



FINAL PROJECT - DE0972

THE CARTER ODYSSEY

MATTHEW CHAPLIN - W15020879

CONTENTS

BRIEF ANALYSIS - 3

RESEARCH - 8

CHOSEN CONCEPT - 36

CONCEPT DEVELOPMENT - 38

USER RESEARCH - 51

VR ESSENTIALS - 59

DEVELOPMENT - 65

BRAND IDENTITY - 101

VIDEO DEVELOPMENT - 101

FURTHER DEVELOPMENT - 113

DEGREE SHOW - 115

EVALUATION - 117

WIKI & RESOURCES - 119

BRIEF ANALYSIS

BRIEF ANALYSIS AIMS & BACKGROUND

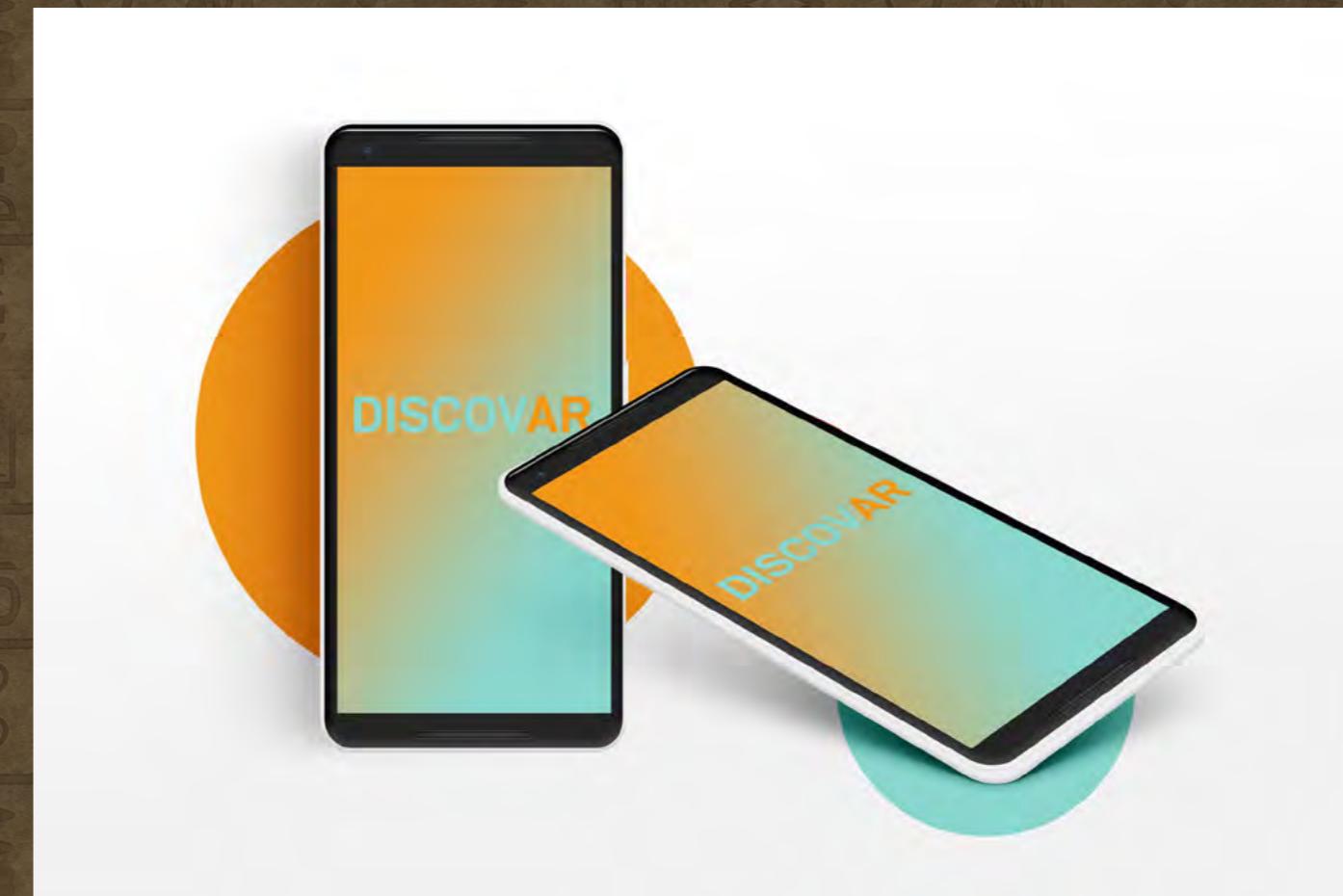
This project is the final project for my time at Northumbria University. It's been a great 3 years and for this final project I really want to do my best for it. In this project I will be continuing the concept of my previous project in Personal Project 1. It involved using augmented reality to bring young people back to museums, for this project I utilised user research and real world professionals inside that field for their input on potential features for the game. The brief is very open as it spans over the longest time yet for a project. Inside this project I will be using a more advanced amount of user research and input using various methods I learnt through my time at university and interacting with professionals in my field.

The background of this brief was the continuation of Personal Project 1, to enable students to continue to resolve their design solutions from Semester 1. What I do for my project is self-determined but for this project I will be continuing the project from Semester 1, for the previous project as I feel like I have done as much as I can with augmented reality. Recently we have gotten an HTC Vive and aim to utilise this technology to its extent.

BRIEF ANALYSIS SEMESTER 1 WORK

In my first semester, I investigated how augmented reality (AR) could benefit a museum and if it could attract more visitors to a museum. In this I created an app that uses the Vuforia plugin for the game software Unity. I found the creation of the overall app interesting and led me to further my research on into the creation of environments and areas in Unity. While looking into the technology behind Vuforia, I found that a large amount of people enjoyed the aspect of the new technology. I found this interesting as when given the question on what the most recent technology that they had wanted to use is, the most received response was VR. This was enlightening as it gave me idea on how to move the concept of learning in AR into VR. The idea of immersing a user in an environment where they can react with a world and learn about everything in the certain situation.

While doing this work in semester 1, I chose a series of eras and ages; such as Ancient Egypt, for these I had created a series of details and information to learn from. I gained the idea of placing this information in greater detail into VR. For this information I wanted it to be an immersive environment that a user can explore at will.



BRIEF ANALYSIS

THE EXISTING PROBLEM

The current problem with interactions and attendance at museums I learnt from the content manager of the Hancock Museum (Great North Museum) in semester 1. During a brief interview with him he had mentioned on how there are less people going to museums as it doesn't have many reasons to go back to the same exhibit if you have already been once.

Something brought up during our conversation was that the most popular exhibits were interactable and had something an attendee could interact with. Such as the Dinosaur exhibit in the Hancock Museum has fossils that the user can touch and hold. Recently there has been a planetarium that has been added where people can pay to experience and look inside. When brought up into the conversation regarding Virtual and Augmented reality he was excited about the concept but brought up that in the past there has been VR additions that were there for a temporary amount of time. I had mentioned that if there was a more permanent VR exhibition if he believes that it would benefit the museum and he agreed greatly as when they had their first VR exhibit in 2015 in greatly brought in people and a more permanent addition to an exhibition with enough variety would fit greatly with their exhibits.

BRIEF ANALYSIS

SCOPE OF PROJECT & INSIGHT

As it is the final project, I really want to do as much research and development as possible. I aim to be using the HTC Vive we have recently acquired for our course and potentially using Unity to develop it. Unity has a high level of usability and functionality when developing something like this due to its community and features such as SteamVR and VRTK, a development toolkit for VR in Unity.

I aim to use playtests inside this project and use the knowledge gained from this to continue to develop my project but with user feedback involved also, I have taken part in several playtests for the local Ubisoft Reflections studio and will be taking practices used there to develop my work which I will be going into in this project.

Due to my recent projects including Unity, I have gotten a good grasp on how the engine works and functions and how to get the best result out of my project.

The insight gained from the first semester of work was incredibly useful as I had used both user feedback and “client” feedback as I was regularly taking my AR project back to the content manager of the Hancock to improve on its usability, general functions and the systems that would be at play when using the AR app.

RESEARCH

RESEARCH - TECH TRENDS

WHAT IS VIRTUAL REALITY?

Virtual reality (VR) is a more expensive and advanced alternative technology to AR. The recent advancements for VR are the publicly released Oculus Rift which is being developed by Oculus, who have been recently acquired by Facebook. Another alternative to the Oculus Rift which is more advanced in its hardware is the HTC Vive, a headset developed by HTC and Valve. Which is a much more heavily advanced version of the Oculus in a technology comparison. There is a headset released for the Playstation games consoles called "Playstation VR" as this isn't usable as much for anything except for the console, as this is a very consumer accessible headset at a price of around £350 average. As of recently a new HTC Vive Pro has been released which boasts a resolution of 4K (3840 x 2160 pixels or 4096 x 2160 pixels) compared to the current HTC Vive which has a resolution of 2160 x 1200.

There are many VR games out at the moment but none are something that will be deemed 'revolutional' for the market. The most recognized VR game mostly due to its impressive and photo realistic setting and level of detail. As an explorative puzzle game it requires the user to move through a level quickly in the base game/ Non-VR game, but as this would harm the user's comfort and may cause sickness it provides a brand new slower pace to the game.

Accessibility - Virtual reality isn't a very public and accessible set of hardware/technology as most headsets now are extremely expensive to have access to and require a powerful computer to run most of the applications that are developed for the headsets.



RESEARCH - TECH TRENDS

WHAT IS MIXED REALITY?

Mixed reality (MR), sometimes referred to as “hybrid reality”, is a newly-coined term which describes/is defined as the following: “the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real time”. MR is currently hard to prototype as larger and more publically-accessible hardware needs to be developed. Another resource heavy option for this is to have a VR headset work alongside a Microsoft Kinect camera, a mobile phone and a TV screen that can combine together to provide an experience for multiple users. As this is an extremely alternate path there is no way that I could provide such an experience of this scale for this project.



An alternative to MR, but just as resource heavy, is to use multiple portals/windows for the user to “see” into the virtual world. For example a TV and a VR headset could be used simultaneously to give multiple users a window into the world being shown. This would require many different sets of hardware to achieve however, and is beyond the scope for this project.

Accessibility - The HoloLens, currently being developed by Microsoft, is not an easily accessible alternative to available AR/VR technologies owing to its recent advancement and high cost. The current developer version of the Microsoft HoloLens costs approximately £2,700GBP compared with the more moderately-priced VRs.

RESEARCH - TECH TRENDS

WHAT IS EXTENDED REALITY?

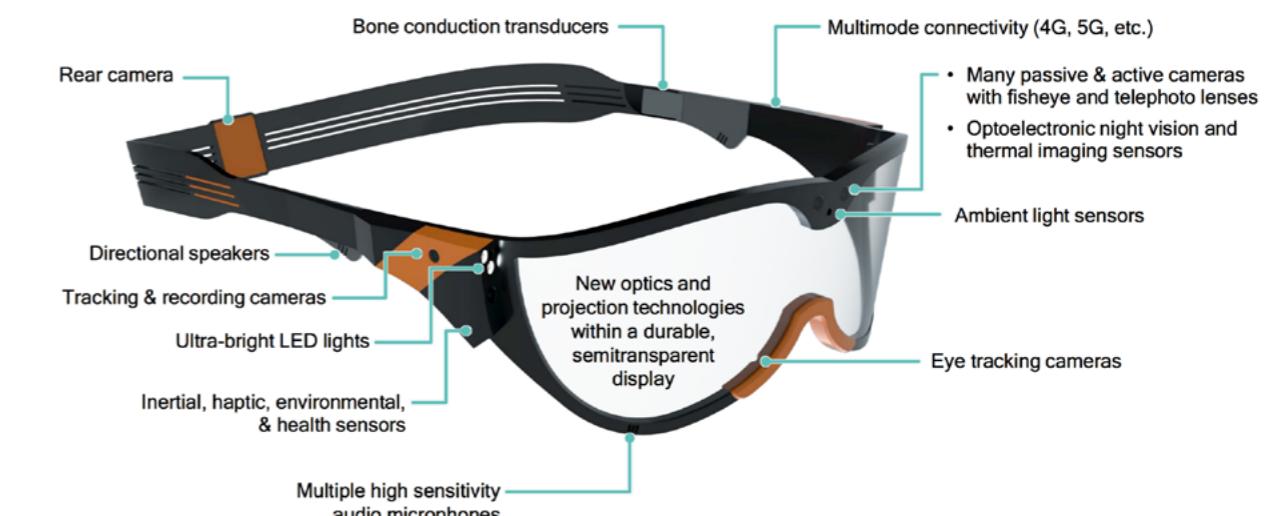
Qualcomm “Extended Reality (XR) is an umbrella term encapsulating Augmented Reality (AR), Virtual Reality (VR), mixed reality (MR), and everything in between. Although drawing the line between AR and VR experiences can be challenging, it is clear that many of the same underlying technologies will power revolutionary XR experiences. XR will transform everyday consumer experiences and many market verticals from industrial manufacturing and healthcare to education and retail.”

In June 2017, Qualcomm did a talk on the future of XR in the mobile future. What the possibilities are and what the end design could look like.

They mention that XR is the next mobile computing platform, where it could be implemented in the world. As an example there could be the possibility to utilising XR in industries such as in healthcare, emergency response; be that firefighters or the police force and entertainment which could benefit the public sector quite significantly.

A glimpse into the future

First responder XR glasses



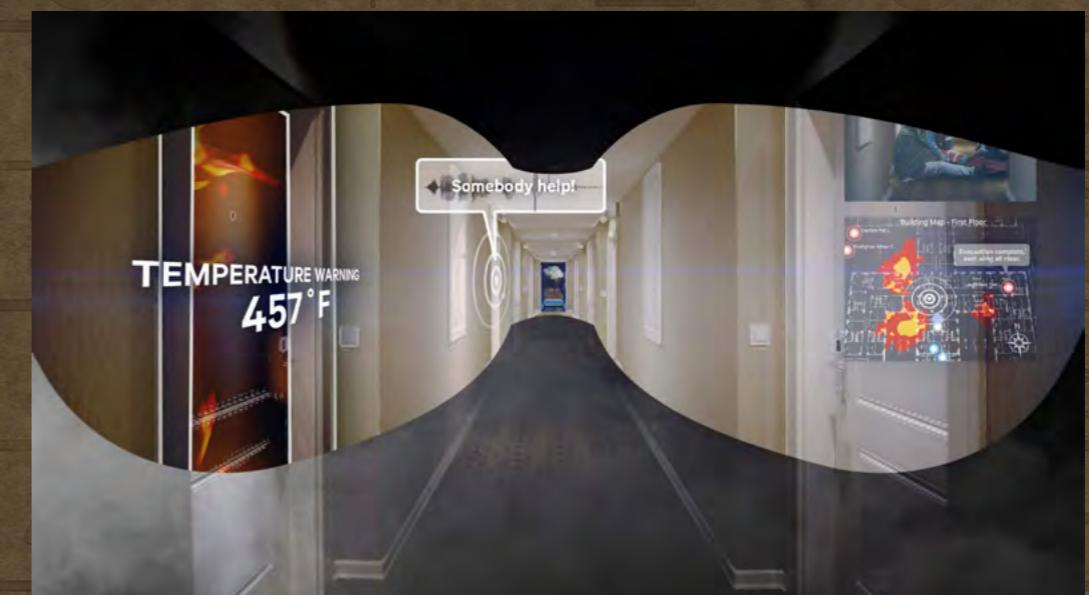
RESEARCH - TECH TRENDS

WHAT IS EXTENDED REALITY? PT.2

The following images are the benefits for the First responder XR glasses.

As seen from these it is clear that XR could heavily change how a First responder could prepare for a scenario. A study done by the National Fire Protection Association (NFPA) showed 69 firefighters died on-duty in the entirety of 2017, the most common fatality being caused by “sudden cardiac death” (heart attack). Firefighters are more susceptible to heart attacks due to their bodies being exposed to intense heats, this causes injury to the heart muscle increasing their risk of heart attack.

Using something like the First response XR glasses could help this cause dramatically as this aids the information that a firefighter has when entering a burning building.



RESEARCH - TECH TRENDS

WHAT IS A HEAD-MOUNTED DISPLAY?

A Head-Mounted Display (HMD) is a device that is worn on the head of a user. It has 2 options of vision where 1 being one large option is having one large screen/optic (monocular HMD) or with more recent advancements, it has been adopted where having an optic for each eye (binocular HMD) has given a significant increase in resolution and having a larger field of view. Devices such as the HTC Vive use the binocular HMD option giving it a large field of view and a higher resolution.

A HMD is used most often recently for gaming but has been used in industries such as aviation, engineering and medicine.

RESEARCH - EXISTING PRODUCTS/ SERVICES

VR GAMES/ APPLICATIONS - PAYDAY 2 (BETA) - GAME

Payday 2, a game released in August 2013 developed by OVERKILL has recently produced a beta version for people to use where a user can control the player in VR. Payday 2 is a first person shooter situated in the world of a bank robber where the player can do multiple heists where they can rob banks for gold, cash or other objectives which vary in stages which get more complicated and difficult.

