

# Game Lab I Project - The Sorcerer VR

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**Abstract**—The Sorcerer VR is a virtual reality game developed for Meta Quest 2 in the time span of a year. It features a gesture based magic combat system with a quest driven story. This paper gives insights on the design process and thoughts about multiple game mechanics which are used in the final product. A discussion about playtest results is included at the end.

## I. INTRODUCTION

In the first two semesters we as students of the course "Games Engineering" were tasked to design and develop a game of our liking. At the start of the project we were tasked to write a report about the games concept and should highlight potentially complicated systems. This helped immensely with setting priorities for the first prototype. One of the assessed difficulties was the key mechanic for the planned virtual reality (VR) spellcasting game in which the player needs to draw a pattern like a circle, triangle or some other customizable pattern in order to cast a spell successfully. The second target which was formulated very early on is to use no traditional point and click interfaces where the player has to point a cursor on a two dimensional plane and click with a button on the controller. With the essential components of the game prototyped work began on getting a proper render pipeline working on the Meta Quest 2 and lighting the scene cost efficiently. This turned out to be one of the harder challenges of the development process. The finished game is the result of many hours of work, one expert playtest with Henrik Tietjens and Marvin Thäns and multiple playtests with my fellow students.

## II. RELATED WORK

### A. *Blade and Sorcery*

1) *Combat and virtual reality*: Blade and Sorcery [1] is a VR sandbox game where the name says it all. You fight enemies in waves or a procedural dungeon with magic and melee weapons. The game is counted as one of virtual reality's classic games. The idea for casting magic has definitely originated from Blade and Sorcery for The Sorcerer VR. But the project should not be a clone of an existing game and that is why the casting system needed to be different as I find the interaction system unenjoyable. Just pressing a button in order to cast a spell is neither fun nor challenging.

2) *Level design*: Blade and Sorcery also is a source of inspiration for much of the level design. Especially the way how rooms generate in the procedural dungeon system. You have to finish the current room to advance to the next one. And if a room is entered too hastily, death is almost certain. The levels are divided in corridors where there are a maximum of two to three enemies. And in bigger rooms there are somewhere around eight to twelve enemies. This makes for a welcome change between fast and slower paced gameplay.

### B. *Escape from Tarkov*

Escape from Tarkov [2] features a quest system which makes the game really unique in its category because it has certain quests force you to play on a specific map. In The Sorcerer VR quests are designed in the same way. The deploy and retrieve system where the player selects a map, deploys to it and can only come back when exiting through an extraction site. And the final and last mechanic is the full loot system where the player drops all their belongings on death. If the player dies while on a mission in a level he or she will lose all quest relevant items and will have to restart the mission.

### C. *Research project 13<sup>th</sup> grade*

I started working on the topic of gesture recognition using the given sensor data of VR devices at the beginning of the 13th grade in school. In that paper I explored the possibilities of using AI for classifying gestures based on the translation of the controllers of a VR device. I drew the conclusion that using AI models was far too slow if it should run locally and with a refresh rate upwards of 90Hz. This year the gesture system advanced from using the k nearest neighbour (kNN) approach to using dynamic time warping (DTW) as it has far less problems with dirty data. Dirty data means for example no part of the gesture at the beginning or end of the recorded data.

### D. *Gorn*

The user interface of Gorn [3] is achieved with physical buttons and no point and click interfaces. This is a far better experience. 2D user interfaces were just ported from flat screen devices like phones and computers to VR and are not intuitive inside a three dimensional space. This design philosophy is used in the whole game.

### III. METHODOLOGY

#### A. Magic system

1) *Setup*: The magic system consists of two phases. In the setup phase the player can assign a maximum of two spells to a hand and assign a gesture to each spell for each hand. Spells are generally handled as a grabbable items which can be put into physical spell slots for the right and left hand.

