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Comparing the Finnish Defence Forces indoor shooting range simulator to a virtual reality training solution

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Bachelor’s Thesis | Abstract

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Comparing the Finnish Defence Forces indoor shooting range simulator to a virtual reality solution

The Finnish Defence Forces constantly seek innovative methods and tools to train their conscript army, aiming to overcome challenges associated with expensive, dangerous, or logistically complex training sessions. This thesis presents the development and comparison of a virtual reality simulator with the existing indoor shooting range simulator utilized by the Finnish Defence Forces. The objectives of the thesis encompass the creation of a new simulator and the refinement of the gun and chair controllers employed in the virtual reality environment.

To evaluate and compare the simulators, eight conscripts, most of whom were from the virtual training environment, were surveyed to obtain their unique perspectives on the simulator usage. The findings indicate that while the indoor shooting range offers a superior shooting experience, the virtual reality simulator offers a heightened sense of immersion. Respondents also expressed a preference for conducting short-range shootings in the virtual reality environment over the indoor shooting range simulator. Participants noted that the ability to move and turn in the virtual reality simulator significantly enhanced their training experience. However, a limitation of the virtual reality solution emerged from the lack of recoil and gun feedback. The results discovered offer valuable guidance for further enhancing the virtual reality training system.

Keywords:

virtual reality, training, simulator, VR-controller

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Jarkko Kankaanpää

Suomen Puolustusvoimien sisäampumasimulaattorin vertailu virtuaalitodellisuuskoulutussimulaattorin toteutukseen

Suomen Puolustusvoimat etsivät aina uusia tapoja ja työkaluja, joilla kouluttaa uusia sotilaita, sillä koulutukset saattavat olla kalliita, vaarallisia tai työläitä toteuttaa. Tässä opinnäytetyössä luotiin uusi virtuaalitodellisuuskoulutssimulaattori ja verrattiin sitä Puolustusvoimien käytössä olevaan sisäampumasimulaattoriin. Tavoitteina oli luoda uusi simulaattori sekä uusi iteraatio simulaattorissa käytettävistä ase- ja tuoliohjaimista.

Tuotteiden vertailijoiksi otettiin virtuaalikoulutusympäristön varusmiehiä heidän simulaattoriosaamisensa vuoksi. Varusmiehien vastauksien pohjalta pystyttiin toteamaan, että vaikka sisäampumasimulaattorilla ampuminen oli parempaa, virtuaalitodellisuus loi suuremman uppoutumisen tunteen. Vastauksista myös selvisi, että lyhyiden matkojen ampumisissa olisi mieluisampaa ampua virtuaalitodellisuudessa. Vastaajat kokivat, että mahdollisuus liikkumiseen ja kääntmiseen paransi kokemusta sisäampumasimulaattoriin verrattuna. Haittana uudessa simulaattorissa vastaajat kokivat aseen rekyylin puutteen.

Asiasanat:

virtuaalitodellisuus, koulutus, simulaattori, VR-ohjain

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List of abbreviations

AR	Augmented Reality
FOV	Field of View
SAS	SAAB’s virtual gun range
VBS	Virtual Battle Space
VKY	Virtual Training Environment. Used for conscripts who work with simulators.
VR	Virtual Reality
XR	Mixed Reality

1 Introduction

Training plays a pivotal role in skill enhancement and maintenance, and within organizations like the Finnish Defence Forces, it holds significant importance for national security. Given the ever-evolving nature of technology, the Finnish Defence Forces actively seek innovative solutions and technologies for their training needs. Virtual reality (VR) has emerged as a promising tool in various training scenarios, including healthcare, construction, and safety. By creating computer-generated environments that replicate real-world situations, VR offers trainees immersive and realistic experiences that enhance learning outcomes.

The goals for this thesis were to create a Unity based virtual reality simulator, to improve the gun and chair controllers employed in the simulator, as well as to compare the new VR simulator with the indoor shooting range simulator in use.

A classroom was also adapted into a simulator room.

The thesis is structured as follows: Chapter 1 introduces the thesis. Chapter 2 goes over the background info and the previous project. Chapter 3 looks at the methodology. Chapter 4 presents pre-existing solutions on the market for controllers and simulators. Chapter 5 discusses how the VR controllers were improved and why a VR simulator was chosen. Chapter 6 delves into Unity and the work that went into the Unity project. Chapter 7 examines the findings from the conscript surveys. Chapter 8 concludes the thesis with a final evaluation.

In addition, the thesis provides a comprehensive exploration of the chair and gun controllers, examines state-of-the-art solutions, documents the process of building the Unity-based simulator, presents results from comparing the VR simulator with the existing indoor shooting simulator, discusses the chosen VR headset, and controller devices, and positions the thesis as a continuation of a previous project, showcasing its advancements in iteration 2.0.

The Intellectual property rights for this project belong to the Finnish Defence Forces.

2 Background to the current thesis project

The thesis is a continuation of a past Capstone Innovation project, known as "Soldiers VR Seat" and had roughly 10 engineering students split into three smaller focus groups: gun, chair, and game engine. The author of this thesis was assigned to the gun group but also worked with the game engine and chair groups when the gun team finished.