The most usable version of the beta is for use through the Steam client. In the beta it uses a belt feature where having the usable objects on the players belt. This features is a welcome one as it doesn't take up the entire of the players vision, keeping this in mind for my project will overall increase the usability of the game and make the users experience better overall.

The movement that is used inside the game is a simple teleport system where the user points at a location where they want to move to, this isn't a very immersive experience as it makes the movement feel very robotic and unnatural. The overall gameplay of this feels very immersive but the movement system takes this away significantly.



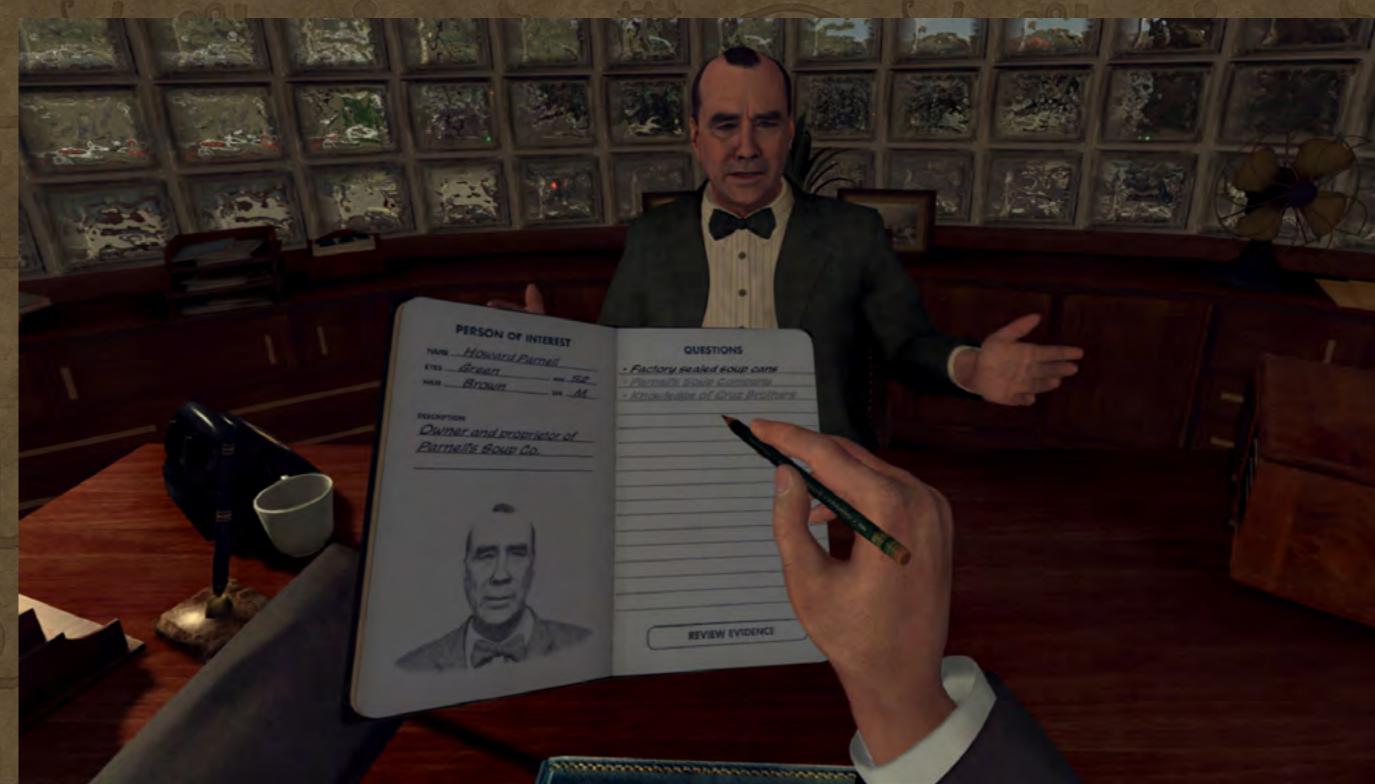
RESEARCH - EXISTING PRODUCTS/ SERVICES

VR GAMES/ APPLICATIONS - L.A NOIRE: THE VR CASE FILES - GAME

L.A Noire: The VR Case Files is a new version of the game L.A Noire which was released in May 2011. The original game which was developed by Rockstar Games, follows the setting of a police officer that has come back from WW2, it is set in the year 1947 in the city of Los Angeles.

The new version of the game, released December 2017, uses a movement system where the user swings their arms in a running motion to move while on the spot, as system doesn't make the player jump while in game so often this increases the overall level of immersion that the user experiences.

The game can be only currently be used on the HTC Vive through the Steam client. The game uses a similar system to the Payday feature of the belt, where it houses the usable items where it keeps objects out the players vision.

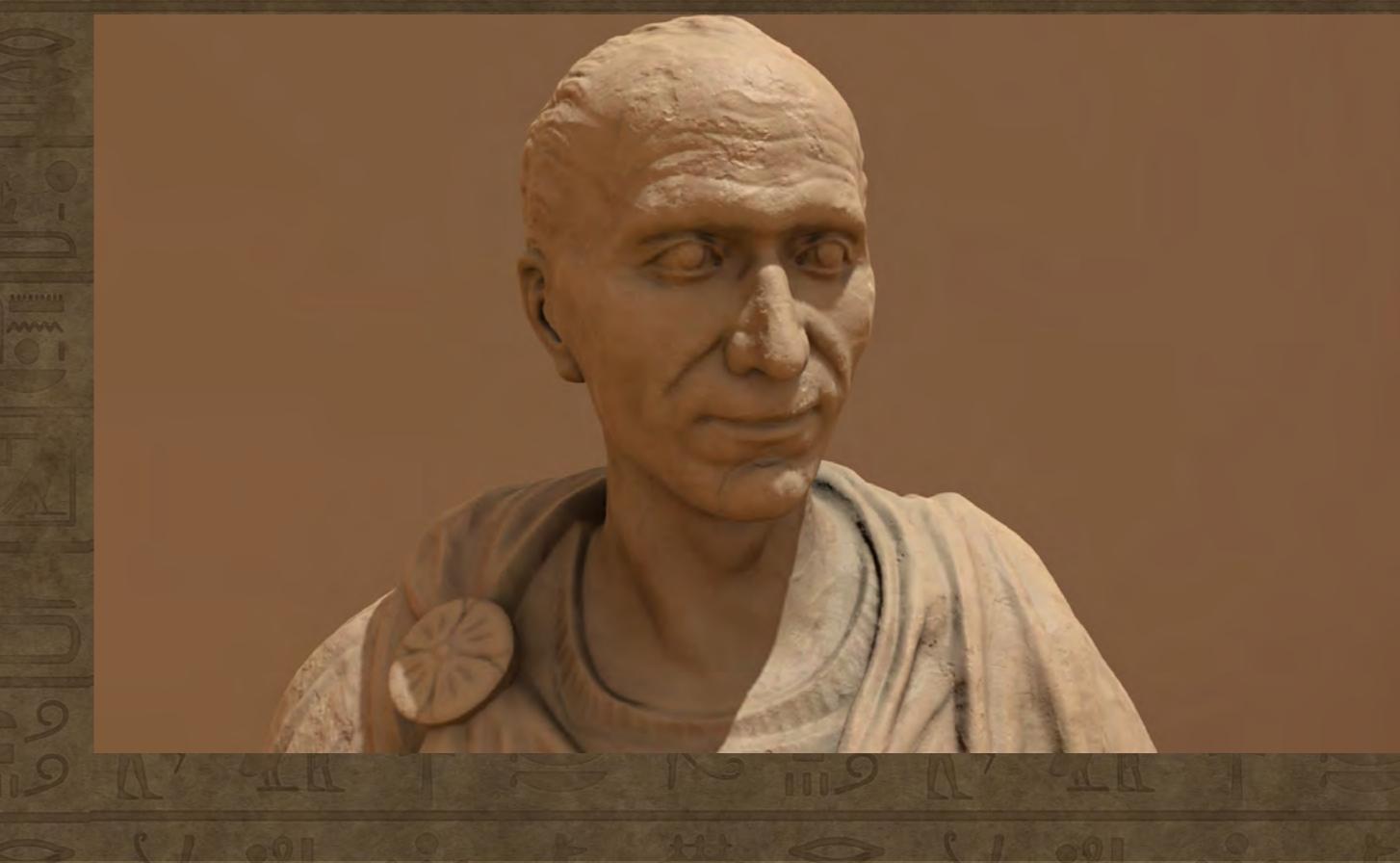


RESEARCH - EXISTING PRODUCTS/ SERVICES VR GAMES/ APPLICATIONS - MUSEUM OF FINE ART - APPLICATION

The Museum of Fine Art is an application released in August 2016 for the HTC Vive, where users can go around a virtual museum and view objects with related information.

In the application due to it being not an overly large area the user uses the same teleporting system that Payday 2 uses. I really like the system that they use to display information, they use a close to see through pane that displays all the information about the exhibit in front of them.

As the information shown is a very good feature one of the problems I had was that I wished that the objects were actually in the environment that they would normally be situated in. Such as a pillar of sorts would be in actual environment that would hold it. I will take this into account when wanting to create an immersive environment.



RESEARCH - EXISTING PRODUCTS/ SERVICES VR GAMES/ APPLICATIONS - TILT BRUSH - APPLICATION

Tilt Brush is an application developed by Google for both the HTC Vive and the Oculus Rift. Made as a painting application it allows the user to use the controllers as a paintbrush and easel. Released in April 2016, the Tilt Brush was well received and has had impressive updates since release such as being able to import other people's creations.

The Tilt Brush is only available on PC, accessible through the Steam platform or through Oculus' shop on its website.

The application places the user in an empty space where the user can paint with a user defined 'brush' and a selected colour in the easel/ colour mixer. The application is a really good display of technological advancement through showing a 3D environment. Users have the ability to create very complex drawings, and use it recreationally within groups of friends to create mini games like pictionary.



RESEARCH - EXISTING PRODUCTS/ SERVICES

WHAT IS AN EXPERIENCE GAME/ APPLICATION?

Experience is a common thing in video games that developers aim to give but there are video games that are deemed as “Experience games” a lot of these recent experience games have been developed for VR.

They invoke feelings and senses to bring the player into their own developed story or setting.

RESEARCH - EXISTING PRODUCTS/ SERVICES

LEGO STAR WARS - THE LAST JEDI - EXPERIENCE APPLICATION

The Lego Star Wars Experience application published by Lego and Star Wars to advertise the new Lego Star Wars - The Last Jedi game, it is a series of 360 videos accessible on the Lego website that can be viewed in Google Cardboard.

The main reason for this applications creation is to advertise and to provide excitement and interest in the new game being released.

The general reason experience applications are featured a lot in VR is due to the immersive atmosphere that it provides.



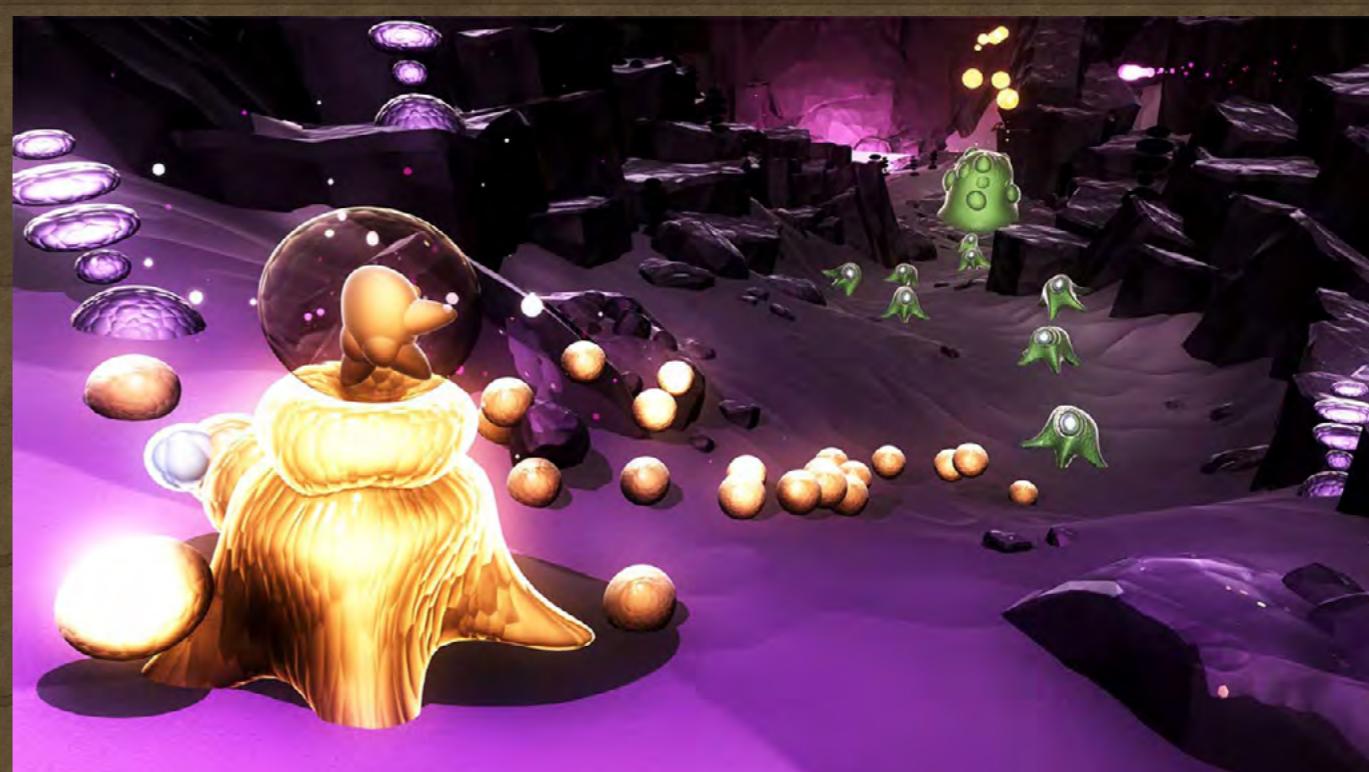
RESEARCH - EXISTING PRODUCTS/ SERVICES

ODE - EXPERIENCE GAME

Ode is an experience/indie game released by Ubisoft Reflections and is a game where I was part of the main playtesting team for it. Ode is deemed a “musical platformer” where the player can explore a series of worlds and environments that start to develop into a grander soundtrack with more detail.

The game, released in late November 2017 was released through Uplay; the Ubisoft game streaming service.

Ode provides the player with a calm and relaxing soundtrack over smooth and slow gameplay to create a soothing and relaxing experience for the player. Something that I will be taking away from seeing the development progress and testing of this game, is how the player is always considered and I will be taking this into my development progress.



RESEARCH - EXISTING PRODUCTS/ SERVICES

STAR WARS: SECRETS OF THE EMPIRE - VR ESCAPE ROOM

This escape room was recently premiered in London, it is a VR escape room similar to mine, but uses the Star Wars brand instead of using it as a tool for education and learning history. They use life size models and objects to control in VR and to provide depth and an experience for the player.

They use advanced tech by having the player carry a backpack with all the necessary equipment such as the computer running the application. Something that our university hasn't fixed at the time of this document is getting a cable for having the VR headset to be able to be setup to be used wirelessly, this would help extremely with both development and showing it off to the public in the degree show.

Something that I will be taking from this is trying to recreate that kind of immersion, using audio and intuitive controls.



RESEARCH - EXISTING PRODUCTS/ SERVICES

FIND THE KEY - ESCAPE ROOM

This escape room uses a series of themes to tell the story of the player trying to achieve these tasks.

They sometimes use real world hints such as going to a location outside the escape room to speak to someone there who could be from the company, they would need hints about what the person would be wearing as an example. This real world integration might work really well with mine in the degree show where I may have the public use a real world object to help them solve puzzles.

Something that I will try and take from this is the themes that they use that involve history they try and keep to a realistic and accurate telling of said history.



RESEARCH - HARDWARE

HTC VIVE

The HTC Vive, a VR headset developed by Valve Corporation and HTC, is currently the most popular VR headset in the market. Developed in April 2016, the Vive has been updated with more advancing features such as new controllers and the ability to use it wirelessly. Unfortunately due to this the Vive is the most expensive headset on the market and due to its impressive features and its high resolution; available at 2160 x 1200, it requires a high performance computer with VR ready components with the most accessible component being the Geforce GTX970 and the AMD RX 580. As these are the cheapest components accessible the overall quality and performance while in VR would suffer quite heavily.

As of the creation of this document, there has been a recently announced HTC Vive Pro, a new headset with a higher resolution; 2880 x 1600, the highest current resolution available in a VR headset alongside the Samsung Odyssey. The Vive Pro has its own wireless adapter integrated into the headset, but has not been released as of this document with no official release date.

With the HTC Vive being more focused recently on gaming, there is an option available for using it in other sectors, such as education and the healthcare sector. We have recently received a Vive and laptop capable of utilising the headset, this is most likely the headset that I will be using.

