in focus, leading to more precise aiming (Wilson, 2008).

Current study revealed that the Vietnamese shooters have a high peripheral reaction. Shooters with a strong peripheral reaction possess a significant advantage, allowing them to react quicker and more effectively to stimuli outside their central field of vision. A strong peripheral reaction enables shooters to detect sudden movements or potential threats appearing in their periphery. This allows for quicker reaction times to hazards or flanking maneuvers, improving overall safety and tactical awareness during competitions. Also, it can mprove shot timing in dynamic scenarios. In fast-paced shooting disciplines, targets may appear or move unexpectedly. A strong peripheral reaction allows shooters to pick up on these subtle cues in their periphery, enabling them to adjust their aim and timing for a more precise shot (Liu & Yu, 2019). It helps reduced startle response, which mean loud noises or unexpected movements can cause a startle response, disrupting focus and aim. A strong peripheral reaction allows shooters to anticipate these events in their periphery, mitigating the startle effect and maintaining composure during the shot. In addition, for some shooting sports involving teammates, peripheral awareness is crucial. Shooters can be alerted to teammate movements or signals through their peripheral vision, facilitating better coordination and tactical execution (Liu & Yu, 2019).

The current study establishes a reference norm for Field of View (FOV) specifically in Vietnamese shooters. However, the generalizability of this finding to shooters from other countries remains undetermined. Further research is necessary to investigate FOV across a wider range of nationalities and demographics to develop more comprehensive field of view norms. Future studies employing larger and more diverse samples can help establish more robust reference values for FOV in shooter populations.

Conflict of interest

The authors confirm they have no conflicts of interest.

Author Contributions

All author contributed equally to this study.

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Ethical Approval

This study received ethical clearance from the Institutional Review Board at Bac Ninh Sport University of Viet Nam. The approved protocol encompasses the use of existing de-identified medical records for research on

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