2.1 VR headset

Varjo Aero (Figure 1) was chosen for the high resolution it offers and the possibility for in the future to utilize the eye tracking the headset has (Varjo, 2023). Other headsets were also planned to be used instead, including Meta Quest 2, which is a wireless standalone headset (Meta, 2020), and Valve Index (Valve, 2019)

Figure 1 Varjo Aero VR headset

2.2 Chair controller

During the Soldiers VR Seat project, a VR Chair controller was made, which allowed the user to move in four directions by leaning on a balancing chair. The movement of this chair was in relation to the user was looking with the headset. The user can walk or run in a virtual world by leaning past a certain threshold.

2.3 Gun controller

The Soldiers VR Seat project also included a gun controller (Figure 2), which allowed the user to aim, shoot, and throw grenades inside of a virtual world. It was crucial that the gun controller would offer a more rigid feel than using VR controllers that often come with headsets. Functionality for the gun controller was implemented with an HTC VIVE tracker, as well as a plastic gun replica which was modified to have buttons for input.

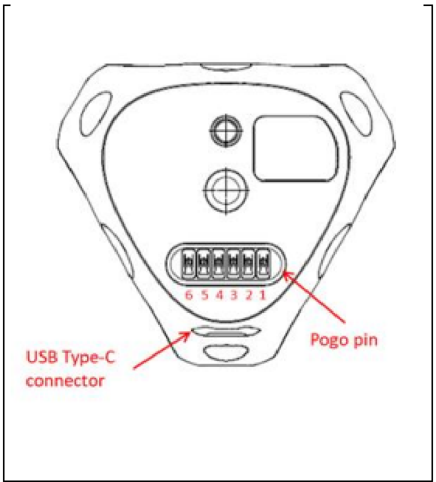
Figure 2. Capstone gun controller

2.4 Game engine

To accommodate the controllers, a game had to support them. For this it was intended to use Virtual Battle Space 4 (VBS 4), but due to lacking plugins it was not possible. Instead, a Unity shooting gallery game project was made to demonstrate both controllers' features.

2.5 Tracker

The VIVE trackers offer pogo pins (Figure 3) on the underside which can be utilized to send inputs to the game engine.



Pin no.	Type	Description
1	Digital output	General purpose output pin
2	GND	Ground
3	Digital/Power input	1. General purpose input pin: Internal pull up resistor to VDD, Active -low (Grip button) 2. Power input pin
4	Digital input	General purpose input pin: Internal pull up resistor to VDD, Active -low (Trigger button)
5	Digital input	General purpose input pin: Internal pull up resistor to VDD, Active -low (Trackpad button)
6	Digital input	General purpose input pin: Internal pull up resistor to VDD, Active -low (Menu button)

Figure 3. VIVE Tracker 3.0 pogo pins (VIVE 2021, 14)

The pogo pins were used alongside the tracking data to convert a plastic gun into a VR controller. The pogo pins allow for emulating inputs of a traditional HTC VIVE VR controller, such as "trigger", "grip", "trackpad", or "menu".

3 Methodology

The development of the new Unity simulator project was done by two engineering students, working from a base project developed during the Capstone project. In addition, help from a few virtual training environment conscripts was received for the development of the new Unity project.

Work was done over 3 months and included adapting a classroom into a demo and simulator room, creating eight sets of gun and chair controllers, and a virtual reality Unity simulator project where the users could utilize controllers. The simulator room featured eight stations, which held a laptop, a Varjo VR headset, headphones, a gun controller, and a chair controller. Each station ran an instance of the Unity project.

The newly built demo and simulator room was to be used to compare the virtual reality simulator to the indoor shooting range simulator.

The results for this thesis were acquired by surveying conscripts, of which a majority were part of the virtual training environment. For the survey, the respondents were asked to try out the indoor shooting range simulator with a close-range, far-range, and combat scenario. After the indoor shooting range, the participants would try the virtual reality simulator. The participants were given instructions on how to operate the controllers, and where to go inside of the virtual environment. To complete the virtual training environment simulator, the participants had to shoot at the shooting range (figure 13), as well as the 360-arena (figure 14). After the participants had done both, they were allowed to play out the simulator for however long they wanted to. After trying both simulators, the conscripts were asked to fill which asked for their opinion on the usability of both simulators, as well as to compare specific features, properties, and scenarios between the two simulators.

4 Existing solutions

4.1 The Indoor shooting range simulator

The indoor shooting range simulator is a virtual gun range simulator created by SAAB. The simulator features replica weapons with close-to-real-life virtual environments (SAAB, 2023). The indoor shooting range simulator which was used in this thesis featured three different gun replicas, a gas-powered pistol, a gas powered RK 62 with recoil, and a compressed air powered single use rocket launcher. The simulator itself runs on a computer and is projected onto a white screen. The guns feature lasers, that a tracking camera records. It then relays that information to the simulator.

The simulator itself simulates ballistics, wind, and weather conditions and provides a breakdown of your latest shooting results by utilizing data from the sensors on the gun, the camera, and the simulator. The SAS also provides instructor tools to create scenarios and easily adjust the weather conditions (SAAB, 2023.)

