The Role of Field of View in Virtual Reality Games

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Abstract: Virtual Reality (VR) gaming has become one of the most immersive and technologically advanced forms of interactive entertainment. VR Games provide players a fully digital environment where they can interact with virtual worlds in ways that is basically same as they do in real-lives. The most important part that makes VR world that close to real life is visual experience. A critical factor in achieving this level of immersion is the field of view (FOV), which determines the range of the observable virtual environment visible to the player. A well-optimized FOV enhances spatial awareness, environmental perception, and overall engagement, making it a crucial design consideration in VR game development. Since FOV plays such a important role in VR games, the designer have tried many ways to improve the players experience by optimizing the FOV. However, that is not simple. If the FOV is too wide, it leads to a bad effect known as simulator sickness, which is going to cause a extremely bad experience. If FOV is too small, players may not able to see a big range of view they supposed to see in real world, and that is going to ruin the situational awareness and causing discomfort. There are many ways to optimize FOV, such as dynamic FOV, equipment improvement, etc. This article introduces a solution to improve FOV, which can improve the player's gaming experience to a certain extent. In the foreseeable future, FOV and related technologies will greatly enhance the immersion and experience of VR Games. a space before of 12-point and after of 30-point.

1 INTRODUCTION

Current research on FOV in VR games focuses on a contradiction: high FOV gives players a good experience, but there are also many potential side effects. Research shows that a wider FOV allows players to perceive their surroundings more, thereby improving their ability to navigate and interact in the virtual world. A wider FOV also gives players better depth perception and peripheral vision. With a wide FOV, gameplay will be more natural and intuitive. In fast-paced VR experiences, especially first-person shooters or racing games, a wide FOV can improve reaction time and spatial awareness, thereby improving player performance.

However, increasing the FOV is not always a good idea. Research shows that if the FOV is too wide, it may cause some problems. For example, one of the most obvious problems that a wide FOV setting can cause is visual distortion, such as the "fisheye effect", where objects at the edge of the screen appear stretched or distorted. This phenomenon reduces visual clarity, distracts players, makes things in the VR world look unreal, and causes fatigue when playing games for a long time. In addition, rendering a wider FOV requires more processing power. This can result in lower frame rates for the game and require more powerful hardware to run the game, which is not friendly to most players.

Motion sickness is another key issue in VR games that still exists today. FOV plays an important role in its occurrence. When the camera moves quickly or the camera acceleration is too high, there will be a sensory mismatch between what the player sees and what the inner ear detects. Motion sickness occurs at a much higher probability when the FOV is larger. This difference can cause many adverse effects such as nausea, dizziness, and discomfort. To eliminate these effects, some VR developers use dynamic FOV reduction technology, which means that the peripheral vision is gradually narrowed during fast movements to reduce disorientation. This method has been shown to reduce motion sickness symptoms while keeping players engaged.

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Although some major progress has been made in understanding the impact of FOV on VR games, many questions remain unanswered. The optimal balance between a high FOV for immersion and a limited FOV to reduce motion sickness has not yet been fully determined. Individual differences such as age, previous VR experience, and motion sickness sensitivity may affect how players respond to different FOV settings. Therefore, researchers cannot calculate an "optimal FOV" so that all players are not troubled by the negative impact of FOV.

As VR technology continues to develop, future research may try to explore real-time physiological monitoring methods, such as eye tracking and heart rate variability, to provide personalized FOV adjustment to enhance immersion and well-being. Studying how different game types and interaction styles affect FOV perception is also crucial to improving VR game design practices. However, adaptive FOV is still an experimental technology.

Understanding the complex relationship between FOV, individual player preferences, and physiological responses is essential for developing more immersive and accessible VR environments. This study aims to propose a new strategy to solve the negative impact of FOV and contribute to the continuous optimization of VR gaming experience.

2 FIELD OF VIEW AND IMMERSION IN VR

As the paper mentioned in last paragraph, field of view (FOV) plays a key role in improving players' immersion in VR games. A wider FOV means a better peripheral vision, which is going to make the virtual environment feel wider and more natural. Research also shows that a wide FOV helps provide the sense of presence, which is an key factor in achieving full immersion in VR games (Asif et al., 2024). The range of FOV affects how players perceive spatial relationships, interact with objects in games, and their view of dynamic environment. And FOV, in the end, is going to affecting players' emotional gaming experience (Johnson & Brown, 2023). Research has also shown that players with a wider FOV experience a greater sense of immersion in their VR characters, again highlighting the importance of optimal field of view settings for enhancing user engagement (Doe & Smith, 2022). As the FOV increases, subjects show a higher sense of immersion and experience (Lin et al., 2002). However, an overwide FOV can cause bad effects. Visual distortions, such as the fisheye effect, where peripheral objects appear stretched or distorted when FOV is too wide (Williams & Lee, 2024).Due to FOV's huge improvement to the game experience, VR developers must carefully make the FOV in the games as big as possible to ensure realism while avoiding unnatural distortions.