PROS

Resolution is high quality

Development is easy and accessible

CONS

Expensive

Components need to be powerful



RESEARCH - HARDWARE

OCULUS RIFT

The Oculus Rift, A VR headset developed by Facebook released in March 2016, is a headset that features 2 controllers but doesn't contain any tracking like the Vive features. As the Oculus doesn't feature a large amount of movement tracking and doesn't have a large display; at 1080 x 1200, it is one of the cheapest headsets on the market.

The Oculus Rift has similar technical requirements as the Vive, but requires a slightly less powerful graphics card. The Rift is capable of using an Xbox One controller as well as its controllers.

As the Oculus and the Vive are both capable of running games and applications but the Vive is the more feature heavy as it can be used and manipulated easily for development.



RESEARCH - HARDWARE

PLAYSTATION VR & SAMSUNG ODYSSEY

Playstation VR (PSVR) is a VR headset developed by Sony released in October 2016, it is mainly used for the Playstation 4 and only available for that platform. As the PSVR isn't capable of being used on other platforms I won't be using this due to the restrictions of functionality.

The Samsung Odyssey is a mixed reality headset released by Samsung and Microsoft released in 2017, it is capable of use with Windows and other games similar, right now there isn't anything greatly developed for it.



RESEARCH - SOFTWARE UNITY

Unity is a game-making engine developed by Unity Technologies. Over 5 billion of the games downloaded in 2016 were developed in Unity, making it the most commonly used free game engine. Unity offers simplicity in its functionality with its world editing feature. If the user wants to bring more complex and unique functions to their game, then Unity offers a scripting function in which the user can utilise multiple scripting languages such as C#, UnityScript (also known as JavaScript for Unity) and Boo. Some of these are simpler to learn than others. The most commonly used script is C# and, due to its ease of use, will be the one used in this project to develop my app.

In this project, I will be using a series of plugins to be able to keep my VR idea together, I will be using VRTK. A plugin for Unity that allows for complex interactions with improved developer usability. An example of an interaction that I will be using is a lever inside of my game that will be used to interact with objects. A plugin that I will need to use to run the HTC Vive is SteamVR. Developed by Valve to support the development of the Vive in Unity, it allows the developer to see a real time view of the headset and controllers in-software.

As this project is my first attempt at VR I will undoubtedly be using tutorials, as Unity has a large community it will be easy to come by these.



RESEARCH - SOFTWARE UNREAL & CRYENGINE

Unreal is a game-making engine developed by Epic Games. With a large amount of games being developed using Unreal such as A way out, Fortnite and Sea of Thieves, it has recently been heavily focused towards its VR capabilities and its real time lighting improvements.

In 2014 Unreal was called the most successful video game engine by Guinness World Records.

Unreal is a very serious consideration when it comes to the engine I will be using for the development of my VR project, but due to my experience in Unity already and the extent of plugins that Unity can provide I will be most likely be using this.

Cryengine is a game-making engine developed by Crytek, popular for the Crysis series, Kingdom Come Deliverance and Prey.

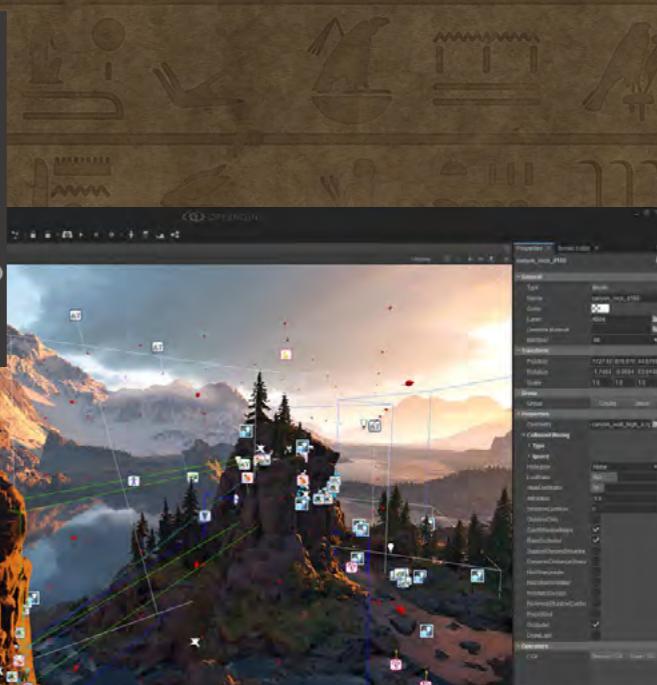
Cryengine is renown for its graphical prowess, unfortunately doesn't offer a large amount of optimisation for VR and the overall amount of features that come with Cryengine doesn't make it a viable choice for production of this project.



UNREAL
ENGINE



CRYENGINE®



RESEARCH - GAME DESIGN

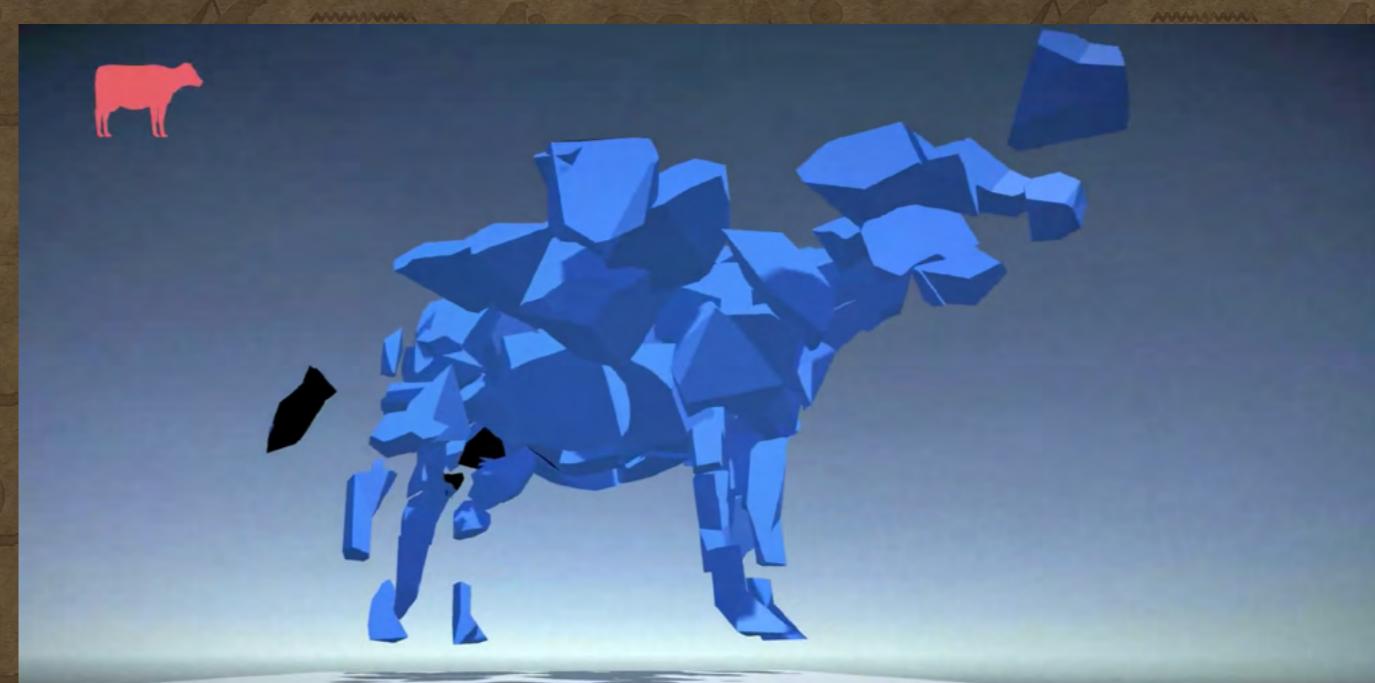
MARK BROWN, UNDEADDEV & HELTIDSLUFFARE

Mark Brown or known as the Game Maker's toolkit, is an incredibly useful resource for game design, he has hundreds of videos that break down main game design concepts such as repetition in video games or systematic games. I will be taking lots from his videos as they also feature legendary game developers such as Sid Meier, creator of the Civilisation games and other great simulation games.

The Undead Dev is someone who I came across who had a large amount of information as a practicing VR game developer, he has a large amount of tips that I came across such as having a large TV for the public to view the players perspective, creating a triggerable tutorial that the player can access at any time. And something that I will be looking into which would be a spectator camera for players using a game controller.

Heltidsluffare is now a very good friend of mine, I found him while browsing the Unity subreddit, he had created a perspective puzzle that he had used inside of Unity but hadn't tested it using VR yet. After speaking to him about development for a while, we started to put together a script that would work for it. Finally after large amounts of development, we eventually got it working. Also don't go translating the name please.

One of the responsibilities of a designer is to protect the user from themselves - Sid Meier



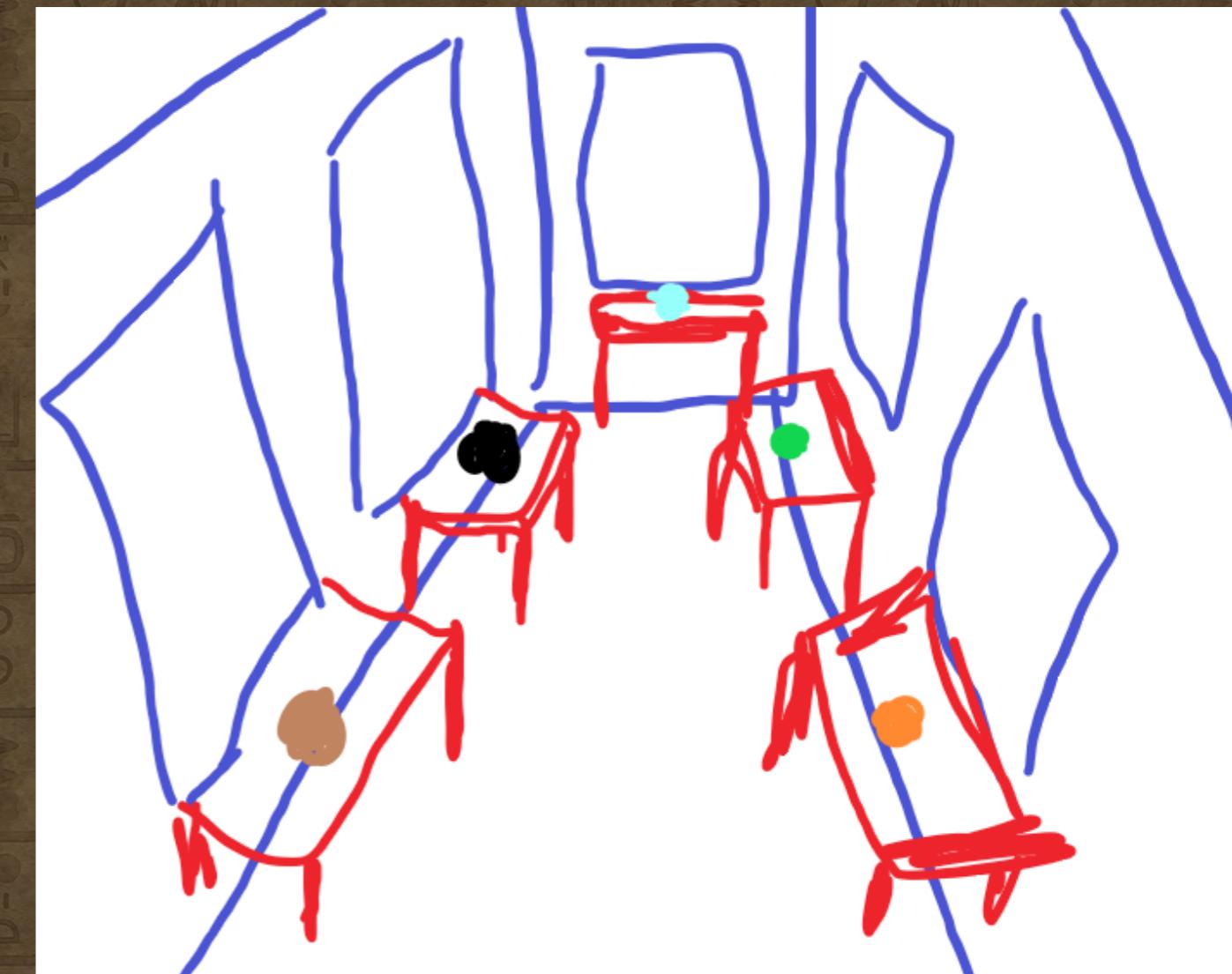
RESEARCH - INITIAL CONCEPTS

My initial ideas surrounded the concept of using VR as an educational tool. One of my original concepts was to create a series of worlds that can be explored and within each of these worlds there would be collectable items that would tell a story.

RESEARCH - INITIAL CONCEPTS

THE "MIRROR" IDEA

The "Mirror" idea was an idea that would start by placing the user inside a corridor where they can walk to each of the mirrors placed inside this corridor and be moved to a new world that they can explore, after thought on this idea I decided not to pursue this.



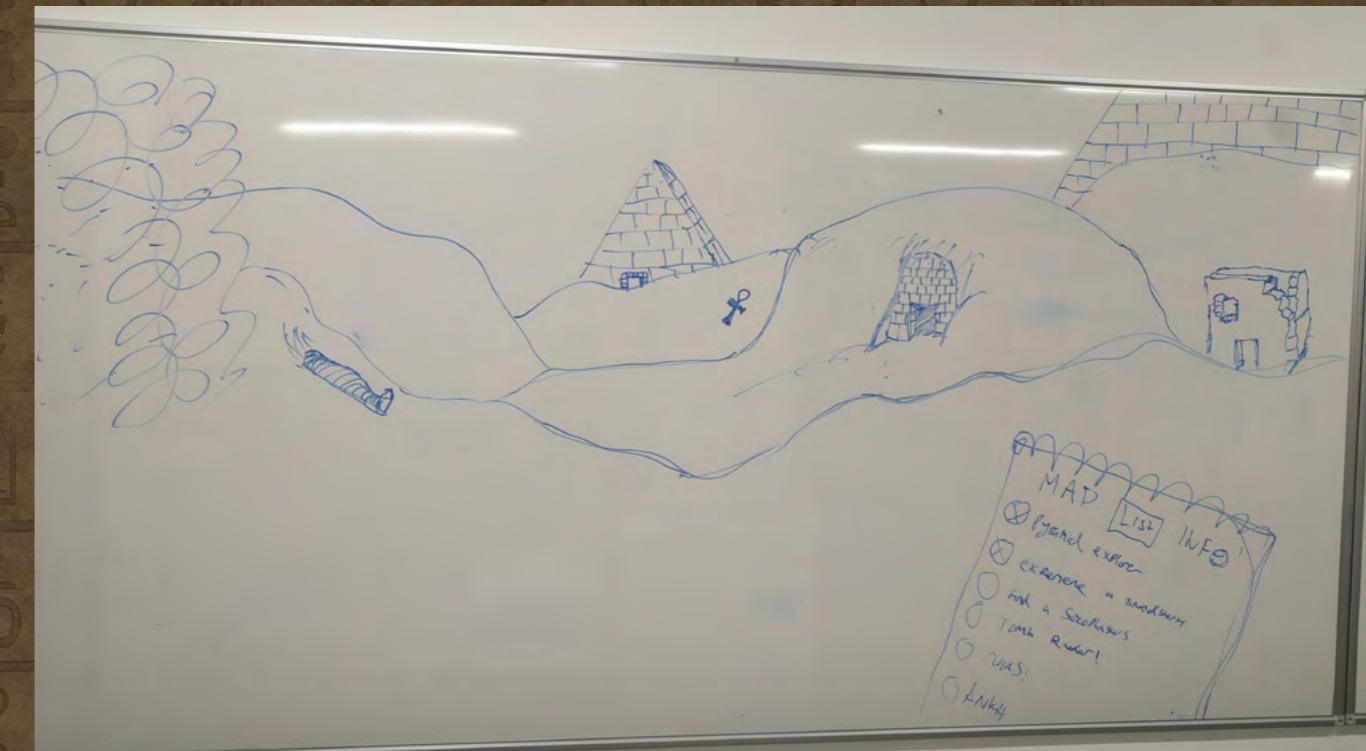
Dont mock it. It was done in paint.

RESEARCH - INITIAL CONCEPTS

LONE EXPLORER IDEA

The Lone Explorer idea surrounded the idea of someone being dropped into the middle of Ancient Egypt in sand dunes and would explore their surrounding area. This would involve going into tombs, pyramids and digging up artifacts.

I did a few bits of concept work and testing around this, I managed to get a large desert into Unity but after consideration on the scale I would be aiming for I still liked this idea and will take concepts into the future for this.



RESEARCH - INITIAL CONCEPTS

ESCAPE ROOM IDEA

The Escape Room idea is something that would be fun to develop as it would give me the excuse to create a series of systems and gameplay that would provide an enjoyable experience.

Though the problem with this would be creating a complicated enough system that will still give the educational system that I am aiming for.

RESEARCH - COMPARATIVE RESEARCH

In October of 2017, the most recent Assassin's Creed game was released "Origins". A game set in Ancient Egypt following the story of an assassin who is hunting the people who killed his son. The game recently has had an update which has mysteriously been named "Discovery". A name incredibly close to my original project; "DiscovAR". Even closer to my project, it gave the player a tour of Ancient Egypt and areas in the world. This idea was incredibly close to my Lone Explorer idea, which gave me the incentive to try and create something better and more interesting.