4.2 Gun solutions pre-text

While VR gun controllers are not new in the VR markets, most VR gun controllers lack in certain fields, such as weight, shape, feel, what weapon it is based on or button location. The gun controller gets its ideas from VR gun stocks (Figure 4) which are generally not based on any gun, VR controller mods (Figure 5) which utilize the controller and can be based on certain guns for shape and feel, and fully custom controllers (Figure 6) which can either be based on real guns or made-up guns but often feature custom buttons and triggers. Our gun controller ended up mostly resembling a custom controller based on a real gun, as an airsoft gun resembling the RK 95 TP was used as the base.

4.3 Different types of gun solutions

Figure 4. Sanlaki VR Gunstock (Sanlaki, 2023)

VR gun stocks often use the controllers with clips, or magnets, and provide a skeleton style solution to the rigidness for the gun. These often lack in shape, weight and function however. Reloading is often done by unclipping the controllers and doing a reloading motion as instructed in the game, or via a button press on a controller.

Figure 5. HelloReal SNOWFOX PRO (HelloReal, 2023)

Controller mods get closer in terms of shape and weight, but can lack in functionality still. Usually the trigger of the controller is used, which can still lack a certain level of resistance. Reloading is often intended to be done with a button press,automatically, or by a certain gesture or wave of the controller.

Figure 6. PPGUN (PPGUN, 2023)

Custom controllers like these often utilize an HTC VIVE tracker type technology. These can come with desired shape, weight, and functionality. Reloading is often done using a detachable magazine, and the trigger might have more resistance to it. Controllers like these often include extra buttons for menu prompts, and possibly joysticks for movement as well.

The main requirement for the gun controller was that it had to be the only controller in the players hands, that meant no second controller that the player utilizes for menu items. It also meant that we needed to get more than just the trigger action on the gun. Reloading plays an important part in gun feel, which meant that reloading had to be done by the user with the controller, not by having the game do it automatically. Gun safety plays an important part when it comes to military action, so the safety switch needed to work as well, or at least exist to build muscle memory. The commissioner also wanted to keep the extra button from Capstone on the side of the foregrip for some utility such as grenades or flashlights. We used an airsoft gun similar in shape and size to the RK 95 TP as a base and implemented a VR tracker into it to utilize it in Unity and Virtual reality. In total we had three inputs, trigger, reload, and the extra button, as well as a mechanical safety switch from the airsoft gun that prevented the trigger from being used while the safety is on.

4.4 Companies that provide Virtual Reality training solutions

There are companies that provide VR training as part of their business model, in Finland companies like ADE are working on creating training simulators for skills such as fire extinguishers, trucks, forklifts, cranes, and nursing. ADE uses VR in their training including custom VR controllers such as a fire extinguisher controller (Figure 7) and replicating controller setups with things like steering wheels. (ADE Oy 2023.)

Figure 7. ADE fire extinguisher controller (Ade, 2023)

Other companies like Tenstar simulation also provide virtual reality training solutions for fields such as Construction, transportation, and agriculture. Tenstar simulation offers a wide range of vehicle simulators (Tenstar, 2023).

5 VR simulator

One of the goals was to improve the gun and chair controllers from the state they were in during Capstone. Another goal was to build multiple sets of them.

A total of 8 improved controller sets were built during the thesis to work with the VR simulator built.

5.1 Why a VR simulator was chosen

Virtual reality simulators offer the opportunity to train on scenarios that can be difficult, expensive, or dangerous to be arranged in physical configurations. Immersion helps with procedural learning in training scenarios (Morélot et al., 2021). Virtual reality alongside virtual avatars offers the potential for greater immersion. (Braun et al., 2022, 407.) In the field of healthcare virtual reality is used to train novices with procedures where opportunities to practice are insufficient (Zhou et al. 2022). In construction and maintenance, it has been used to safely train and improve workers' knowledge and skills (Adami et al., 2021). Although VR promises a lot of benefits for training, there are multiple barriers that continue to hinder real-world applications still (Zhang et al., 2022)

Virtual reality as a technology is still growing and full of innovative ideas. While the Finnish Defence Forces current indoor shooting range is being used actively, a VR solution could offer benefits that the current SAS does not. SAS offers great metrics for shooting, as one of its main purposes is to get training data to improve shooting, however VR could offer a training experience more similar to what you would get out in the field, as with it one could practice on things such as movement, shooting, where to look, and could provide trainers with live data that can be hard to get in the field, such as eye tracking, bullets in the magazine, position information, and information on where each gun is pointed. Simulators are already widely in use by aviation, land transportation, and maritime industry, both in civil and in military use. Military troops also have different simulators in the Finnish Defence Forces. One of the most used simulators in the Finnish Defence Forces is known as Virtual Battle Space 4, which is operated using keyboard and mouse.

A VR simulator, or any simulator for that matter will probably never fully replace first-hand experience, but utilizing a training tool such as virtual reality together with real experience increases the efficiency of training.

5.2 Improvements to the controllers

The main improvement for the chair controller was to make it move in the direction of the chair, and not the way the player is looking as we felt this improves the intuitiveness of the movement and seemed to not cause as much motion sickness. The 16 possible movement states from the Capstone chair were changed to be a more fluid and dynamic system, which would look at the rotation of the chair, and move the player based on that. This was achieved by attaching a VIVE tracker to the chair controller (Figure 8) and updating the code inside of the Unity project. The tracker gives both rotation and position data, which were used in determining the movement direction, as well as movement speed.

Figure 8. Improved chair controller.

