Close-up In Virtual Reality

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Abstract

Watching films creates a habit of following the edited sequence and understanding meanings of cuts, shot sizes, and camera movements. However, in Virtual Reality our field of view is all around us. Locomotion enables us to move closer to some objects in virtual scene to better see their details. We can also grab them and look closer. Still, the lack of close-up is noticeable in certain applications. The aim of this research is to offer a solution for implementation of close-up in VR. We will show it by using an example VR application called Tiger I – Last Defense. It is a simulation of tank warfare. The user is inside a tank and needs to aim correctly to destroy the enemy tank. However, the sight device is pretty small and aiming is quite challenging. Close-up implementation solves this problem. The user experience evaluation results show that the majority of the players find it useful.

Keywords: Virtual Reality, VR film language grammar, User experience

1 Introduction

Films have shaped visual storytelling for decades. The art, techniques, and narrative formulas of using different shot durations [1], shot transitions, shot scale, shot motion, shot luminance, character introduction, and distributions of conversations, music, action shots, and scene transitions are always developing and being perfected to achieve the ultimate goal of grabbing and holding the viewer's attention [2]. Virtual reality (VR) is breaking this formula by creating immersive environments that engage users' senses in ways traditional media cannot. This has its advantages and disadvantages.

While VR enables a higher level of immersion and engagement in comparison to traditional films [3] it also has its drawbacks, one of the most important being Limited field of view (FoV) [4] [5]. This limitation made it difficult for viewers to notice specifics or focus on disant or narrowly defined sections within a scene. In Hollywood films, such specifics would be emphasized with the help of zoom-ins and close-ups - powerful tools utilized to guide viewer looks and emphasize key narrative. In VR, the lack of such framing devices can lead to problems in guiding user attention, especially when visual cues are important. Thus, users may miss important objects, lose contextual information, or become disoriented when trying to understand or interact with the virtual world. Close-ups can help draw attention to specific details, feelings, or movements that would otherwise be out of the user's immediate line of sight, thereby enhancing comprehension and emotional impact. One possible way for attempting to draw the viewer's attention to specific details, emotions, or actions out of the FoV of the user is by incorporating close-ups in the virtual reality environment.

This paper proposes an approach to incorporating close-ups into VR environments, demonstrating its effectiveness through a case study using the VR application Tiger I – Last Defense. This application simulates tank warfare, placing the user inside a tank where they must aim accurately to destroy enemy targets. The existing sight device within the game is small and challenging to use, highlighting the need for a closer, more detailed view. By implementing a close-up feature, the aim is to improve the user's ability to aim precisely and enhance their overall gameplay experience.

The implemented VR application was used in a user experience evaluation to assess the effectiveness of the close-up implementation, gauge user preferences, and analyze the impact on gameplay performance. The evaluation was performed with two versions of the application, first without using the close-up feature, and the second with its usage. After the users tried both versions of the application, they took a survey about their experience with the emphasis being on the question if the close-up feature enhanced the user experience of the game without hindering it in any other way.

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2 Background

Several works explore the subject of giving users the option to zoom in or get a close-up view in a virtual reality scene to enable them a more accurate view of individual objects and other elements. Chen [6] introduced QuickTime VR, a commercial product that uses cylindrical environment maps or panoramic images to create virtual environments. The zoom option is achieved by using multiple resolution image zooming. Rambly et al. [7] propose a step-wise zoom approach, a technique using 'hotspots' in image-based VR applications which are used to focus on an object in the scene. This approach produces a more accurate view of objects of interest in a scene, but is limited by the huge file size needed for the implementation, which in turn limits the number of objects of interest in the scene.

Pfeuffer et al. [8] propose the *Gaze + Pinch* interaction technique which integrates eye gaze to select targets, and indirect freehand gestures to manipulate them. One of the use cases they tested was image zooming by creating a zooming gallery. The zoom is achieved with a two-handed scaling gesture, which in turn zooms into the position of the user's gaze. Messaci et al. [9] propose a technique for selection of distant and occluded objects named *Zoom-fwd*. The technique enables the precise selection of elements even in crowded scenes, as well as elements hidden behind other objects, by using hand gestures.