Recently a lot of large museums such as the British Museum, The Franklin Institute and the Europeana Foundation (European Cultural Institution) have been adopting VR into their museums.

The EUseum, a VR museum set up in collaboration by the Europeana Foundation and a Dutch group. Their goal was to show the "innovative and interactive way of experiencing art through the power of VR". They created a series of environments where users can go into VR and see paintings and artwork from famed artists.

In February of 2017 there was a conference for "MuseumNext Australia" which included someone from Google, the Auckland War Memorial Museum and ACMI (Australian Centre for the Moving Image) where they spoke on how museums can use VR.

Something that was mentioned inside this talk was the following:

"One thing, though, is very clear to us, that at least at our museums in the two times that we've had major installations of VR is that visitors love it, they love it and we have some hot numbers that support that."

Obviously from this and other statistics gained, museums could benefit quite heavily from VR in many forms.



RESEARCH - COMPARATIVE RESEARCH INSIGHTS

Through my comparative research it is evident that museums are slowly adapting to new technology such as VR. The talk by MuseumNext Australia is extremely insightful. They speak on how that museums are going to have to start adopting VR and AR, how the VR application/game will have to include a level of story-telling and immersion for it to truly fit inside of the museum setting.

They speak on how a VR addition to their museums “the two times that we’ve had major installations of VR is that visitors love it, they love it and we have some hot numbers that support that”, from this it is clear the benefits that VR could bring to museums.

Something that I will be taking into my project is keeping the user as heavily immersed as possible and creating a story that will encapsulate the user.

RESEARCH - CONCEPT MERGING

I am heavily interested in both of the concepts of the escape room and the explorer idea, the escape room in general for its functionality and using the explorer concept as the story.

The player will start off with the introduction what the year is and that they have been trapped inside the tomb while exploring. They will have to complete a series of challenges to escape.

CHOSEN CONCEPT

CHOSEN CONCEPT

Explorer attempts to escape Ancient Egyptian tomb by completing series of challenges in VR.

CONCEPT DEVELOPMENT

CONCEPT DEVELOPMENT - CONTEXT OF USE

WHERE WILL IT BE USED?

The game will be placed alongside a main exhibit and themed alongside what the exhibit will be. The main target audience will be generally people who enjoy museums but there is a large amount of people that could also be an audience.

As I learnt in semester 1, the number of people attending museums to learn is dropping, particularly young people, something should be done to alter the decline.

As I aim to create something that will be educational and fun at the same time, it will have to be limited to a certain time frame.

CONCEPT DEVELOPMENT - CONTEXT OF USE IN SITUATION - WHAT MUSEUMS COULD IT FEATURE IN?

DISCOVERY (NEWCASTLE)

What is their “core” (main) exhibition?

History of Newcastle

What are their “visiting” (temporary) exhibitions?

Army and Rocket Science

What could VR do for their theme of museum?

Certain areas of Newcastle recreated inside of VR could be explored

Concept on what their main feature could be?

Exploring space or Newcastle

NATURAL HISTORY MUSEUM (LONDON)

What is their “core” (main) exhibition

History (Human evolution, oceans, dinosaurs)

What are their “visiting” (temporary) exhibitions?

Butterflies & Venom

What could VR do for their theme of museum?

Exploring history through the eras

Concept on what their main feature could be

Walking with dinosaurs

JORVIK (YORK)

What is their “core” (main) exhibition?

Viking camps/ battles

What are their “visiting” (temporary) exhibitions?

Viking festival, collaborations with large museums such as British Museum

What could VR do for their theme of museum?

Exploring a viking camp

Concept on what their main feature could be?

Re-enactment of a battle

CONCEPT DEVELOPMENT - CONTEXT OF USE IN SITUATION - WHAT MUSEUMS COULD IT FEATURE IN? PT.2

SCIENCE MUSEUM (LONDON)

What is their “core” (main) exhibition

Space

What are their “visiting” (temporary) exhibitions?

DNA

What could VR do for their theme of museum?

Exploring space in VR

Concept on what their main feature could be

Spaceship exploration

IMPERIAL WAR MUSEUM (STRETFORD)

What is their “core” (main) exhibition

War through the years

What are their “visiting” (temporary) exhibitions?

Women in war

What could VR do for their theme of museum?

Explore certain areas of world wars

Concept on what their main feature could be

Trench warfare/camp of soldiers

CONCEPT DEVELOPMENT - WHO, WHAT, WHY? WHO IS IT FOR, WHAT IS IT AND WHY IS IT BEING MADE?

A VR escape room game set in Ancient Egypt that will be made for museums attendees to bring people in and to get more attendees while still being educational and fun.

CONCEPT DEVELOPMENT - CONCEPT USP

USING VR AS A TOOL FOR INNOVATION IN A MUSEUM SETTING TO CREATE AN INTERACTIVE EXHIBIT BY PROVIDING A LEARNING ENVIRONMENT BASED ON AN ESCAPE ROOM TO ALLOW THE PUBLIC TO SEE NEVER SEEN BEFORE ARTEFACTS AND OBJECTS

CONCEPT DEVELOPMENT - CONSIDERATIONS

A very useful resource that I have found that will provide large amounts of information for my development of the VR game.

UXOFVR is a list of resources that developers consider when keeping in mind the UX when developing for VR.

Something that I will be considering is keeping the user as immersed as possible but at the same time keeping it as educational as possible.

Something that is very common in VR development is the possibility that people can get movement sick, something to consider is user movement and if the project will be used by more than one person or if they are in a group what the other people get to witness due to VR being a majorly single-player game.

A consideration that I will have to undertake is whether people will actually want to go to a museum to see it or if it will just be a gimmick for a short amount of time. Though this could be argued against due to the research surrounding VR getting more popular through the years and upcoming years.



The UX of VR

A curated list of resources to help you on your journey into the User Experience of Virtual Reality

CONCEPT DEVELOPMENT - TECHNICAL CONSIDERATIONS

As Unity is a difficult game engine to develop VR in due to the complications of VR being a new technical advancement when it comes to developing in Unity.

There is a great technical consideration that the levels might not have enough depth and design that the player won't be as immersed as aimed.

A technical problem is that I don't especially have a great knowledge of coding which could impact the speed of development and could raise issues.

A problem that I will face is the same visual style of the game and to keep them as suitable and relevant to a museum setting.

Due to the player having full control of the movement in game, I will have to ensure that the player won't be able to simply walk through a wall.

CONCEPT DEVELOPMENT - DO'S AND DON'TS

THINGS TO DO AND THINGS TO AVOID

To do:

- Make sure that the world is immersive as possible
- Keep the game educational at its core
- Keep the player experience at the front of the mind in development
- Not make the game too complicated due to the targets audience varied age
- Make sure the educational sections keep the question as simple yet effective as possible

To avoid:

- Overpopulating the game with worthless content
- Make the game too hard
- Fill the users perspective with UI
- Overly loud audio and soundtrack

CONCEPT DEVELOPMENT

WHAT MAKES AN ENJOYABLE EXPERIENCE?

An enjoyable/interesting VR experience depends on user input and how they interact with the world. Having a world that is immersive and is filled with interactable objects will help the overall UX of the experience.

CONCEPT DEVELOPMENT

WHAT MAKES AN IMMERSIVE EXPERIENCE?

An immersive experience is filled with story and character, where an area has to keep the players mind active. Immersion is improved by adding features such as audio and haptic feedback when players interact with objects.

CONCEPT DEVELOPMENT

WHY DO PEOPLE GO TO MUSEUMS?

If you ask someone why they go to museums, an average response may be “I don’t (often) go to museums, I’ll just look at the exhibits and may not learn anything.”

Due to this, a goal of this project is to create something that will bring groups of people to the museum and providing a new way of learning about the information that the museum offers.

CONCEPT DEVELOPMENT

VISUALISING DATA

According to data, there is a drop in attendance at museums in general. From my comparative research, it is clear that museums can and have benefited museums in the past from VR additions to their exhibits.

USER RESEARCH

USER RESEARCH – TARGET AUDIENCE

Due to my project aim to bring more people into museum to see a new side of history, the audience I would be aiming for would be families, groups of friends who would come in to try the technology and schools in general to learn through new methods.

A benefit of the aim to this project is that VR is constantly on the rise in interest. Due to this, and that people generally are always interested in new technology.

With the idea of adding a competitive aspect into the game surrounding a timer and score, the museum in choice could give rewards to attendees to encourage for attendees to return.

USER RESEARCH - USER PERSONA

STUDENT INTERESTED IN GOING TO MUSEUMS

Name - Graham

Age - 18

Occupation - Student

Graham is history student attending university with a drive to learn new things about his favourite topics. He loves museums but has already seen everything the museum has to offer due to its normal exhibits being props and that's it.

Goals - Graham has been visiting his local museum as inspiration for his university course, due to him using all the current exhibits in his project already he is wanting to use a new exhibit to get information and knowledge of.

Tech ability - Graham understands how to use VR and mobile devices. He doesn't actually own a phone, however his local museum offers Samsung galaxy tablets that people can use during the visit.



USER RESEARCH - USER PERSONA

DESIGNER INTERESTED IN NEW TECHNOLOGY

Name - Kevin

Age - 30

Occupation - UX Designer

Danny is an enthusiastic worker. He enjoys researching and looking at new tech trends. As he learns about the latest trends, he also enjoys expanding his knowledge. In his spare time, he likes to look into Ancient History but due to his local museums not having many new exhibits involving the topics he wants he doesn't want to attend the museum. He has recently been learning about VR and its uses and is interested in the use of it in a public space.

Goals - Kevin wants to learn new things about history at his local museum using VR.

Tech ability - Kevin is comfortable using many different types of digital technologies such as his laptop, VR and video game consoles. He owns multiple computers, tablets and a mobile phone with latest technology installed.



USER RESEARCH - USER PERSONA

ESCAPE ROOM ENTHUSIAST

Name - Janet

Age - 40

Occupation - Receptionist

Janet is a receptionist in Newcastle. An escape room has recently opened across the street from her and has taken part in it on multiple occasions, the escape room is in the theme of WW2. She wants to do more but wishes that escape rooms could be more accessible. She is interested in learning history through this medium.

Goals - Janet wants to have escape rooms more accessible and have them in different themes.

Tech ability - Janet owns an iPhone X and has used virtual reality before but she didn't understand how to use it.



USER RESEARCH - USER NEEDS

WHAT INFORMATION DO THEY WANT?

When starting my user testing I used a group of peers to see if they understand the questions and problems to solve.

I will be speaking to the local curator of the museum to get some users for testing, this will be extremely beneficial. I am currently a playtester for a local Ubisoft division what I regularly and will be using methods used by their research team.

Using the methods learnt here, I will be going into my user testing with a large advantage due to professional methods that I have learnt from both Ubisoft and my time at university.

USER RESEARCH – USER NEEDS USER TESTING

For my user testing, I got back in touch with the curator of the Great North Museum in Newcastle to see if he could get me in touch with a focus group he uses for when they plan an exhibit.

When I was able to bring in the focus group to try out some examples of interactions within the prototype of the game I brought up the question surrounding how to keep it educational. This sparked a very good discussion surrounding whether it was better to use hard questions on the theme of ancient egypt, or whether to use objects to answer questions, such as questioning what a certain object is.

Due to my target audience being quite broad and the aim of the project being to use VR as an educational tool, I will have to keep my game educational but still have aspects that keep it replayable at its basic mechanics.



USER RESEARCH - USER NEEDS

USER TESTING FEEDBACK

Some feedback that I received from my user testing was the following:

- Keep features educational
- Make sure to keep as accurate to history as possible
- Have the tutorial obvious for first time players
- Some direction of what to do with prompts

A student was so immersed that they forgot that they had cut their finger open and actually had bled all over the controller, good feedback received thankfully.

UR ESSENTIALS

VR ESSENTIALS

In this section, I will be speaking about what the essentials for developing in VR is. In my research I have found a series of developers who have been developing for VR and resources that will help me when I am developing.

VR ESSENTIALS IMMERSIVE ENVIRONMENTS

One of the main aspects of VR is the immersion that encapsulates people when they are using VR.

There was a talk done in Australia for MuseumNext in february 2017, where they mentioned that when trying to create an immersive experience, the environment that the user is placed in is incredibly important. Due to my project being set in history I will be investigating into how these areas were built and setup in the time period.

I will be doing so by looking at current findings about what buildings were built in Ancient Egypt and how construction went about with these. Such as how tall the rooms were in the underground tombs or in the pyramids.



VR ESSENTIALS INTERACTIONS

VR has one of the most unique interaction systems as it uses the persons real world locations and tracking of their movement and hands. Using this, I will try to create a series of interactions using user feedback also to see what interactions feel the best. Alongside this, I will be utilising haptic feedback, to make them feel as realistic and reactive.



VR ESSENTIALS

AUDIO

Audio or a soundtrack is something that is always sought after in video games and helps create an immersive environment especially for VR.

Having a soundtrack that has a sense of urgency will also help give the player the feeling of incoming trouble.

VR ESSENTIALS COMPELLING STORIES OR INTERESTING GAMEPLAY

Having a good story or interesting gameplay helps the player feel like they are interacting within the game and using its mechanics correctly, I will achieve this by utilising user feedback and testing.



RESIDENT EVIL

Merchoid

DEVELOPMENT

DEVELOPMENT

KEEPING TRACK OF DEVELOPMENT

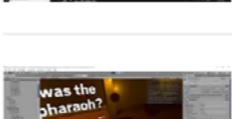
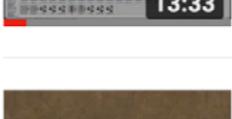
For this project, I took advantage of the screen recording software OBS Studio(Open Broadcaster Software), a software package that I used to record the stages of development I was at.

This was incredibly useful as I could take notes on what could be done and let me re-watch it later in detail to see improvements that I wouldn't see at first glance. Such as upping the power of the bow I would be creating or changing the pen to a more obvious and time relevant object such as charcoal.

I decided to keep recording and updating the footage every week or depending on a large breakthrough for my project.

You can access this playlist here: https://www.youtube.com/playlist?list=PL_UXLq17xqlkmly8DJGX6B8dr7bNuPcLT



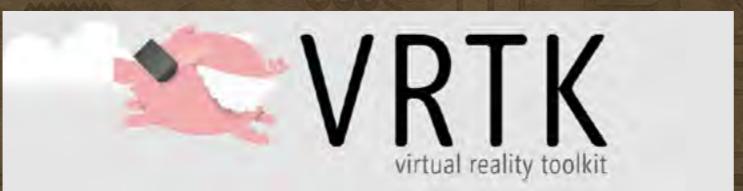
-  03/04/2018 - CARTER
Chappy3697 2:20
-  03/04/2018 - CARTER - NOT WORKING BOW
Chappy3697 0:58
-  04/04/2018 - CARTER - ARROWS STICK IN AND NEW BOW SKIN
Chappy3697 2:41
-  06/04/2018 - CARTER - STOPPING THE TIMER & BOW SPAWNER
Chappy3697 2:20
-  06/04/2018 - CARTER - TORCH AND BOOK START
Chappy3697 1:33
-  13/04/2018 - CARTER - PUZZLE AREA START AND MISC
Chappy3697 3:02
-  17/04/18 - CARTER - LIGHTING BROKEN & SLIDER
Chappy3697 2:03
-  The Carter Odyssey - Rough gameplay before QOL improvements
Chappy3697 13:33
-  The Carter Odyssey - 10/05/2018
Chappy3697 2:06

DEVELOPMENT PLUGINS THAT I WILL BE USING

SteamVR: SteamVR is a plugin for Unity, that allows for the use of the HTC Vive in Unity and offers a series of development scripts and prefabs for use.



VRTK: VRTK is a plugin and toolkit for Unity that offers a great amount of functionality to the players control and a great amount of developer choice in Unity. I am currently part of the Slack group and they offer feedback and troubleshooting. They have a plugin that is constantly being updated on Github with new features such as body tracking and new forms of movement.



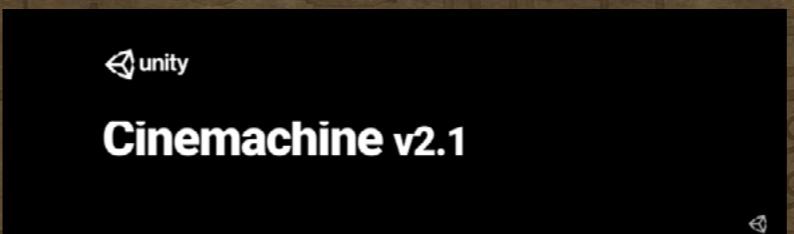
Post Processing: This is plugin used within Unity, it applies high quality textures and filters to the main camera in the game. The effects that are included inside these are extremely high quality, I will be utilising these to give a high quality of gameplay in the terms of the visual style.



ProBuilder: An incredibly useful level building tool, it allows for simple and effective generation of objects to be used for my building.