For the gun controller the main improvements were to make it more sturdy, reliable, slightly heavier and to hide wires inside of the gun. A lot of this was done by changing the solid plastic base from Capstone with an airsoft gun (Figure 9).

Figure 9. Improved gun controller.

Reloading was done with two different approaches, on some of the guns a magnetic switch was used, and a magnet was attached to the magazine to detect when the magazine in place. The idea behind the magnetic switches was that it would be a contactless solution, increasing the longevity of the switch, but it was deemed that because the switches themselves are fragile glass tubes which a few of were broken during the building process, it would probably be better to have a simple microswitch that can easily be swapped without resoldering later if it breaks using a simple solution such as jump wires. The rest of the guns had a microswitch in the magazine well that would be actuated by the magazine pressing against it (Figure 10).

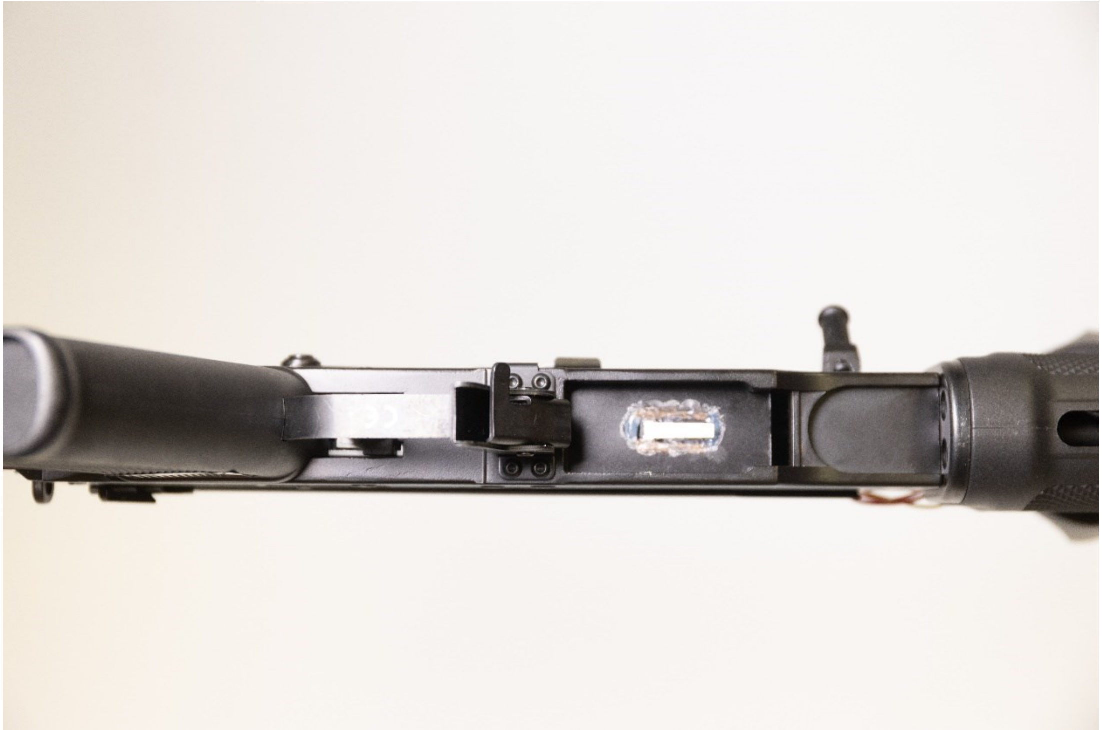


Figure 10. Magazine switch.

Other ideas such as proximity sensors and light sensors were also thought of, but decided that for a proof of concept, the simpler solution of using a switch would be better.

The grenade button was also integrated more fluently into the gun (Figure 11).

Figure 11. Grenade button and VIVE tracker

6 Unity

6.1 What is Unity?

Unity is a game engine created by Unity Technologies. As an engine Unity is most used in the games industry but can also be used in the creation of automotive, digital twin, engineering, film, architecture, construction, and military projects (Unity 2023). In the context of this thesis, Unity was used to make a VR simulator proof of concept game.

For this thesis the choice of engine was between Unity and Unreal engine 5. Both offer VR support, but in the end, Unity was chosen for two reasons: Previous knowledge with Unity as a developer, and as per the commissioner's request. This ended up being a positive as we could work off the Capstone project instead of starting from scratch.

Using unreal engine 5 would have allowed us to more easily make a

6.2 Project requirements.

For the unity portion of this project, we decided to use the Capstone project as a base as it would provide us with the basic functionalities to expand from. There were certain requirements that still had to be implemented into the project both for the requirements of the thesis, and for the requirements that the project commissioner had. The commissioner also made the request that the project should have multiplayer functionality implemented.

In the Unity scene we wanted certain things that the players can do with their controllers and VR headset. The main requirement in terms of gameplay was that the player must move to a location using the chair controller, and when they arrive at the location, they have targets they can shoot at using the gun controller. We also wanted a location where the player would have to physically turn to search for and to destroy targets, even if sitting still.

6.3 What was done in Unity

The Capstone project that was used as a base had an outdated VR plugin, the first steps we did was to update said plugin, and Unity editor version.