A close-up view is utilized in medical VR applications, such as Ayoub and Pulijala [10] where a feature of the developed training tool for orthognathic surgery allows the user to zoom the size of the content using specific gestures. Similarily, Bhat et al. [11] introduce a VR framework for interactive and immersive interaction with CBCT dental data. The framework enables dental professionals to rotate, zoom, slice, threshold, and manipulate the data at the user's convenience. Another example from Hann et al. [12] proposes a technique of intuitive zoom in endoscopic work. The authors developed a feature that enlarges the endoscopic image in VR on forward movement of the head. Its usage is also proposed in engineering applications in [13] where Sastry and Boyd developed an interactive grid repair virtual environment where users examine the broken element both in context and close-up from within the immersive 3D environment and manually adjust its node. In [14] the authors review VR systems for architecture, engineering, and construction industry. They present several VR solutions and note that some of them include zooming interfaces. Even though such methods do offer valuable insights into zoom and close-up behaviors, none of them are specifically directed toward image-based or desktop VR systems and fail to transfer easily to immersive VR settings. Step-wise zoom, resolution scaling, or gesture magnification normally disrupt the user's sense of presence by introducing artificial camera movement or unnatural controls. Moreover, all of them rely upon pre-rendered pictures or large data sets, which are not feasible in real-time, physics-based applications like Tiger I – Last Defense. Gesture input devices like gaze + pinch or head-lean zooming can be untrustworthy or cumbersome when the user is already engaged in complex manual interactions, i.e., operating a tank's controls. Furthermore, they do not provide spatial consistency, which makes it difficult for users to be able to use a stable point of reference when playing at high speeds. In immersive VR spaces that require precise and smooth interaction, such as aiming through a tight scope under pressure, a more immediate and context-sensitive close-up solution is needed.

3 Proposed approach

Tiger I - Last Defense is a short VR game that focuses on tank warfare. The player takes the role of a tank operator inside a simplified interior of an immobilized Tiger I tank created in Blender [15] specifically for this game. As the last crew member inside the tank, the player needs to manually load, aim and destroy enemy tanks swarming on his position to win the battle. The game is designed to provide an authentic tank combat experience, with realistic controls and immersive mechanics. One of the main challenges in the game is to aim through the sight device of the tank, which is relatively small and difficult to use effectively in VR as shown in Figure 1. Aiming at enemy tanks remains challenging despite the zoom mechanic included in the sight and possibility of physically moving closer to the sight. The limited field of view and precision required for the targeting create difficulties in accurately aligning shots, especially for people with poor eyesight and those who wear glasses. To address this issue, we developed a close-up feature that enhances aiming sight without breaking immersion.

Figure 1: Normal sight size in the original version of the game

3.1 Game Mechanics

The mechanics of the game are simple. The player can move within the tank either by physically walking in the play area (room-scale movement) or by using the joystick (thumbstick) on the controllers. There are also buttons assigned for zooming, firing gun, pause menu and grab function as shown in Figure 2.

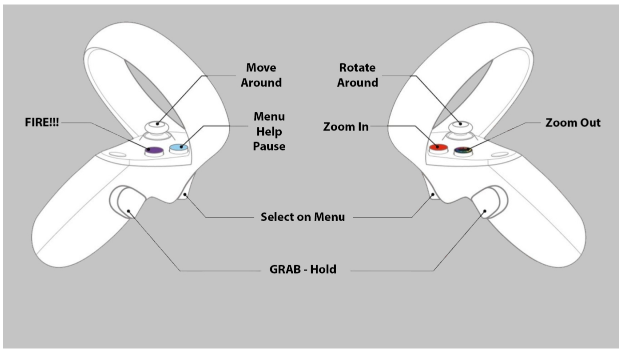

Figure 2: Help menu with instructions

The player has access to an ammunition storage area located on the side of the tank, where shells are stored. To load the tank gun, the player must manually grab a shell using the grab feature of the XR Interaction Toolkit [16] and place it into the gun's loading chamber as shown in Figure 3. Once the shell is loaded, aiming is controlled through two manual adjustment wheels: one for vertical gun elevation and another for horizontal turret rotation. After aligning the target, the player fires the gun by pressing the fire button on the joystick. The sight system is implemented using a RenderTexture that displays the view from a camera positioned at the end of the tank barrel. A Render Texture is a type of texture that Unity creates and updates at runtime. Zoom functionality is achieved through a small script that adjusts the field of view (FOV) of this camera, creating a magnification effect to aid in aiming. The zoom is activated using a button on the right joystick, as shown in Figure 2, and should not be mistaken for the close-up functionality proposed in this article.