CineMachine: A cinematic camera system that allows for following of an object through a scene that is then able to be filmed and recorded, I will be using this later to create my video.



DEVELOPMENT SCRIPTING AND UNITY KNOWLEDGE

My knowledge of Unity and scripting in C# is varied, I am not familiar with designing in a 2D space but I am experienced in 3D design quite heavily due to my work in the first semester with my AR application. But from this, I am quite experienced in the raw basics of Unity and scripting in an entirety.

But for more complicated systems I may have to get help for it and by looking on Youtube for anything that could help.

DEVELOPMENT MOVEMENT AND LOCOMOTION

Movement and player presence is a big consideration in VR.

Something that is included inside the toolkit that I am using, VRTK, is the script inside of Unity called “Body Physics” this script allowed me to start to test out elevation inside of the game and provides the ability to create different puzzles with could incorporate this.

There are many different ways to have player movement in Unity.

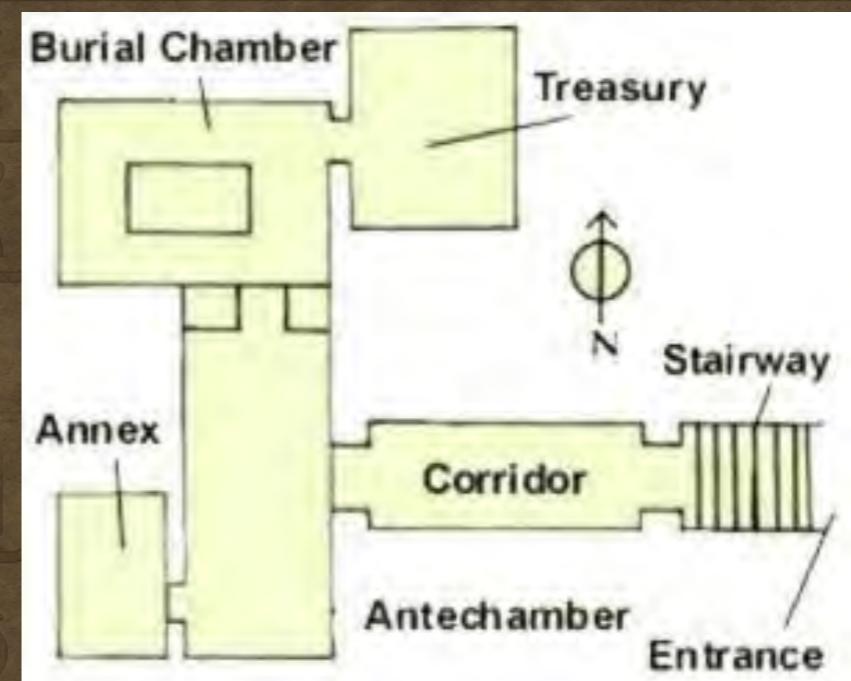
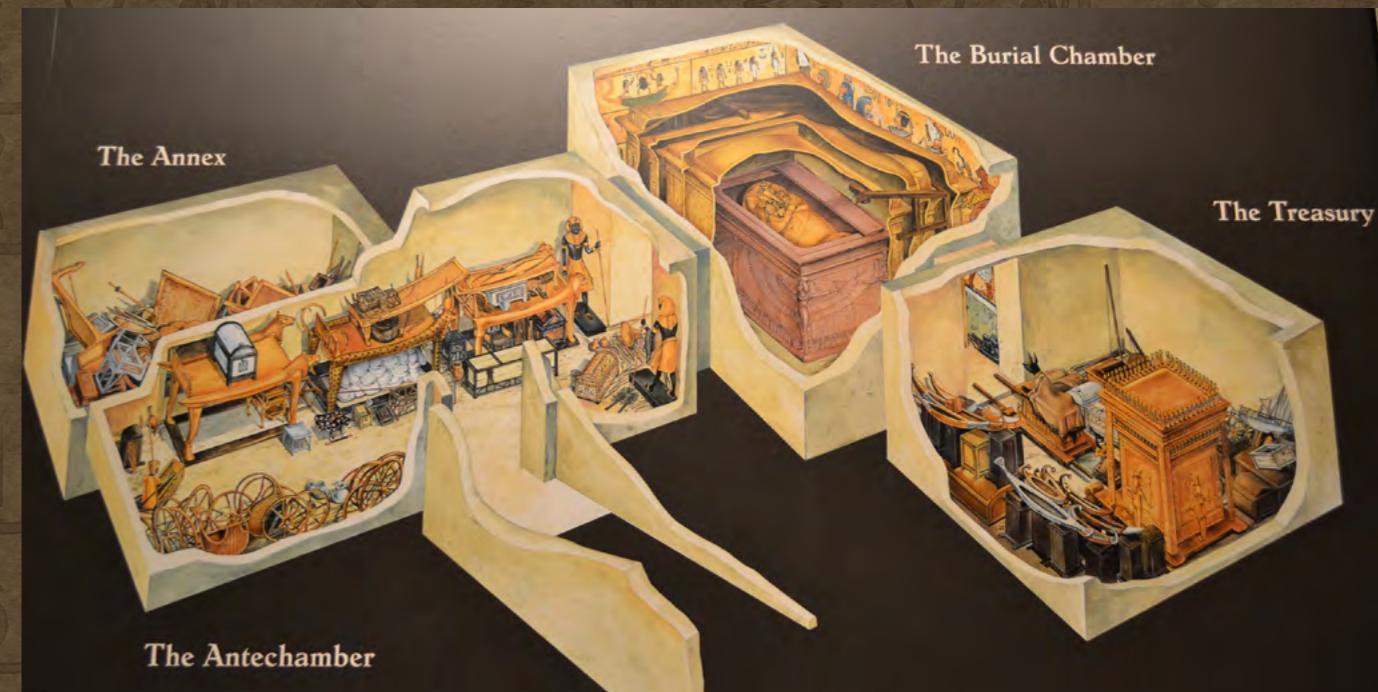
VRTK allows for movement using the touchpad of the Vive controllers, this is a very basic form of movement but doesn't really allow for other interactions using the touchpads. Another form of movement inside of VRTK is just simply moving your arms in the motion of walking to move, as this doesn't really involve the user simply walking inside the game, this is not a type of movement I intend to be using inside of my game. The final type of movement that is included inside the toolkit is a basic teleport, where the player points to a location and is moved to this location.

This technique isn't fully immersive but gives the player the most control as well but as mentioned inside this article it feels sometimes “limiting and unfun” But as this is currently the best alternate and is also used in large game titles such as L.A Noire and Skyrim. As this also allows the user to move around simply and effectively when not teleporting and still lets them move inside the current play area.

DEVELOPMENT CHOOSEN TIME PERIOD INVESTIGATION

The investigation for the time period started by looking into current maps of tombs in Egypt. After examination of these maps, I started to look into how the rooms were built.

I looked online for blueprints and notes on how they were so I could keep my rooms as realistic and accurate as possible. With this I started to plan my levels.



DEVELOPMENT UI

The UI in my game I wanted to keep to a pure minimum, due to the immersive nature of VR. I just wanted to have the main sections of my map to incorporate UI to be the hints at the beginning of the level and the timers that will be placed against a wall which won't get in the players vision that much.



DEVELOPMENT

DEVELOPMENT CONSIDERATIONS

There are many large considerations that I will be facing in the development of my game.

DEVELOPMENT - DEVELOPMENT CONSIDERATIONS

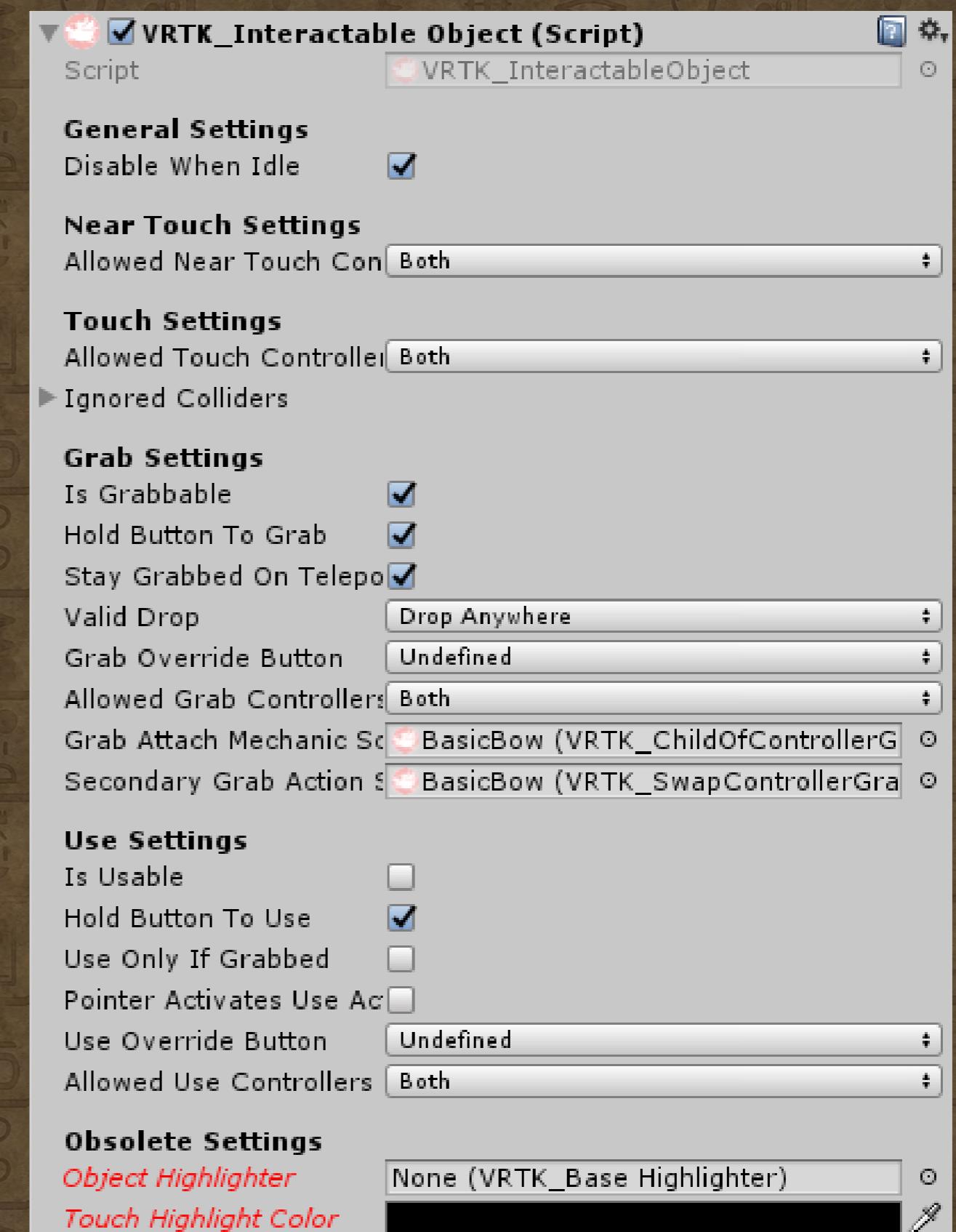
GRABBING OBJECTS - HOLD TO GRAB

There is an option inside the toolkit that I will be using, to determine if I should have the player hold down the grabbing button to grab the object or to simply press it and attach to the object.

After a series of playtesting I found that players found it more immersive to keep the grab button held rather than pressing it once.

This is incredibly helpful and useful as mentioned inside one of the playtests, keeping it more obvious that the player had to keep it held down such as haptic feedback.

All interactions I wanted to have it feel as physical as possible to make sure that it felt as immersive as possible for the user. Buttons and levers will require the user to actually move their hands towards, this in testing has had great feedback.



DEVELOPMENT - DEVELOPMENT CONSIDERATIONS

HAPTIC FEEDBACK

As mentioned above, haptic feedback (vibration inside the controllers) is a feature that will help with my game, but in testing, the more feedback, the less obvious it was there as players would get too used to it and start to dislike it.

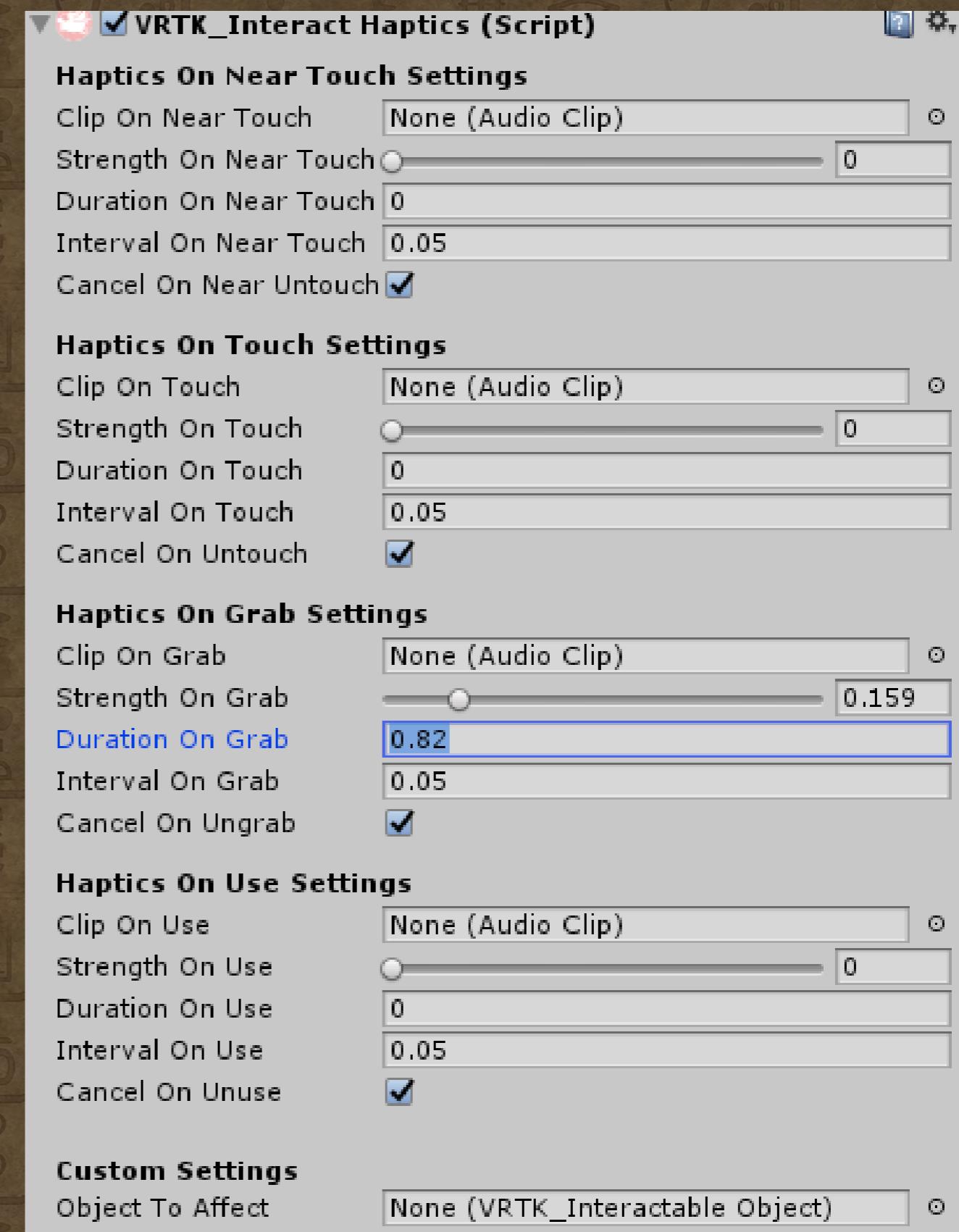
The main areas where I will be including haptic feedback will be inside the bow, when the player pulls back the bowstring I will be adding feedback to simulate the vibration of the bow when holding it.