The VR functionality was updated from the old SteamVR plugin to the newer OpenXR plugin, which gave us the functionality we required for the headset to work in Unity. OpenXR also had support for more recent versions of Unity compared to SteamVR. The SteamVR hub was still used though as it is a central tool for most VR headsets. Varjo Aero still uses SteamVR as a hub, but we stopped using the SteamVR unity plugin. The two share the same name so from now on, SteamVR refers to the VR hub tool, not the plugin.

We also have the old gun and chair controllers' functionalities which were not changed much from the Capstone state. For the gun Unity functionality, the grenade from Capstone was changed to a flashlight, and the shooting was synced to multiplayer with Mirror. For the gun controller, SteamVR's tracker management was used, where you can give each input of the tracker an action that unity can read. These inputs come from the pogo pins underneath the tracker, wired to the buttons on the gun. These were largely left the same from the Capstone setup, although the naming was changed slightly to be more up to date.

For the chair, we used the location and rotation from the newly attached tracker and dropped the functionality of the accelerometer and gyroscope. This also meant that we needed to rewrite the chair movement code, which meant we could update the restricted 8 direction movement with a more fluid and dynamic system. While re-doing the code, we got rid of the two speed settings and made the speed be tied to how much the chair is tilted. The rotation of the tracker was mainly utilized to figure out when the chair is tilted and where it's tilted towards. That way we can move the player in the direction of the chair, at the right speed, as opposed to moving it in the direction of the headset at set speeds.

6.4 New Environment

Alongside updating the functionality of the gun and chair controllers, the environment was updated to have higher graphical fidelity and be more open to exploration. The environment was done using Blender, a free open-source 3d modeling software. Alongside the update space was also left for possible future project expansions as well. The new environment has new shooting range as one of its main locations (figure 12), as well as a wooden box arena that was nicknamed as the 360-arena. The main shooting range has three targets, one close, one at the middle, and one far that the players can shoot at.

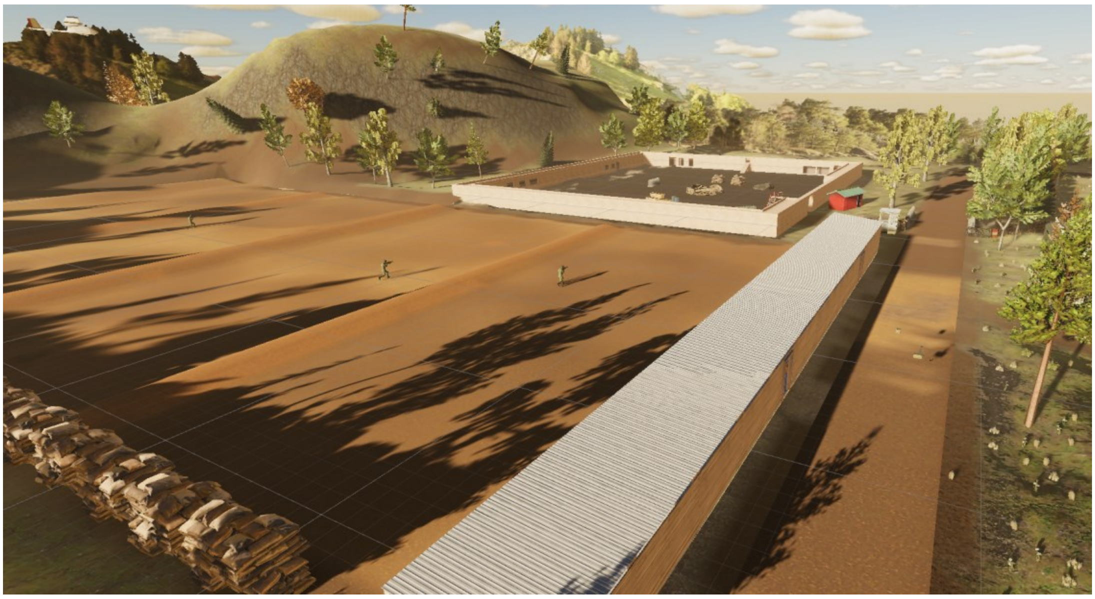


Figure 12. Unity scene main area

With this new environment, the requirements for the player are fulfilled as the player must move to an area where there are targets. The player can then shoot at the targets using the gun controller at either the shooting range (figure 13) or the 360-arena (figure 14).

Figure 13. View of the shooting range

The 360-arena has targets spawning from around the arena, and then approaching the central platform (figure 14). The targets will spawn at the ends of the path and move alongside the path. The targets spawn every 3 seconds, which seemed to be a good amount of time for both one player testing as well as two players.

Figure 14. 360-arena with target paths visible

The targets in this environment will be destroyed by a single bullet no matter where it hits. The gun also does not have accurate ballistics and instead is a laser that checks for collision.

6.5 Mirror multiplayer

The multiplayer was done using Mirror, a free open-source networking library for Unity (Mirror 2023.). We decided against using dedicated servers and instead would host from one of the VR laptops, as hosting a session is lightweight enough to run alongside the VR client of the project. For the multiplayer portion we decided to synchronize the location of the player, guns, and targets. The guns shooting would be synchronized as well, as the targets should be destroyed on all clients simultaneously. Validating things like ammo was not done as it was deemed unlikely that someone would use fraudulent data during a military training session. This means that the project’s multiplayer has no anti-cheat of any kind other than what protection Mirror might provide.