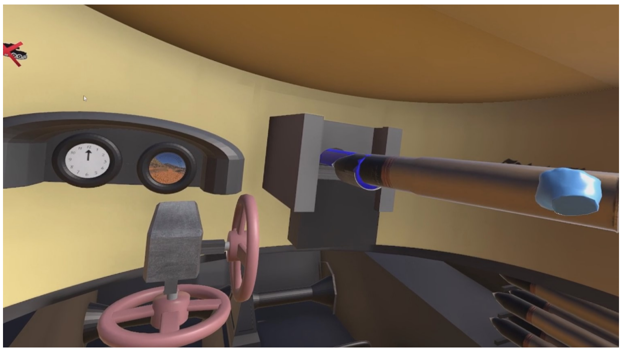

Figure 3: Grab and load shell mechanic

3.2 Solution implementation

The solution for the sight close-up is implemented with a simple interaction. In Unity, a BoxCollider is a type of collider component that defines a rectangular (box-shaped) physical boundary around an object, allowing it to detect interactions with other objects. A Rigidbody is a component that enables an object to participate in Unity's physics system, allowing it to move and respond to forces or collisions. When combined, these components allow the system to detect when physical interactions, such as a hand entering a specific area, occur in the scene. A BoxCollider with a Rigidbody is attached to the aiming device, and a corresponding BoxCollider is placed on the XR-Player's hands, as shown in Figure 4 and Figure 5. A script is applied to the aiming device to detect when either of the player's hands enters its collider. When a hand is detected, the sight immediately enlarges and moves towards the player for quick aiming.

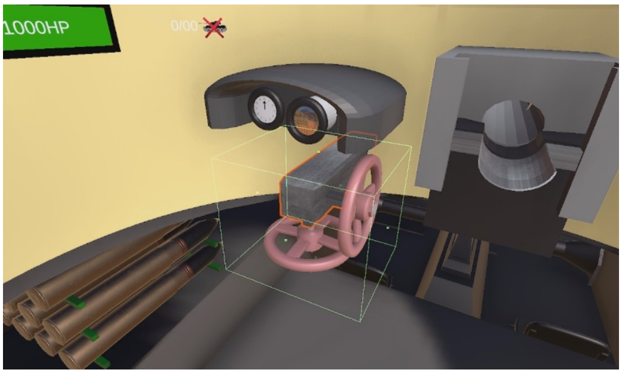

Figure 4: BoxCollider on aiming device

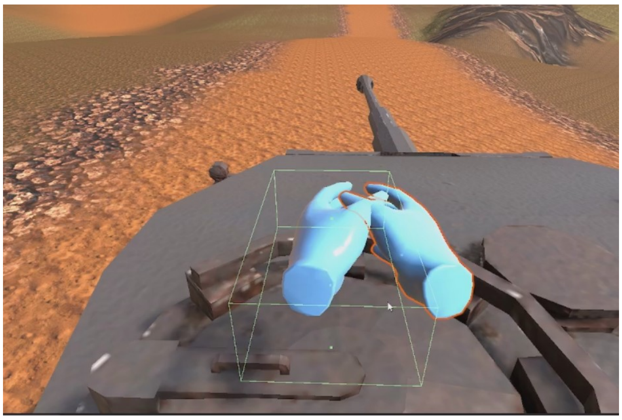

Figure 5: BoxCollider on one of the XR hands

The sight remains enlarged and in the scaled-up position as long as at least one hand stays within the collider of the aiming device. Once both hands exit the collider, the sight immediately returns to its normal size and position. The interaction between colliders is fast and without delay. As soon as the hand and aiming device colliders touch, the sight is scaled-up. This speed is important for fast reaction that the game requires from the player. For this solution no further optimization is necessary, because custom script does not create any new objects that demand a large amount of processing power. Contrarily, it only scales up and moves forward the existing sight with RenderTexture, as shown in Figure 6.

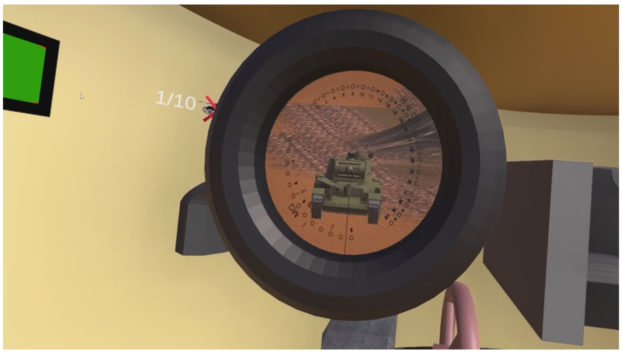

Figure 6: Enlarged sight while hands are on aiming device

4 User experience evaluation

In order to confirm improvement of the gameplay, the initial user experience evaluation was performed. The user evaluation in this study included 13 participants, consisting of both students and teaching assistants from the Department of Computer Science and Informatics at the Faculty of Electrical Engineering, University of Sarajevo, aged between 20 and 30. Among them, 7 were female and 6 were male. Demographics statistics are listed in Table 1.