As the game is developed more, I will be looking into where I can add feedback elsewhere.

```
public float powerMultiplier;
public float pullMultiplier;
public float pullOffset;
public float maxPullDistance = 1.1f;
public float bowVibration = 0.062f;
public float stringVibration = 0.087f;

private void PullString()
{
    currentPull = Mathf.Clamp((Vector3.Distance(holdControl.transform.position, stringControl.transform.position) - pullOffset) * pullMultiplier, 0, maxPullDistance);
    bowAnimation.SetFrame(currentPull);

    if (!currentPull.ToString("F2").Equals(previousPull.ToString("F2")))
    {
        VRTK_ControllerHaptics.TriggerHapticPulse(VRTK_ControllerReference.GetControllerReference(holdControl.gameObject), bowVibration);
        VRTK_ControllerHaptics.TriggerHapticPulse(VRTK_ControllerReference.GetControllerReference(stringControl.gameObject), stringVibration);
    }
    previousPull = currentPull;
}
```

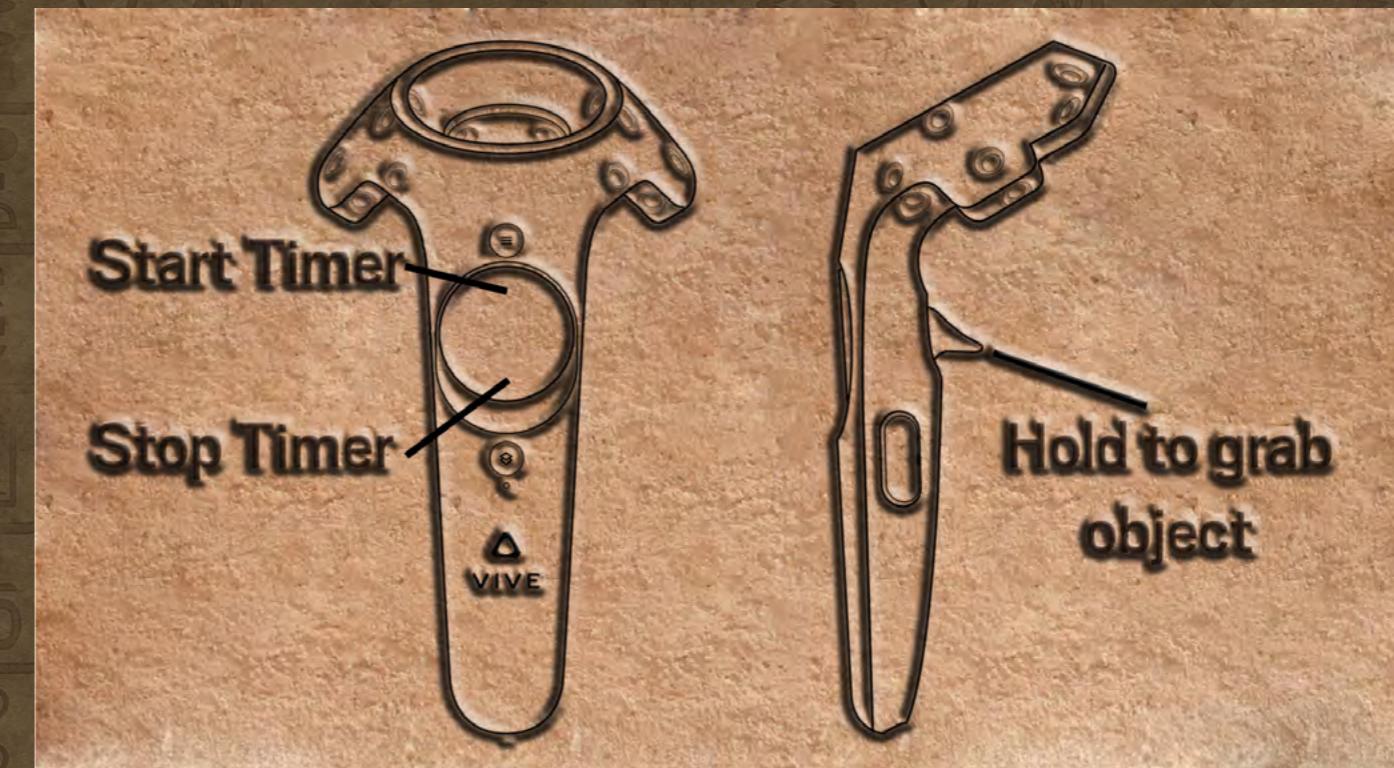


DEVELOPMENT - DEVELOPMENT CONSIDERATIONS

TUTORIALS

In my playtests, It was brought up a lot that players couldn't just pick up the headset and use it due to the controls not being as obvious as possible.

The tutorial I had included inside the playtests were rather basic, and it ended up with me having to explain the controls, due to this unfortunate outcome I had to create a much more obvious tutorial explaining the games mechanics.



DEVELOPMENT - DEVELOPMENT CONSIDERATIONS

LIGHTING

Lighting is a large problem inside Unity as it can be very taxing on the engine and can impact performance if not done correctly. For this I started to research online on how to properly create lighting that is both useful and atmospheric.

I found from a video online, that by removing any ambient light and removing any form of light from the skybox, would let me create a light system that would be incredibly immersive and atmospheric at the same time.



DEVELOPMENT - DEVELOPMENT CONSIDERATIONS

PLAYER BEHAVIOUR

In this section I will be talking about something that is a large problem inside game design, players behaviours behind certain aspect of game mechanics. When WoW (World Of Warcraft) was first released, blizzard made a timer that reduced the amount of XP you get the more you play it.

This would later be changed to where you get an XP boost when you don't play the game and get the boost when the player next logs in. Making a system that rewards players that finish it quickly rather than punish a player for being too slow.

As my original timer punishes the player for taking too long and reducing their score, they don't get an actual score for finishing the level early. Due to this, I implemented a bool inside the script that toggles the timer off and shows the score the player is currently at, doing this provides the player with a sense of achievement for completing it rather than punishment for almost failing as well as giving incentive to replaying the level in the fastest time possible.

Some more examples of encouraging player behaviour is like in the recent Doom game. Mechanics push the player to a more aggressive playstyle, they achieved this with the "glory kill" mechanic that gives you benefits if you close in on your enemy instead of running away and firing from a distance.

This move doesn't use any ammunition, instantly kills an enemy and gives the player health pickups, a contrast from FPS games in the past which teach the player to stick to cover and recover health. In Doom, the player spends much of the game running headfirst towards enemies.

In Bloodborne they also achieved this with the "rally" mechanic, which lets you recover health if you attack an enemy if you have just taken damage. It is a much more fast paced change from the previous dark souls games in the series.



DEVELOPMENT - GAME MECHANICS

TIMER

The Timer is a large part of my game and its mechanics. Due to my plan of encouraging the player to try and complete it as fast as possible, the timer had to play a large part of the game. As I am fairly well experienced in coding within Unity, I wanted to start the project with some groundwork so I looked into a tutorial on Youtube, from this I started to rip apart their code and implement it into the VR interactions within my project.

One being the enabling of the component, and the timer by pressing down on a button. I created a system where I knew that if I made a bool that when toggled would active the timer and would start counting down from whatever number I deemed.

Inside this statement in my code, I stated that if the timer wasn't active then it will display the player score where the timer was in game. This wouldn't interrupt the script externally as the script had to be turned on first for it to start displaying the timer.

After large amounts of testing I got it to a certain point where I was happy with and was easy to control in both the inspector of Unity and the script.

```
public class CountdownTimer : MonoBehaviour
{
    public float CountdownGameTimer = 300; // change this for Timer and in Inspector
    public bool TimerActive = true; // setup for true statement
    public int OldScore = 30; // what score the player receives OLD TIMER
    public int NewScore = 30; // what score the player receives NEW TIMER
    public int Score = 30;
    public int ScoreText = 30;

    // use this for initialization
    void Start()
    {
        timerText = GetComponent<Text>();
    }

    // update is called once per frame
    void Update()
    {
        if (TimerActive == true)
        {
            int min = Mathf.FloorToInt (CountdownGameTimer / 60);
            int sec = Mathf.FloorToInt (CountdownGameTimer % 60);

            CountdownGameTimer -= Time.deltaTime;

            timerText.GetComponent<UnityEngine.UI.Text>().text = "Your score is " + OldScore + " sec: " + sec;
        }
        else
        {
            Time.timeScale = 0f;
            updateScore();
        }
    }

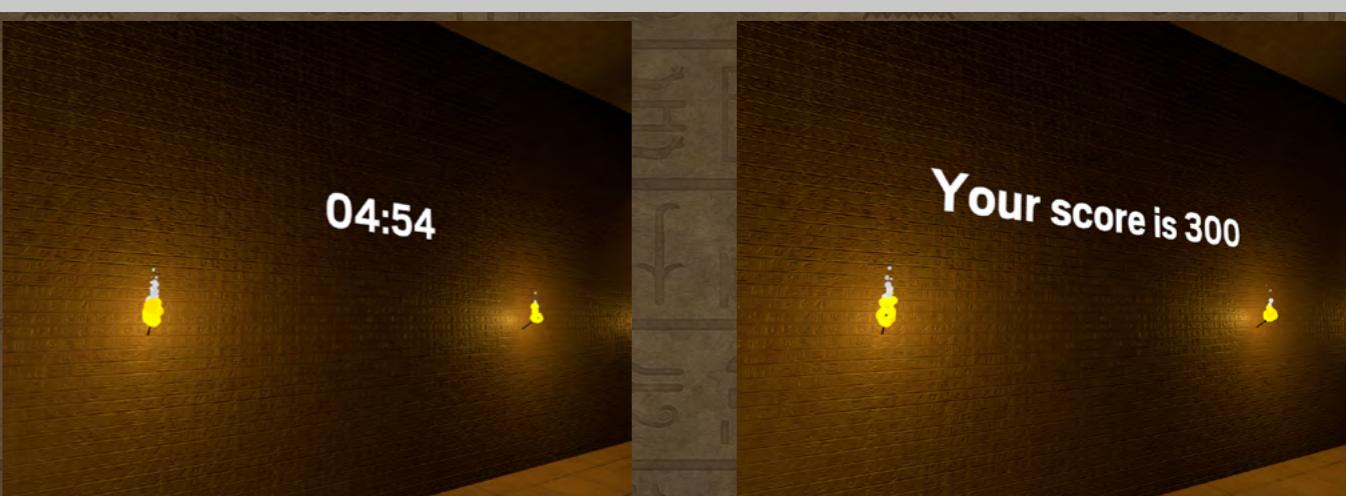
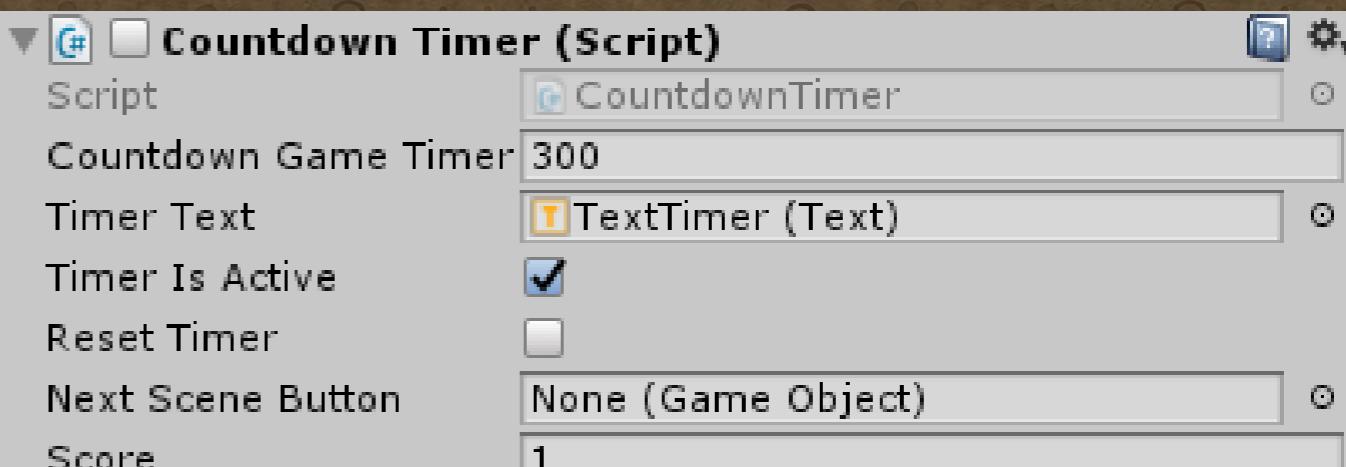
    void UpdateScore()
    {
        if (CountdownGameTimer <= 0) // if countdown timer is 0 then...
        {
            timerText.GetComponent<UnityEngine.UI.Text>().text = "You're out of time!" + "Your score is " + Score;
            CountdownGameTimer = 30; // keep timer at 30
            print("You're out of time!");
            NextScene();
        }
        else
        {
            timerText.GetComponent<UnityEngine.UI.Text>().text = "Your score is " + Score;
        }
    }

    void NextScene()
    {
        if (ResetTimer == true)
        {
            Restart();
        }
    }

    void Restart()
    {
        CountdownGameTimer = 300;
        ResetTimer = false;
    }

    void CountDownGameTimer()
    {
        CountdownGameTimer -= 1;
        print("Your score is " + CountdownGameTimer);
    }

    void UpdateScore()
    {
        //CountdownGameTimer = 30; // how many seconds left of game
        //CountdownGameTimer *= score; // multiplying the time left by a per score
        Score += (int)CountdownGameTimer * 10;
        print("Your score is " + CountdownGameTimer);
    }
}
```



DEVELOPMENT - GAME MECHANICS

PEN

The pen was of similar difficulty to script together as it had to use raycasts, which is something in Unity that fires an invisible “laser beam” of sorts out of the pen object I was using, when it gets to a distance away from the object tagged as a whiteboard, then it locks the axis so it can’t be moved from easily without the user physically pulling away from it.

The way that the pen is setup is so that I can increase the distance that the pen is from the whiteboard by simply changing a value in my script, and the colour of the pen that I will be keeping black.

The actual object of the pen is something that I have been having trouble with as it was colliding against objects, the current size of the pen is really good due to it not having a large amount of collision and can be seen and used quite easily by the user.

The problem that I've been having with the pen is that users keep pressing too far into the whiteboard expecting resistance against the whiteboard. This will require a large amount of testing to get it working correctly but I will be testing this for the degree show.

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using VRTK;

public class whiteboardpen : MonoBehaviour {

    private Whiteboard Whiteboard;
    private RaycastHit touch;
    private bool lastTouch;
    private Quaternion LastAngle;

    // Use this for initialization
    void Start () {
        this.Whiteboard = GameObject.FindGameObjectWithTag ("Whiteboard").GetComponent<Whiteboard> ();
    }

    // Update is called once per frame
    void Update () {
        float tipHeight = transform.Find ("tip").transform.localScale.y;
        Vector3 tip = transform.Find ("tip").transform.position;

        if (Physics.Raycast (tip, transform.up, out touch, tipHeight)) {
            if (!touch.collider.tag == "Whiteboard") // tag of object
                return;

            this.Whiteboard = touch.collider.GetComponent<Whiteboard> ();
            Debug.Log ("Pen is Touching!");

            if (lastTouch) { // stop snapping to whiteboard
                tipHeight *= 6f; // distance from whiteboard
            }

            //change this for colour
            Whiteboard.SetColor (Color.black);
            Whiteboard.SetTouchPosition (touch.textureCoord.x, touch.textureCoord.y);
            Whiteboard.ToggleTouch (true);

            if (!lastTouch) {
                lastTouch = true;
                LastAngle = transform.rotation;
            }
            else {
                lastTouch = false;
                this.Whiteboard.ToggleTouch (false);
            }

            if (lastTouch) {
                transform.rotation = LastAngle;
            }
        }
    }
}
```



DEVELOPMENT - GAME MECHANICS WHITEBOARD

The whiteboard and the pen were developed concurrently. In the pen script, I had referenced the whiteboard as a tag and a game object, meaning that if I name something “Whiteboard” and give it the tag of whiteboard I will be able to draw on it.

The pens touch point on the whiteboard is then calculated and when the pen has touched it begins to add a square 10 pixels by 10.

This is then added to the whiteboards material, unfortunately due to the unfortunate nature of creating a brand new material with this script, I can't use more than 1 pen at the same time. I will be investigating this later on before the final show.

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using System.Linq;

public class Whiteboard : MonoBehaviour {

    private int textureSize = 2048;
    private int penSize = 20;
    private Texture2D texture;
    private Color[] color;

    private bool touching, touchingLast;
    private float posX, posY;
    private float lastX, lastY;
    // Use this for initialization
    void Start () {
        Renderer renderer = GetComponent<Renderer> ();
        this.texture = new Texture2D (textureSize, textureSize);
        renderer.material.mainTexture = this.texture;
    }

    // Update is called once per frame
    void Update () {
        int x = (int)(posX * textureSize - (penSize / 2));
        int y = (int)(posY * textureSize - (penSize / 2));

        if (touchingLast) {
            texture.SetPixels (x, y, penSize, penSize, color);
        }

        for (float t = 0.01f; t < 1.00f; t += 0.01f) {
            int lerpX = (int)Mathf.Lerp (lastX, (float)x, t);
            int lerpY = (int)Mathf.Lerp (lastY, (float)y, t);
            texture.SetPixels (lerpX, lerpY, penSize, penSize, color);
        }

        texture.Apply ();
    }

    this.lastX = (float)x;
    this.lastY = (float)y;

    this.touchingLast = this.touching;
}

public void ToggleTouch(bool touching) {
    this.touching = touching;
}

public void SetTouchPosition(float x, float y){
    this.posX = x;
    this.posY = y;
}

public void SetColor(Color color){
    this.color = Enumerable.Repeat<Color>(color, penSize * penSize).ToArray<Color> ();
}
```