7 Results

7.1 Results info

For this thesis Conscripts, most of whom were from the virtual training environment (VKY) were asked to compare this new virtual reality proof of concept with the indoor shooting range simulator (SAS) in terms of usability as well as specific features. These virtual training environment conscripts have experience with the indoor shooting range simulator, as they help run training sessions with it, as well as create scenarios for said training sessions. This gives them the unique perspective of being the ones being trained, the ones training, as well as the ones maintaining the simulator space. It should be known that while it is possible to develop scenarios for the indoor shooting range simulator, developing new tools and guns for it are not possible by the conscripts and instead must go through SAAB.

7.2 SUS score

To begin with, I asked the respondents to answer a System Usability Scale (SUS) questionnaire for both the SAS and the VR. There were 7 VKY Conscripts who responded and one non-VKY conscript within this group.

The SUS questionnaire is a quick and dirty way of measuring usability (John Brooke, 1995).

The SUS score results ended up quite close and both ended up getting a good grade. The SAS got a score of 76.6 average, highest individual score was 92.5 and lowest was 72.5. The median for SAS was 77.5. The VR solution got a score of 73,4 average, highest individual score was 95.0 and lowest was 35.0. The median for VR was 75.0 (Figure 15)

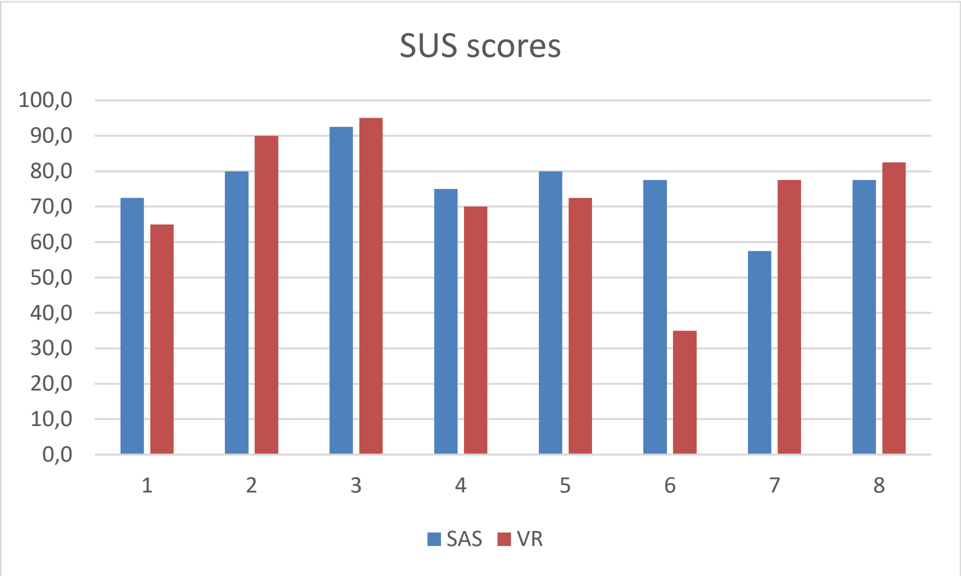


Figure 15. SUS Scores

7.3 Feature comparison

The respondents were also asked to compare specific features between simulators. The first questions were about how the gun feels to use (Figure 16).

Based on the answers the respondents gave, SAS has more realistic gun controllers by some margin.

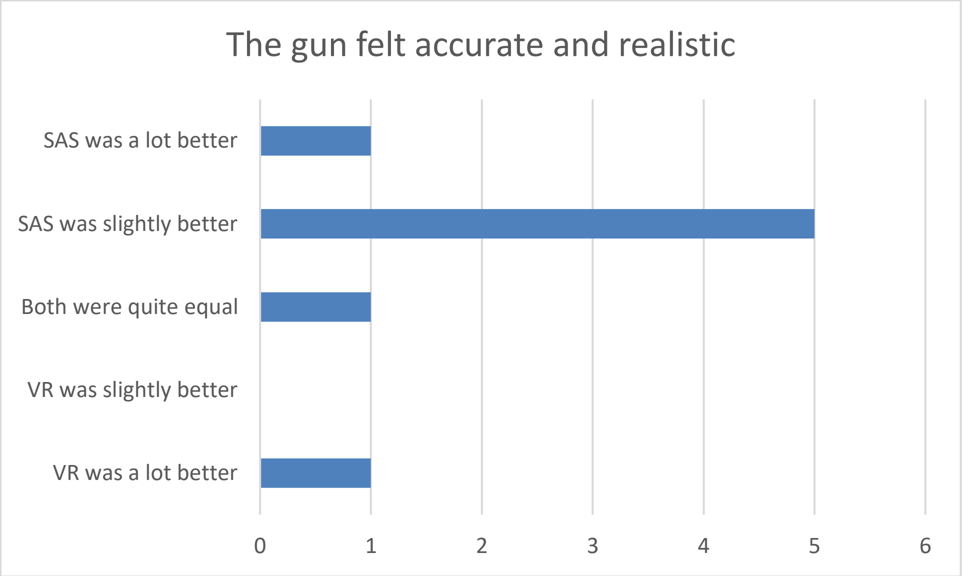


Figure 16. Realistic gun feel results

SAS also seemed to give a better shooting experience to the respondents. (Figure 17).