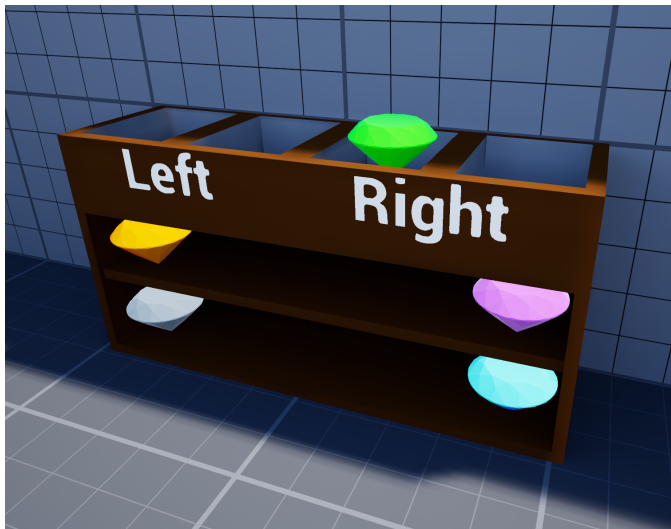


Fig. 1. Staff configurator where the regeneration spell is equipped on the right hand

This is a result of the no interface philosophy described earlier on.

2) *Spell types*: Spell types:

a) *Fireball*: It is the only damage inflicting spell and a projectile. Projectiles have a lock on feature if an enemy is within the player's view cone. If an enemy is further away than six metres from the player's head the spell will fly into the direction where the player is currently looking.

b) *Lightning spell*: The lightning spell is also a projectile but does not inflict any damage. It is one of two movement interruption spells. When an enemy is hit by this spell they get dizzy for seven seconds. This gives the player a time frame to heal him or herself and place a shield before the enemy comes back to its senses.

c) *Forcepush*: Its main feature is that it teleports enemies away from the player. In case of encirclement this gets especially helpful or for interrupting an enemies attack cycle.

d) *Mana shield*: When cast it spawns a shield which acts like a wall standing around in the world. It has four hits to kill and a lifetime of ten seconds which makes it ideal to protect the player from incoming projectiles.

e) *Regeneration*: This is the only way to regenerate health inside of a raid. The health regeneration lasts for 6 seconds and regenerates 2 hits on the players health bar with  $\frac{1}{3}$  of one hit per second.

#### B. Player

1) *Health*: The player has ten hits to kill. This means the player can only take 10 fireballs until he or she dies. As already discussed in the magic section, regeneration spells can regenerate two of those hits over seven seconds. Before the playtest there was also a heal spell which instantly regenerated 2 hits to kill. The problem with that spell was that it made heal spamming possible. This increased the shield usage in the playtests after the change.

2) *Movement speed*: At the beginning of the development the movement speed was left at the default value of  $5\frac{m}{s}$  which was fine for testing purposes. When the expert playtest came it was described as being too fast and motion sickness inducing. After that it got reduced to  $3\frac{m}{s}$ .

3) *Inverse kinematics*: Floating hands in VR games usually look bad. That is why The Sorcerer VR was supposed to include at least an upper body. This turned out to be problematic because it occluded objects which were in the lower parts of shelves and boxes. In the final version the player has arms up to his or her shoulders which heighten the immersion considerably.

4) *Player camera*: The game uses the forward shading model which enables complex lighting and shader effects compared to the much faster vulkan rendering pipeline. Another implemented feature is Dynamic fixed foveation. This flattens out performance spikes by downsampling the area around the centre of the rendered image. This makes for an almost lag free experience. The complex lighting effects can create some really dark and spooky areas. In such areas a headlamp activates automatically so that the player is not completely blind.

5) *Movement Modes*: The player has two different movement sets. You can either control your character with the left joystick or teleporting and look around using snapturn or turning your head. Teleporting and snapturn were implemented as a measure to decrease the amount of people who are affected by motion sickness through the default movement options. Early in the development cycle a jump functionality existed as the games concept was still a lot faster paced. After the first play test were conducted the jump was removed in order to have a slower and more deliberate combat experience and reduce motion sickness potential for players.

#### C. Quest system

1) *Game loop frame*: The quest system acts as the main frame for the gameplay loop. The gameplay loop begins with the player accepting a quest in the game's hub area. After accepting a quest the guild master explains what the quest is about and a little bit about its backstory. Quests dialogues are skippable by attacking the guild master with any offensive spell so when the player is not interested in the story he or she can just start with the mission.

2) *Story*: The player is in an apocalyptic world where he or she registers at the mercenaries guild office which is an organisation focused on helping settlements keeping their infrastructure running. So when bandits come and plunder the

local grain storage it is your duty to go out into fortified supermarkets to retrieve supplies from them. Mostly by brute force.