Question	Response	Number (%)
Age	18-25	5 (38.5%)
	25-35	8 (61.5%)
	35+	0 (0%)
Gender	Female	7 (53.8%)
	Male	6 (46.2%)
Previous VR Experience	YES	13 (100%)
	NO	0 (0%)
Previous experience with precision shooting games in VR	YES	7 (53.8%)
	NO	6 (46.2%)

Table 1: Demographics questions overview

The VR game was set in the laboratory and presented to the participants. Participants first played the tutorial level to learn commands and to better understand mechanics of the game. After the initial tutorial of the game, participants proceeded to the first level of the original version of the game, that contained regular-sized sight device. After passing the level, they played the same level, but with sight scale-up turned on in settings. After playing both versions of the same level, participants were asked to complete the questionnaire, made in Google forms. What almost all of the participants agree of, is that the controls of the game were adequately explained to them during the tutorial in the beginning, as shown in Figure 7, where 1 represents unclear explanations, and 5 represents fully understandable explanations. All participants indicated that the close-up of the cannon sight contributed to achieving their goals in the game, as shown in Figure 8, where 1 represents it made the task harder and 5 represents it made the task easier.

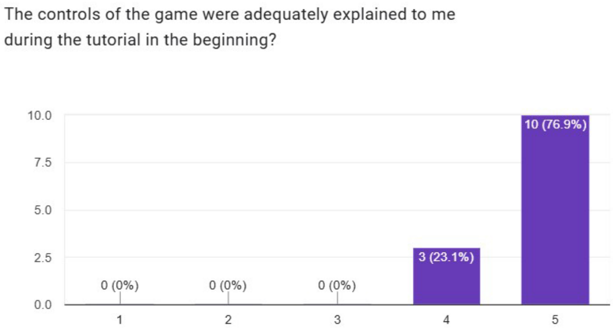

Figure 7: Frequency of responses considering ease of use

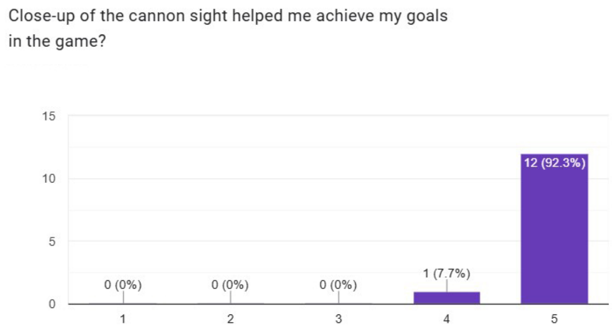

Figure 8: Frequency of responses considering help of the scaled-up sight

Out of the responses, all players preferred the version with the close-up or scope zoom option, noting that it made the game easier and more enjoyable. Many stated that the close-up feature allowed for more precise targeting, making it easier to hit enemy tanks, especially those farther away. Players with poor eyesight found the close-up cannon sight significantly improved their experience, providing a clearer view and better accuracy. The zoom feature was also praised for enhancing the field of view, helping players find enemy tanks more easily and making it easier to aim and engage targets. Some players enjoyed both versions but favored the second one slightly more, as it allowed for a closer view of enemies, improving gameplay. Overall, the close-up option and sight zoom were appreciated for making the game feel more realistic and providing better feedback, which ultimately contributed to a more accurate and satisfying experience. Despite these positive results, the evaluation is limited by the relatively small and demographically homogeneous participant sample. All participants were from the same computer science department and had prior VR experience, and it is possible that this might have influenced their adaptability and tolerance in the virtual world. This also creates generalizability issues, as the findings might not be generalizable to the experience the broader population, for example, novice users or other participants with different educational or professional backgrounds. For subsequent studies, a heterogeneous, larger sample population and a wider breakdown of participants' experience with VR, gaming habits, and eyesight would more accurately establish the broader use and applicability of the proposed feature. Also, the addition of objective performance metrics, such as hit accuracy or time-to-target, would strengthen the evaluation by supplementing subjective user ratings.