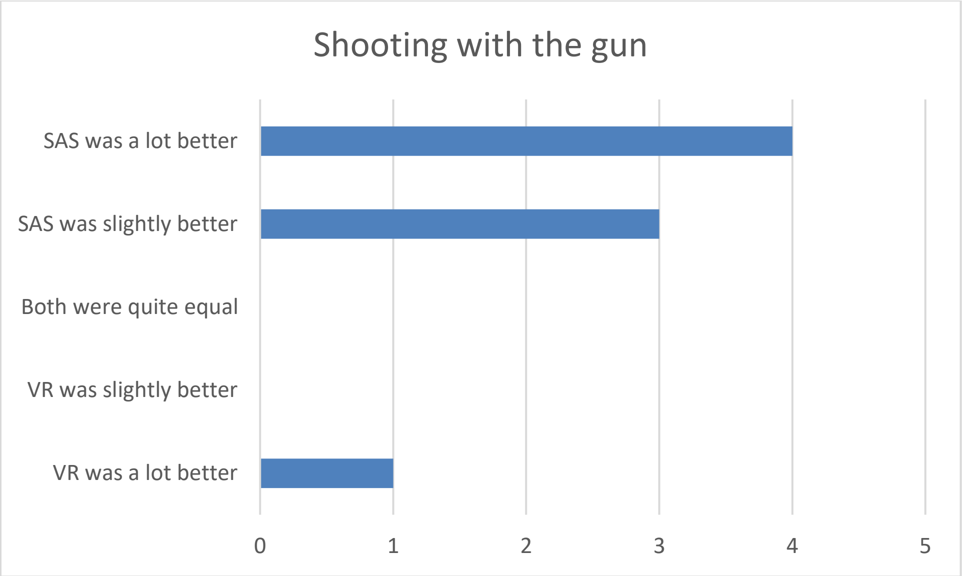


Figure 17. Gun shooting experience results

The next question had to do with how immersive the simulator environments were. To this question all respondents sided with VR being slightly, or a lot better (Figure 18).

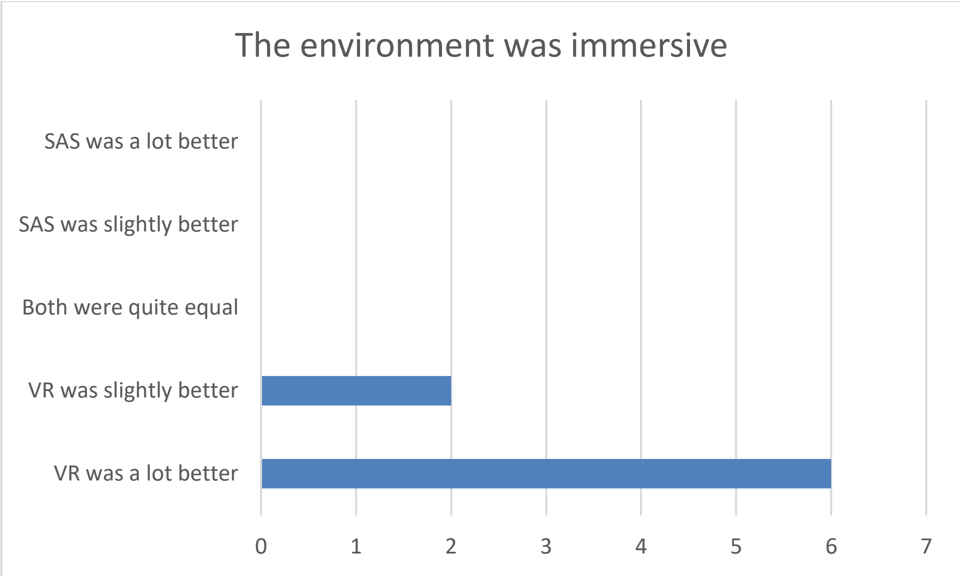


Figure 18. Immersive environment results

The next set of questions was about the movement and ability to turn around in VR. This question was important since in SAS the user is standing, crouching, or laying on a single spot, and is always looking towards the projection screen in front. The thought behind this set of questions was that in a real-life situation, the enemy wouldn't just be in the front, but could come from any direction. In this question the 360-arena played a crucial role, as the player must move to the arena, and then rotate around looking for the targets.

While the respondents somewhat thought that movement was an improvement (Figure 19), a large majority strongly thought that the ability to look around was an improvement (Figure 20).