#### D. Inventory and Items

The players inventory is the central unit where all loot from a raid gets stored. Therefore the player has two inventories. One for during the raid that acts as a kind of backpack and one that acts as a persistent storage unit. Dying with loot in the backpack means loosing all of the backpacks contents. This motivates the player to play a lot more defensive as the whole progress is on the line. There is also always the possibility of leaving a raid after each cleared section.

#### E. Level design

1) *General design:* All quests are almost always tied to a level. Especially if they have a loot table because loot is scattered randomly on so-called loot spawners. They can come in the form of a shelf or a freezer depending on which section of the map the player is at.

2) *Visual design:* Levels are generally built in a linear manner with a few branches which are dead ends to break up the structure of the levels. The rooms interior is positioned out of the players direct line of sight from the door as this gives the player a quick overview of the room. If a player can't instantly see a certain location in the room it is either a different section of the room or it is a point of interest. There are doors which are protected by enemies. Those doors only open when the guards are killed which prevents the player from rushing through a level and forces them to fight the enemies. This further improves how players go about using strategic planning to their advantage.

3) *Stair vs. Elevator:* Most multi story buildings in the game are connected via an elevator which essentially acts like a teleporter between the stories. This design choice was made as the default implementation of walking up stairs is a horizontal and vertical linear motion which feels really disorienting and induces motion sickness. This made the solution of a teleporter system really obvious. One problem arising from this is the loss of orientation relative to the lower floor. Light shafts or larger open areas over multiple stories like in the guild office are a great way to give the player an anchor point for their sense of orientation.

4) *Lighting:* The lighting is mostly baked onto lightmaps and there are almost no dynamic light sources. The baked lighting is raytraced baked lighting which enables fully dark areas and accurate shadows. Rooms featuring such lighting are only placed in optional parts of the level so the player is not forced to visit them. As described in the player a headlamp activates when on entering a dark room. This adds one additional challenge for the player to work with and makes the level more interesting.

5) *Player guiding:* The player is guided by different types of hints. The auditory narrator in the background of the tutorial tells the player how to play the game and where to go next. Similar to the narrator there is also the guild master

who tells you about the backstories of quests and the tasks at hand.

#### F. Assets

All 3D models have been made from scratch and in a low poly aesthetic for this project and only coloured with two different colour maps. One for assets with a natural aspect such as plants and one for all buildings and furniture. This gives the game a distinctive and consistent look. The meshes have almost no detail textures as this is simply out of scope and looks bad when not done consistently throughout the project. The players' hands are an exception to the low poly rule as they are on screen all the time and the rounder version of the players hands proved to be more pleasant to look at for longer durations than low poly gloves. Level of detail is present on very few meshes as they are already in a form where the highest density meshes are at a maximum of  $\approx$  two thousand. There is also the reason that the level are small and objects get occluded by Round Robin Occlusion which further reduces the polys in the viewport. The Sorcerer VR has a lot of meshes which are placable in grids which increases the reusability of said assets. Levels are built on the same grid that the floor is only allowed to exist in full metres. Most lightmaps, especially the ones with important lighting features, are made within blender to ensure a higher lightmap density using a plugin called UV-Packer [?] as bigger surfaces have too small areas on the light map with the native unreal engine lightmap generation algorithm. All animations and skinned meshes (former Skeletal Meshes) are sourced from asset packs or the vr expansion plugin example.

#### G. Enemies

1) *Enemy placement:* Enemies are scattered in levels where quests can be completed. They are always placed so that the view / trigger cones do not overlap with the door frame of entry. This opens up the possibility for the player to take a peek into the room without the enemies instantly starting to chase after the player. This allows for planning and strategic decision making on whom to attack first.

2) *Balancing:* As mentioned earlier, health is balanced around hits to kill. As enemies don't have the means to regenerate health the hits to kill stays fixed. A second parameter is the enemies movement speed because it allows the player to run away on the easier difficulties. This is not possible in the harder difficulties.

TABLE I  
BALANCING

Enemy Level	Stats	
	Hits to kill	Movement speed % relative to Player
Easy	3	50
Medium	7	100
Hard	16	166

3) *No melee combat*: VR melee games are a popular category where only a few good games exist. But that is not without reason. Getting physics systems to behave in a way that makes for good melee combat is possible but a hard thing to do and most of the time combat ends up being a flailing motion instead of hard or fast deliberate strikes. To prevent having to work on physics systems as one single developer and with a buggy unreal engine chaos module The Sorcerer VR only features ranged enemies.