5 Conclusion

In this paper, we presented an approach for addressing the challenges posed by small sights and reticles in VR applications, with a particular focus on the VR game Tiger I - Last Defense. After implementing a scale-up solution within the game, we conducted a survey among participants, which yielded positive feedback. The results demonstrate how a simple method can effectively resolve a problem that was challenging even for players with good vision, and especially for those with poor vision, all while maintaining the game's realism. Additionally, the proposed solution is advantageous as it does not demand additional computational resources, ensuring optimal performance.

Looking ahead, future work could explore the scalability of this solution across different VR genres, such as simulation, adventure, or first-person shooters, to determine its broader applicability. Further user testing, including a more diverse participant pool, would help refine the approach to better accommodate various visual impairments and preferences. Additionally, implementing adaptive sight and reticle scaling based on real-time user feedback could create a more personalized experience. Finally, research into how other factors—such as lighting, contrast, and color—affect visibility in VR could complement this solution, offering a more comprehensive strategy for improving accessibility and user experience.

References

[1] J. Cutting and A. Candan Simsek, "Shot durations, shot classes, and the increased pace of popular movies," *Projections*, vol. 9, pp. 40–52, 12 2015.

[2] J. E. Cutting, "Narrative theory and the dynamics of popular movies," *Psychonomic bulletin & review*, vol. 23, pp. 1713–1743, 2016.

[3] R. Carpio, O. Baumann, and J. Birt, "Evaluating the viewer experience of interactive virtual reality movies," *Virtual Reality*, vol. 27, no. 4, pp. 3181–3190, 2023.

[4] Y. Sauer, A. Sipatchin, S. Wahl, and M. García García, "Assessment of consumer vr-headsets' objective and subjective field of view (fov) and its feasibility for visual field testing," *Virtual Reality*, vol. 26, no. 3, pp. 1089–1101, 2022.

[5] S. Masnadi, K. P. Pfeil, J.-V. T. Sera-Josef, and J. J. LaViola, "Field of view effect on distance perception in virtual reality," in *2021 IEEE conference on virtual reality and 3D user interfaces abstracts and workshops (VRW)*. IEEE, 2021, pp. 542–543.

[6] S. E. Chen, "Quicktime VR: An image-based approach to virtual environment navigation," in *Proceedings of the 22nd annual conference on Computer graphics and interactive techniques*, 1995, pp. 29–38.

[7] D. A. Rambli, S. Sulaiman, M. Nayan, and A. Asoruddin, "A step-wise zoom technique for exploring image-based virtual reality applications," *World Academy of Science, Engineering and Technology*, vol. 38, pp. 197–200, 2009.

[8] K. Pfeuffer, B. Mayer, D. Mardanbegi, and H. Gellersen, "Gaze+ pinch interaction in virtual reality," in *Proceedings of the 5th symposium on spatial user interaction*, 2017, pp. 99–108.

[9] A. Messaci, N. Zenati, M. Belhocine, and S. Otmane, "Zoom-fwd: Efficient technique for 3d gestual interaction with distant and occluded objects in virtual reality," *Computer Animation and Virtual Worlds*, vol. 33, 11 2021.

[10] A. Ayoub and Y. Pulijala, "The application of virtual reality and augmented reality in oral & maxillofacial surgery," *BMC Oral Health*, vol. 19, pp. 1–8, 2019.

[11] S. Bhat, K. Hareesh, A. Kamath, A. Kudva, R. Vineetha, and A. Nair, "A framework to enhance the experience of cbct data in real-time using immersive virtual reality: Impacting dental pre-surgical planning," *IEEE Access*, vol. PP, pp. 1–1, 01 2024.

[12] A. Hann, B. M. Walter, N. Mehlhase, and A. Meining, "Virtual reality in gi endoscopy: intuitive zoom for improving diagnostics and training," *Gut*, vol. 68, no. 6, pp. 957–959, 2019.

[13] L. Sastry and D. R. Boyd, "Virtual environments for engineering applications," *Virtual Reality*, vol. 3, pp. 235–244, 1998.

[14] D. Ververidis, S. Nikolopoulos, and I. Kompatsiaris, "A review of collaborative virtual reality systems for the architecture, engineering, and construction industry," *Architecture*, vol. 2, no. 3, pp. 476–496, 2022.

[15] Blender Foundation, "Blender," 2025, computer software. [Online]. Available: https://www.blender.org

[16] Unity Technologies, "XR Interaction Toolkit Documentation," 2024, accessed: 4 March 2025. [Online]. Available: https://docs.unity3d.com/Packages/com.unity.xr.interaction.toolkit@3.0/manual/index.html