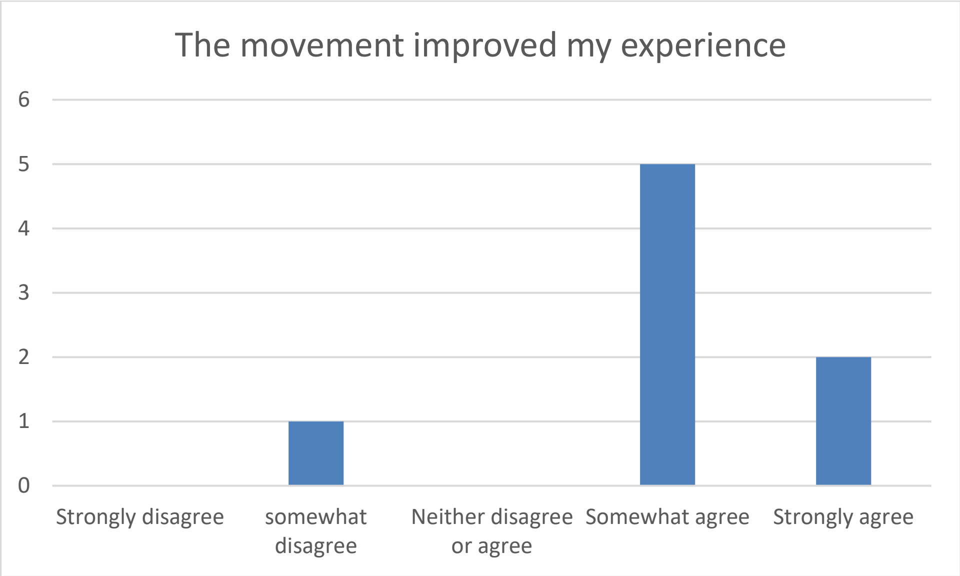


Figure 19. Movement results

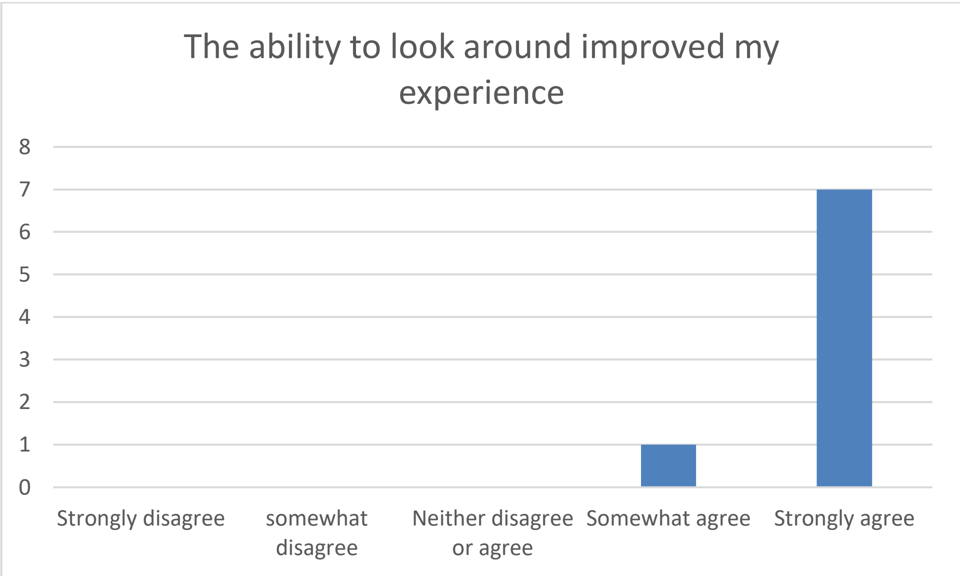


Figure 20. Turning results

As most of the respondents answered that SAS gave them a better shooting experience, a further question was added regarding recoil.

8 Conclusions

The thesis aimed to achieve several goals: developing a new Unity-based virtual reality simulator, creating an improved iteration of the gun and chair controllers, and comparing the new simulator with the current indoor shooting range simulator used by the Finnish Defence Forces

To compare the simulators, a survey was conducted among eight conscripts who tested both systems, with most of the respondents being virtual training environment conscripts. The results strongly suggest that virtual reality has potential as a training tool in the Finnish Defence Forces. Although the current iteration of the VR simulator has limitations compared to field training and the existing state-of-the-art solution, there is room for further development. Despite its limitations, respondents rated the VR experience as competitive or superior in certain aspects compared to the indoor shooting range simulator.

While the idea of transitioning from a one-directional training tool to a 360-degree tool may be appealing, it may not be suitable for every scenario. The indoor shooting range simulator provides data that the VR solution currently lacks, but at the same time, the VR training solution offers unique features that would require substantial redesigning of the entire simulator to be achieved by the SAS.

The current virtual reality project serves as a proof of concept for a Unity-based simulator that can be expanded to include different gun setups and loadouts. Simulators offer cost-saving benefits by reducing material losses such as bullets and fuel. However, achieving realistic ballistics remains an important goal for the simulator's development. Presently the VR simulator does not provide the same level of realism in ballistics as the SAS. Nevertheless, the addition of movement in the VR simulator enables the creation of training scenarios that were previously impractical due to SAS limitations.

One drawback of the controllers is the issue of wiring. The modified airsoft guns used as gun controllers, fitted with HTC VIVE trackers, experienced problems with loose wiring. This issue can be addressed by iterating on the 3D-printed piece connecting the tracker to the gun. Additionally, the ability to turn in the VR simulator can cause headset cables to coil up, resulting in used discomfort. Implementing a cable management system within a dedicated station can alleviate this problem.

The next steps for developing the controllers should be to implement some type of haptic feedback to the user when they fire the gun. Possible recoil system implementation is another important feature that still requires development. A gas-powered recoil system is a possibility but requires safety precautions to be thought of. Although recoil is an important field, having something like a rumble motor activated when the trigger has been pulled, like how traditional gamepad controllers do it, could likely improve the user experience.

Also improving the simulator to include more realistic ballistic simulations and weather conditions can provide more realistic training scenarios, possibly resulting in better training data.

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