4) *No movement while attacking*: Enemies do not move while attacking as this is really annoying behaviour. As the player does not only have to focus on getting the spells correct but also on keeping his orientation facing the enemy which is not a necessary roadblock in the difficulty of the game.

5) *Spell types*: Enemies are only casting two different types of spells. The fireball, their only offensive spell and the mana shield, their only defensive spell. A heal spell for enemies would only mess up the balancing as there are no real means of interrupting the enemy and it voids progress the player has already made in a fight which can lead to frustration. The force push is also out of question as it would be motion sickness inducing and therefore it has no benefits for the player. And finally the lightning sphere would be a bad choice as well as it is a spell which limits movement and would only be annoying to deal with instead of an additional challenge.

6) *Behaviour*: Enemies have two different states. Their default state is an idle state where they stare off into the distance. When the player either walks into their vision cone or attacks them they change from idle to aggressive where they will follow the player up to a certain range and start attacking when inside of that range. Before actually firing a spell the enemy will first check if the player is actually in line of sight and did not just move behind a barricade. If that check fails it will restart and try to move to the player. If the player is not inside of its view cone but still in its attack range it will start turning towards him or her. When all of those tests succeed an animation will be played to let the player know of the enemy attacking and then the spell will be spawned. If the enemy is too close to a wall the spell won't be spawned.

#### IV. RESULTS

A normal playthrough would start in the tutorial where the player would encounter their first challenge. Setting up gestures is not an easy feat as it requires multiple actions back to back before one can successfully cast their first spell. This often proved to be quite challenging as there are no similar systems the user can draw experience from. With the first few successful casts the player would move to the guild office where the first quest would be received. This would either result in confusion when the player did not listen to the guild master explaining how to interact with the present systems or just fine behaviour. When entering the first quest the player is tasked to repeat what he or she learned in the tutorial by collecting five items and defeating at least one enemy. The first enemy is often a bit of a surprise because the dummies inside

the tutorial would remain static and do not defend themselves. Contrary to that, the tutorial enemy would just start attacking.

#### V. DISCUSSION

The playtests were an important tool for measuring how well the intended purposes for the implemented systems were conveyed to the player. By starting with the tutorial the player would have a gradually increasing difficulty where they would get to know the basic game mechanics. Having a narrator and therefore less text to read often helped the players with understanding what to do and keeping the visual load down. This newly gained knowledge is essential in the following quest as it will get put to the test. The player is only told the names of the spells which often leads to them only using the fireball which is the only damage inflicting spell in the game. But this play style mostly changes with the player attempting harder missions as playing without a shield and a stun is almost certain recipe for failure. There were some cases where players with a higher tolerance to motion sickness were able to dodge the enemies projectiles instead of blocking them via a shield spell. This strategy was only proven to be viable on easy and medium difficulties.

#### VI. CONCLUSION

The Sorcerer VR is a game for Meta Quest 2 which features a working combat, inventory and gesture based spellcasting system with a small story surrounding the game. The player learns the mechanics during the tutorial and gets to repeat what they learned during their first guided mission. After that they are free to accept any quest they want. Having no point and click interfaces proved to be quite the success as there were no complaints about inputs being too small or the player not being able to read certain passages. A second welcomed side effect of no interfaces is a more streamlined and intuitive interaction system.

#### VII. FUTURE WORK

The next steps would be letting the player add two gestures for each magic spell in order to increase the accuracy as this is currently one of the weak points of the game. Another addition would be increasing the detail density in some levels as there are areas which can look a bit plain. Another feature which did not make it into the final submission due to my feature freeze a week before submission is a system to deal with the loot which is left over after a quest. Plans are to use them as fuel for healing spells so the player gets almost forced to use the shield as a defence. If that rhythm gets broken up the player gets hit and needs to cast as shield again. This would make the hard difficulty even harder than it is now. Further additions would be more quests and a deeper story.

#### VIII. ACKNOWLEDGEMENTS & REFERENCES

##### REFERENCES

- [1] "Blade and Sorcery," [Desktop-VR], WarpFrog, 2018.
- [2] "Escape from Tarkov," [Desktop-PC], Battlestate Games, 2017.
- [3] "Gorn," [Desktop-VR], Devolver Digital, 2019.