DEVELOPMENT - GAME MECHANICS

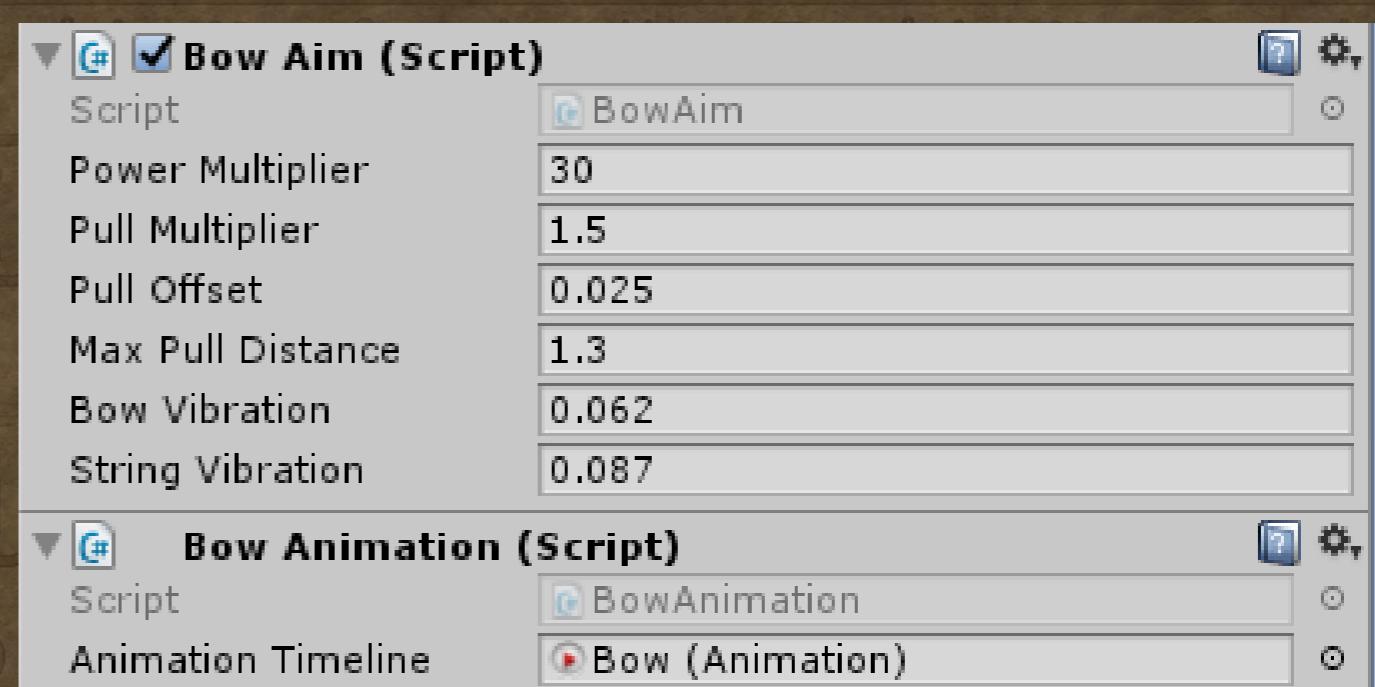
BOW

The bow was a script that I spent the most time prototyping and getting user feedback and testing for. I started off by getting a basic rigged bow and working on getting the arrow inside of the bow, with the toolkit I am using, it uses a “Snap Point”.

This places the object on that snap point when interacted with, then when pulling the arrow back it calculates the distance between the handle of the bow and the snap point and it moves the frame of the animation to the distance calculated, during this time with each movement of the arrow there is haptic feedback when the value of the distance between the string and the handle is changed.

When the grabbed arrow is released when it is in the snap point, it does a series of calculations that took an incredibly long time to calculate, such as the power modifier, the distance the string has to be pulled back and the and the distance before the arrow starts dropping.

These variables and more allowed me to get the bow to an incredibly near perfect series of settings that I will be giving minor adjustments for the final show.



DEVELOPMENT - GAME MECHANICS

ARROW

The arrow was something that became a large part of my bow and arrow level, it started off just as the generic model from an object in the Unity asset store, an idea that came about with this would be having a player hit all the targets in that certain area and with each target they hit, the torch that would be illuminating it would turn off, a problem that I had with this is specifying the amount of targets inside the area. After a series of user testing and attempts at speed running it, I found a good amount of targets to keep inside the level. The script that I used for the arrows, involved getting a large amount of game objects then creating an if statement when all of the game objects are turned off then to start doing something.

This brought on the idea of when the targets are all turned off, the player is then dropped into the next area via falling through the floor. This was achieved by creating an animation that drags the player downwards when the targets are turned off and the floor is disabled under them. In playtesting, the speed of the animation had to be reduced due to people getting a little sickly.

After a series of tests with the arrow in its state, I wanted to have it when arrows are fired then when they collide with an object then it freezes in place when the object has been fired. A problem that I had found was that when the arrow had fired or dropped, the rigidbody attached to the arrow would make the arrow freeze in mid-air, I have yet to fix this, but I will try to amend this before the degree show.

While developing the arrow, I had a problem where I had to have a large amount of arrows already in the game which I had to pick from. To solve this, I took the concept of a quiver where the player reaches behind their head to get an arrow to fire, for this, I created a script that allows the user to reach behind them into a location and grab to bring out an object, a problem that I have had with this was integrating it with my other scripts, but after a large amount of trial and error I managed to get it working.

I have also managed to change it to where it is a designated object dependant on what I decide to place inside the inspector.



```
private void Start()
{
    spawnDelayTimer = 0f;
}

private void OnTriggerStay(Collider collider)
{
    VRTK_InteractGrab grabbingController = (collider.gameObject.GetComponent<VRTK_InteractGrab>() > collider.gameObject.GetComponent<VRTK_InteractGrab>() && collider.gameObject.GetComponentInParent<VRTK_InteractGrab>());
    if (grabbingController && NoArrowNotched(grabbingController.gameObject) && Time.time > spawnDelayTimer)
    {
        GameObject newArrow = Instantiate(arrowsPrefab); // making a new game object of the ArrowPrefab
        newArrow.name = "ArrowClone";
        grabbingController.GetComponent<VRTK_InteractTouch>().ForceTouch(newArrow);
        grabbingController.AttemptGrab();
        spawnDelayTimer = Time.time + spawnDelay;
        gameObject.tag = "Arrow";
    }
}

private bool CanGrab(VRTK_InteractGrab grabbingController)
{
    return (grabbingController && grabbingController.GetGrabbedObject() == null && grabbingController.IsGrabButtonPressed());
}

private bool NoArrowNotched(GameObject controller)
{
    if (VRTK_DeviceFinder.IsControllerLeftHand(controller))
    {
        GameObject controllerRightHand = VRTK_DeviceFinder.GetControllerRightHand(true);
        bow = controllerRightHand.GetComponentInChildren<BowAim>();
        if (bow == null)
        {
            bow = VRTK_DeviceFinder.GetModelAliasController(controllerRightHand).GetComponentInChildren<BowAim>();
        }
    }
    else if (VRTK_DeviceFinder.IsControllerRightHand(controller))
    {
        GameObject controllerLeftHand = VRTK_DeviceFinder.GetControllerLeftHand(true);
        bow = controllerLeftHand.GetComponentInChildren<BowAim>();
        if (bow == null)
        {
            bow = VRTK_DeviceFinder.GetModelAliasController(controllerLeftHand).GetComponentInChildren<BowAim>();
        }
    }
    return (bow == null || !bow.HasArrow());
}
```

DEVELOPMENT - GAME MECHANICS

PUZZLE AREA

The puzzle area is where a significant amount of time went into creating and developing the logic behind the puzzles. The questions and puzzle behind this, I decided to use a series of interactions that have been used throughout the game up to this area. This area will be the final area and level inside the game, for this section I planned to have a more complicated and less obvious series of puzzles.

The starting interaction would begin with pressing a button to show a lever close to the play area, through the game, pressing the main button would start the timer, but for this button, due to the level of difficulty within this area. I decided to use a large lever to start the level entirely as it could require help from your team as well as yourself.

This would then start the timer and the puzzle in general. The puzzle area consisted of 6 overall interactions that would increase in difficulty.

Starting off with a slider that the player would grab and move into position, then a box would appear with hieroglyphs on the side, this would spell “Ankh” and using the book that is already inside the level the player would have access to. After this, the player would have to answer another question, this correct question would then spawn a series of objects hovering in the air, this would then have to be solved to create a staircase.

When the player steps inside the right position, the random objects would move together to create a staircase that the player would go up to access the final scarab beetle.

When placed inside the sarcophagus, this would open up a door with a glowing light to simulate escaping the tomb. I used the PostProcessing plugin to create a shader that glowed and allows me to change the colour freely.



DEVELOPMENT - GAME MECHANICS

PUZZLE AREA - SLIDER

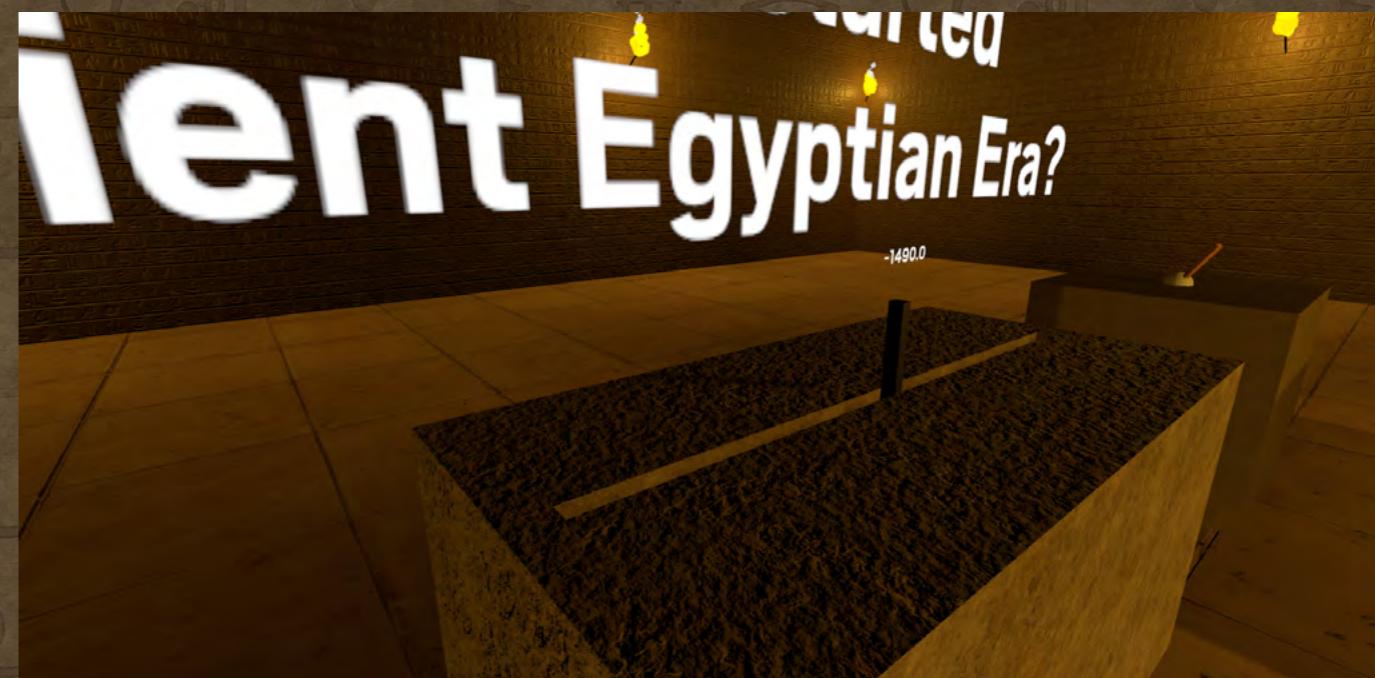
The slider is part of the VRTK toolkit, though to do what I wanted to do; placing the lever inside a target area, and when placed there for a period of time it goes to the next area was incredibly hard to do.

There is an already coded number that is moved inside of the script, first I had to calculate what the actual variables to these are and to see if it could be manipulated and changed.

A great way that I learnt from our Unity technician Andrew is to just fill the script with debug logs stating a number and depending on what version of the debug log it gets up to in the console then that's where the problem will end up being, this has helped significantly.

After a large amount of testing and prototyping this, I managed to edit the script to where it will display a set variable that I can decide on.

After picking a question, I got it to a certain point between the two variables and after another set of testing to see if it could work, I got it to a point where I am happy with but I have a few issues with how easy it is to actually solve the question which I will solve for the degree show.



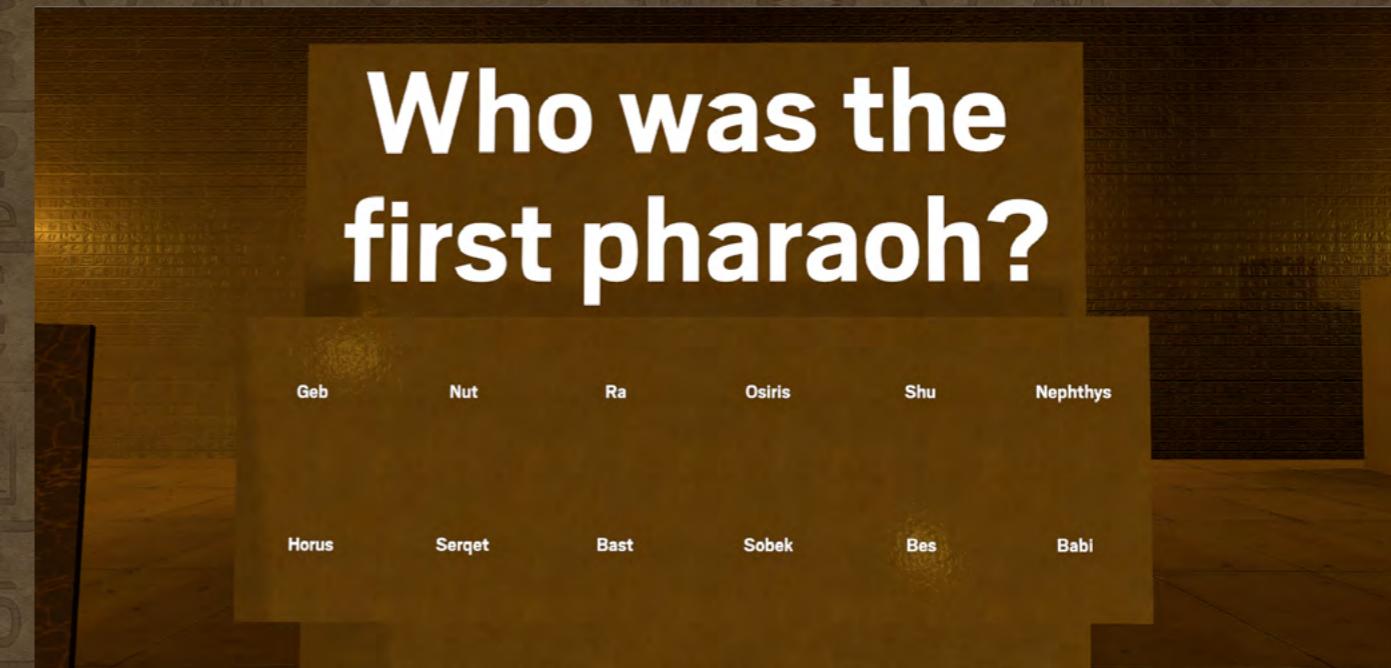
DEVELOPMENT - GAME MECHANICS

PUZZLE AREA - WALL BUTTONS

Something that I may need to redo for the degree show is the visuals of the wall buttons. Though the actual code for them is perfectly fine, they still look incredibly basic and out of place but I am still happy with it.

The code is an already made section from VRTK, but for what I needed, once again I needed to edit the code to work in line with what I wanted doing. I wanted the buttons to display text when pressed, depending on what button was pressed I wanted it to say different thing; this is where I learn about strings that could be edited inside the inspector.

Depending on what button I press, I have a different part of text that is shown for the when the button is pressed against what it is when it is released. A simple edit of the code allows for the ability to set an object active when the correct button is chose.