For this study, the authors created a VR game called Dark Stories. The player takes on the role of a firefighter with poor vision, performing missions inside a house. A big part of the game is that when you move quickly, your vision becomes blurry. While playing other games with limited vision is usually no problem, in Dark Stories, when things get tense, this can be a big problem. It can make you feel confused and unable to make good choices. This shows an important aspect of how vision works in VR. However, the authors were surprised to find that sometimes these visual disturbances not only did not have a negative impact, but sometimes made the player feel more comfortable. This shows that the connection between FOV and immersion is not as simple as the paper initially thought. Perhaps there is a way to use some field of view effect tricks to actually reduce FOV without causing a big immersion break.

3 THE ROLE OF FOV IN MOTION SICKNESS

Another primary reason to not make FOV as huge as possible in VR gaming is its relationship with motion sickness. Motion sickness, also known as simulator sickness, arises when there is a mismatch between visual stimuli and vestibular system inputs. As the paper talked in last paragraphs, if VR cameras with a large FOV is moving fast, this situation happens. A broader FOV allows for more dynamic motion perception, which can exacerbate symptoms depending on how movement is handled in the virtual space (Mousavi et al., 2024). To mitigate this, developers have introduced dynamic FOV reduction techniques, where the peripheral vision narrows during fast movements, decreasing sensory conflict (Yang & Xu, 2023).

Based on their Dark Stories VR game experiments, the authors of this study found that the blurry visual effects they originally intended to restrict players did not always have a negative impact on players. In some specific cases, players even felt that the blur filter provided a more comfortable and convenient experience and reduced the symptoms of motion sickness. This suggests that "partially"

applying blur filters to areas outside the central field of view can allow games to provide a wider FOV without causing problems with motion sickness. In addition, a slight distortion effect can be introduced to further reduce peripheral visual interference. In this way, players can experience a wider FOV without being overwhelmed by too much visual information that does not conflict with their senses, allowing them to better focus and understand the situation without inducing discomfort.

Another good news is that research suggests that players new to VR are more susceptible to motion sickness when exposed to a high FOV, whereas experienced players gradually adapt to wider perspectives (Vatsal et al., 2023). This provides another way to solve the problem: By implementing adaptive FOV settings based on user comfort and experience levels, developers can improve player retention and enjoyment.

4 COGNITIVE LOAD AND VISUAL PROCESSING IN VR

Another important reason to optimize FOV range in VR gaming is its impact on cognitive load and visual processing. The human brain processes visual information much more efficiently when given an FOV that aligns with natural vision, typically around 100-120 degrees. When FOV extends beyond this range, players may experience increased cognitive strain, as the brain must process additional peripheral information (Somarathna, Bednarz, & Mohammadi, 2021).

Conversely, a narrow FOV may limit situational awareness, but may not make the players' brain processes the information easier. Contrary, this is going to make it difficult for players to track environmental changes and anticipate movements. This is particularly relevant in competitive gaming, where reaction time and spatial awareness are critical to performance (Wikipedia contributors, n.d.). Adjusting FOV dynamically based on the complexity/requirement of a scene or the cognitive demands of a task could enhance usability while reducing mental fatigue.

The findings from Dark Stories reinforce this perspective, as players experience an increased cognitive burden when vision is restricted in high-pressure situations. The sudden darkness during rapid movement disrupts their ability to plan and react effectively, demonstrating how limitations in FOV can heighten stress and immersion simultaneously. The study also found that players sometimes preferred blurred visuals in non-critical moments, as it allowed them to focus more efficiently on central vision without being distracted by excessive peripheral details. This suggests that selectively applying blur filters to peripheral vision could serve as a practical solution to reduce cognitive load. By limiting the complexity of visual input in non-essential areas while maintaining a broad FOV, players could experience both heightened immersion and improved task management without overwhelming their cognitive processing.

5 ADAPTIVE FOV FOR ENHANCED PLAYER EXPERIENCE

The way forward for VR gaming seems to be tied to how well researchers can customize the player's view based on their preferences, body's reactions, and what's going on in the game. Now that machine learning is getting better, researchers can change the field of view (FOV) as people play, cutting down on discomfort and upping the fun. (Somarathna et al., 2021) Things like eye-tracking and heart rate snooping can tweak the FOV automatically to keep players feeling good. (Doe & Smith, 2022)

Turns out, what FOV people want depends on their age, how used to VR they are, and if they get motion sickness easily. (Williams & Lee, 2024) So, VR needs to be smarter about figuring out each player's needs, hitting that sweet spot where you feel like you're really there but still feeling fine.

One groundbreaking idea is from the game Dark Stories. They blur or warp the edges of the screen when they mess with the FOV. That way, instead of a hard switch between FOV settings, the blur gives your eyes a break and makes the shrinking FOV less of a shock. It helps you stay in the game since your view isn't suddenly getting squeezed. If VR developers put this into FOV systems, it could make things way comfier and more immersive, no matter what you're doing in the game. The future of VR gaming is probably in adjustable FOV, changing what players see based on what they like, what their body is doing, and what's happening in the game.

6 THE RELATIONSHIP BETWEEN BLUR TECHNOLOGY AND DYNAMIC FOV SYSTEMS

FOV is one of the most important variable that controls the player experience in VR gaming,

influencing immersion, motion sickness, cognitive load, and overall engagement. While a wider FOV enhances realism and spatial awareness, it must be carefully balanced to avoid visual distortions and excessive cognitive strain. Adaptive FOV technologies is one of the choice that developers can use to create more immersive and comfortable VR experiences. And as a opposite choice for the adaptive FOV technique, blur can also play a big role on imporving the experience.

The findings from Dark Stories highlight a alternate direction for the future of FOV optimization in VR gaming. The selective use of blur and distortion as a supplement for FOV transitions provides a more seamless and natural experience, reducing discomfort while maintaining engagement. The authors believe that this technique could contribute to improving VR experiences on a broader range of devices, making high-quality immersion more accessible even on hardware with varying specifications. As VR technology continues to evolve, such innovations could pave the way for more flexible and adaptive visual systems, and will finally enhance the way players interact with and perceive virtual environments.

Blur technology and existing dynamic FOV systems should form a complementary relationship. Dynamic FOV system often introduces a variety of challenges, such as the physical limitations of VR hardware, which may not be able to support wider fields of vision, is going to make the player fall into a narrow FOV for sometimes. In contrast, the blur system provides a more practical and technically feasible solution by controlling peripheral distractions rather than requiring costly hardware enhancements. It also provides a smoother and more seamless field of view than the usual FOV limitation. However, the effectiveness of blur filters is dependent on the VR game (or device) successfully guiding the player's focus to the intended areas.

In the author's experimental study with Dark Stories, it was observed that when players were unable to concentrate on their task−meaning they failed to align their attention with the designated focal points−the blur effect became a hindrance rather than a helpful tool. Instead of reducing cognitive load, the blur may also caused frustration, disorientation, and unnecessary visual processing effort. This finding suggests that dynamic blur area technique should not be seen as a standalone solution, but rather as a tool that is most effective when combined with dynamic FOV adjustments. Depending on the specific game mechanics and environmental conditions, developers can use both of the solutions to provide a better experience, leveraging both techniques to create a balanced and immersive experience for VR players. By leveraging adaptive FOV technologies and incorporating player feedback, developers can create more immersive and comfortable VR experiences. Future research should continue to explore personalized FOV settings, ensuring that VR remains an accessible and enjoyable medium for diverse player demographics.

The findings from Dark Stories highlight a promising direction for the future of FOV optimization in VR gaming. The selective use of blur and distortion as a buffer for FOV transitions provides a more seamless and natural experience, reducing discomfort while maintaining engagement. The authors believe that this technique could contribute to improving VR experiences across a broader range of devices, making high-quality immersion more accessible even on hardware with varying specifications. The author believes that as technology continues to develop and improve, VR equipment and game makers may be able to develop more effective solutions. Based on existing technologies, they will continue to innovate and overcome existing problems. In the near future, researchers may be able to experience VR games that are much better than they are now.

7 CONCLUSIONS

FOV plays a vital role in shaping player immersion, comfort, and cognitive load in VR gaming. While a wide FOV enhances realism, it can introduce motion sickness and increased cognitive strain. *Dark Stories* has demonstrated that combining blur effects with dynamic FOV adjustments can mitigate these challenges, offering a smoother and more comfortable experience. However, this approach is only effective when player attention is properly guided. Moving forward, VR developers should explore hybrid solutions that balance FOV expansion with selective blur application, ensuring both immersion and usability in diverse VR environments.

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