DEVELOPMENT - GAME MECHANICS

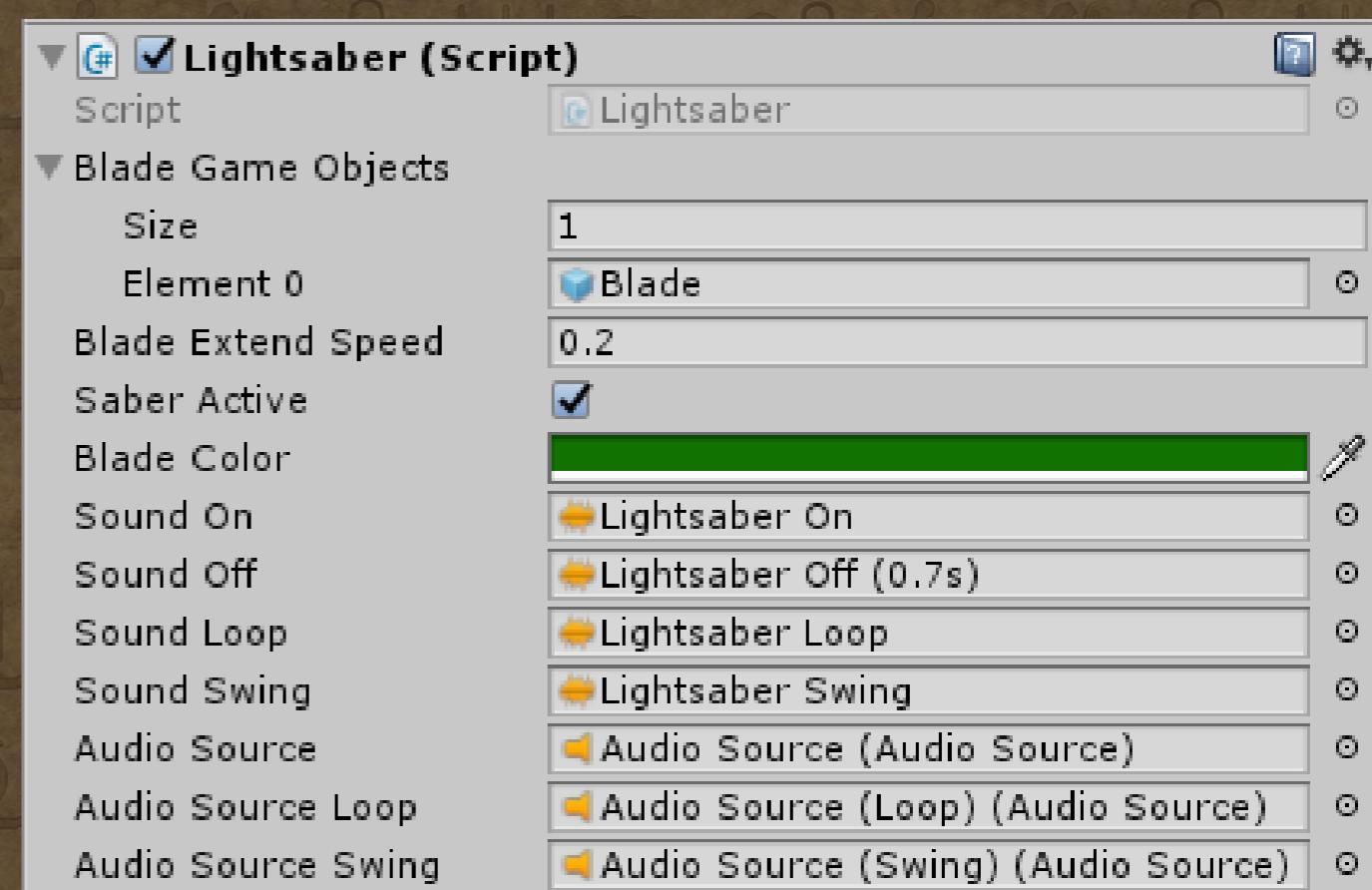
LIGHTSABER... SLIGHTLY OFF TOPIC

As a small side project, using the same material that I used for the last door in the final area. I wanted to create something fun and out of context as I had began to get frustrated with a certain aspect of the coding as I couldn't figure it out.

I started by creating a series of small cylinders, applying my glowing shader, then with some changes to the shaders colours and intensity I was happy with the look to the blade sections.

After ripping a series of sound effects from the movies, I used a script to say that if the lightsaber was gripped and not moving then to loop a certain sound effect of it being idle but if it was moved at a certain velocity to play a moving sound effect.

A fun little side project that I included in the final area for the player to play around with.



DEVELOPMENT - LEVEL DESIGN

The techniques that I used for my level design I learnt and adopted from Ubisoft and how they apply their practices to my own work.

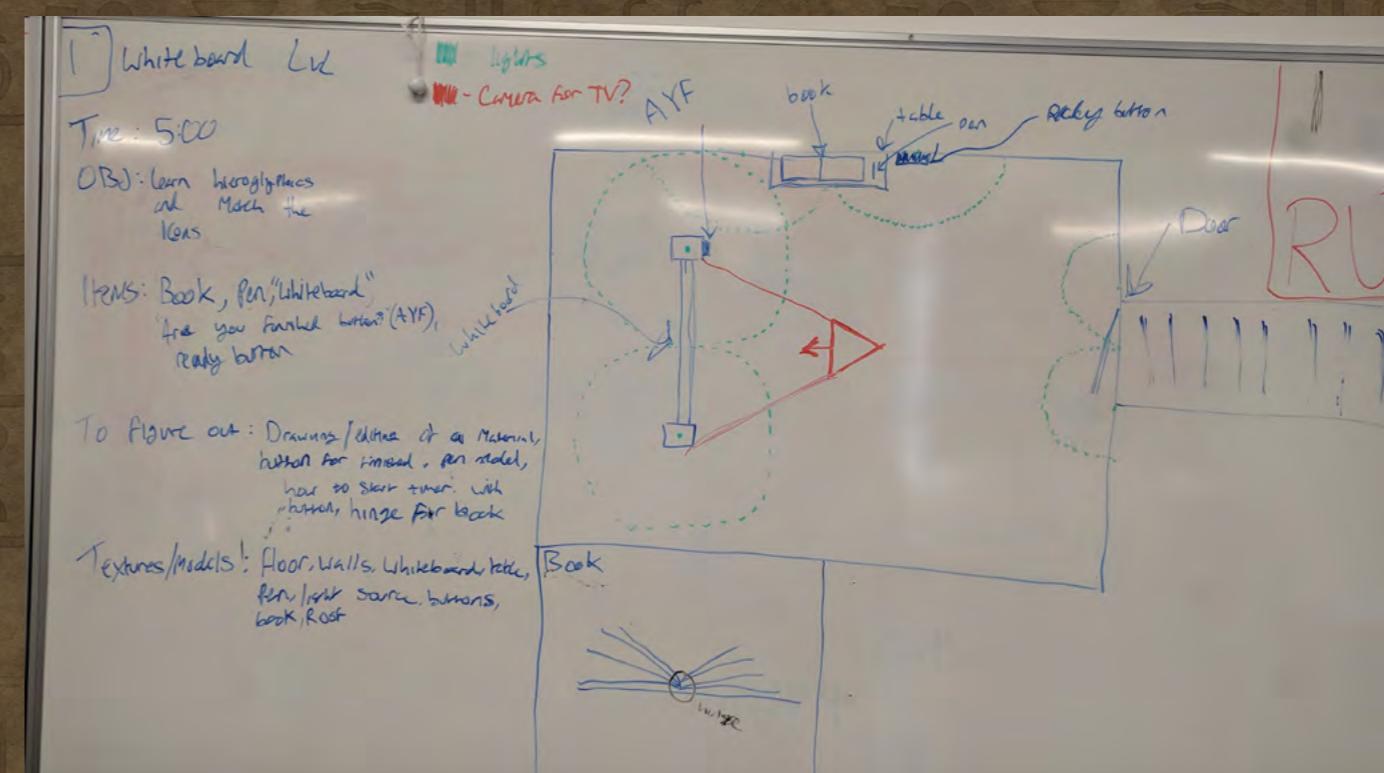
With the mechanics that I had in my games testing area, I started to separate them into their respective levels and planning where objects and interactions could be placed inside the game.

The whiteboard level started off being incredibly basic, where I started to plan the level, I wasn't aware of the size of the book. As I planned the for the book to be resting on a table against a wall, I had problems with the size of the book in general when placed against a wall due to the colliders that were attached to the object. It resulted in being placed against a pillar which would then be quite large in size due to when in play tests.

This resulted quite well, as I created a camera that would then be displayed for the other team, I wanted to create a small image or something that only the team not in VR will be able to see but won't be able to finish this in time for the creation of the video though I do have a good idea about how I will execute this.

The bow level went through various changes dependant on the difficulty and speed of the timer, as the timer was going to be 5 minutes each time, I had to decide how many targets there will be. I conducted a series of playtests surrounding this problem of the amount of targets, in these tests, I had people who I had testing it

constantly, first time players and people who have played VR but not my game. I decided to keep it at around 20 targets. Due my original plan including 3 targets, the design I had originally intended to use with the building was rather wide but I eventually had to redesign this due to having more than 3 targets. I had to expand the size of the building due to the increase in targets but this wasn't a problem as it gave me more space for the timers.



DEVELOPMENT - LEVEL DESIGN PT.2

The puzzle area went through various stages of design, from having the puzzles integrated into the wall, to having the puzzles all on 1 wall but it ended up looking as it currently does where it is separated out depending on what stage of the area you are on.

The pillar to collect the scarab beetle to finish the level was kept on top of a pillar so the player can't cheat the area, but it ended up being quite useful due to the addition of the perspective puzzle.

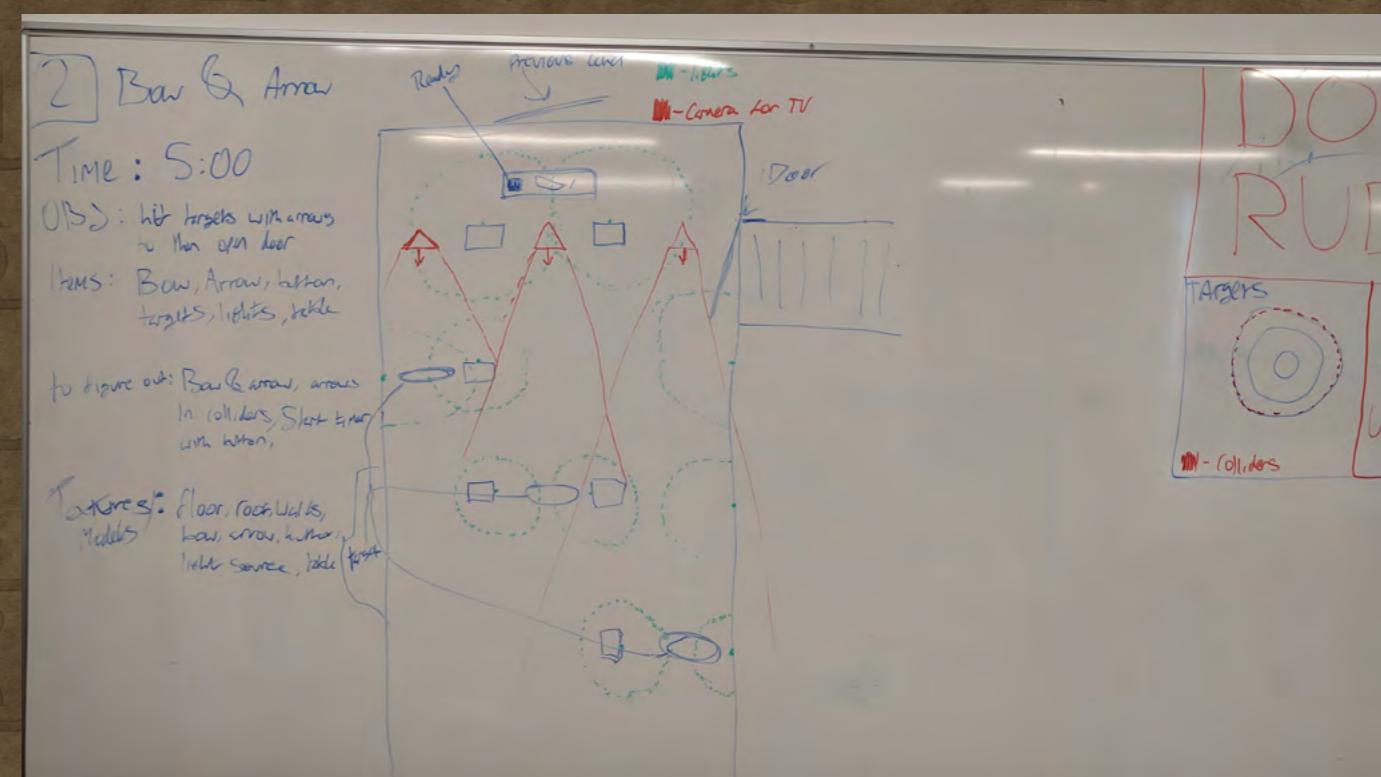
The tutorial areas came at a later and are still in development, this came after a rather tragic demonstration to the course, there was a few issues with external influences but the one thing that was obvious was that the tutorial had to be more obvious, even more than it was especially if the public was to use it.

I decided on 3 main tutorial levels, that would include all the main interactions within the game without giving away all the puzzles immediately. A basic teleport level was the first as it became obvious that some people couldn't understand which section of the controller was to be used for teleporting.

There is a script that comes with VRTK that allows for the highlighting of a section of the controller, to make this obvious I made the touchpad; that is used for teleporting highlighted a bright green, a colour that is absent from the rest of the game. I placed text in a large font that explains how the teleport works and to press a

button that isn't used for anything else to navigate to the next tutorial.

This would move the player to the grabbing tutorial which explains the simple mechanic of keeping the trigger held to grab an object and when to release it.



DEVELOPMENT - LEVEL DESIGN PT.3

I created a surrounding table for the player so they aren't distracted from the main tutorial.

This tutorial once again used large text to make it clear what the user has to do.

The next tutorial would be the other general interactions, such as pressing down and pressing buttons physically, grabbing levers and moving them into the correct direction and the snapping which is slightly more complicated than the rest.

As this was just the tutorial, I just had the interactions do incredibly simple things such as turning off the hint text once the player has done the correct section of the tutorial so they could keep track of how far through they are, after this is done the player presses the button on the controller again to start the game.

DEVELOPMENT - AUDIO AND SOUNDTRACK

Audio is a large component of VR and immersion, if the soundtrack is immersive enough with enough detail then the player can be encapsulated by this. I wanted the soundtrack to start at the beginning of the game with a drum that hits every second. I initially created a soundtrack but after debating and having issues with it, I felt like it was much too sinister and lacked the egyptian feel to it, I decided to redo this and using a series of samples of a snake charmer and studying Egyptian and Arabic music, I was finally happy with this result. The next bit of audio I had was after feedback during user testing, players wanted an audio queue.

After doing some research online, I found a really interesting video of audio designers for video games and they had mentioned their feelings and findings on certain video game sound effects. An effect that came up often is the Zelda sound effect for opening a chest, it's an incredibly classic sound effect and this brought upon the creation of my sound effect for finishing a level. After testing with players, I am really happy with this result.

When creating these sound effects and tracks for the game I had used a series of plugins that I have used previously and are incredible.

Completed Effect: F Piano Harp Phrases

Soundtrack 1: Exhale - Ancient Idols

Lumina - B Mystery - Trail through the Woods
Abbey Road - Late 60s Kit Full

Soundtrack 2:

Wind - Kontakt Library - Harp, Flute, Piccolo

Oohs - Exhale - Merfolk

Bass Drum- Kontakt Library - Bass Drum

Guitar - AUSampler - <https://www.looperman.com/loops/detail/79551/arabic-theme-with-flute-by-jensmuse-free-120bpm-ethnic-flute-loop>



DEVELOPMENT - AUDIO AND SOUNDTRACK PT.2

I created a series of voice overs that play at certain points if a user is struggling to finish the game, these play just as helpful reminders for the player to keep track of what they need to be doing. For sections of the game where audio would not be wanted immediately, I had to create a simple script that waits for an amount of seconds and after that a certain gameobject would become active (the audio).



DEVELOPMENT - GAME PROGRESSION

The game progression is something that I planned quite simply, as I want it to be completed in a team based series of activity. Due to this, I wanted to divide the game into equal sections, where the player would complete a team based activity first.

Then after the team based activity of the whiteboard level they have to do a dexterity based challenge and once the bow and arrow level is completed then you have to complete the puzzle area.

The balancing of this where it still keeps everyone involved throughout has worked out very well.



DEVELOPMENT - TEXTURES

The textures used I have sourced from gametextures.com where I may or may not have abused their free textures service.

Other more difficult to get textures such as the translated book I created using a hieroglyphics font in photoshop then using two gameobjects together inside of an empty gameobject to create a page feeling for the book.



DEVELOPMENT - DESIGN PROBLEMS

I have had many design problems throughout this project, from hardware issues with Unity constantly crashing to having technical problems with baking times in Unity. From the start of the project, the space that we had the VR headset in was shared with another student and tutor who had to have constant access to it. This was incredibly frustrating at points but we got to a point where we had moved the VR into a more accessible location, the problem with this was the scale of the VR area.

One large developing problem inside of Unity was the lighting is hard to get used to, and baking the lighting in project then I have to wait an incredibly long time; 40 minutes and over an hour after a while.

A problem with the Ankh snapping was that it was supposed to freeze in mid air, the problem with this is that it just didn't want to freeze whenever the player places it inside of the snap location. Another problem that came around was the complexity of the VRTK plugin as it interacts with all the other scripts in the level, having to hack this and code it to my needs.

After joining the VRTK slack and asking question surrounding these issues and much help, it was incredibly helpful for their responses.

The perspective puzzle was created by somebody I had spoken to on Reddit, he had created a script that using cell fracture on a model in blender, the player can move to a certain location and it completes the solution. The main problem with this, due to one script having to use the Unity editor, I can't fully build the game into a finished application and for the game at the final show, I will try and fix this.

A problem that I had inside the playtests was that players were cheating when they were moving around the level, by walking outside the walls and inside objects. A way that I have solved this, is by using the a series of scripts that give resistance against when the player is trying to misbehave, by fading the players view to black once they walk into one of these walls.

DEVELOPMENT - FINAL LEVEL DESIGNS - STARTING AREA



DEVELOPMENT - FINAL LEVEL DESIGNS - WHITEBOARD



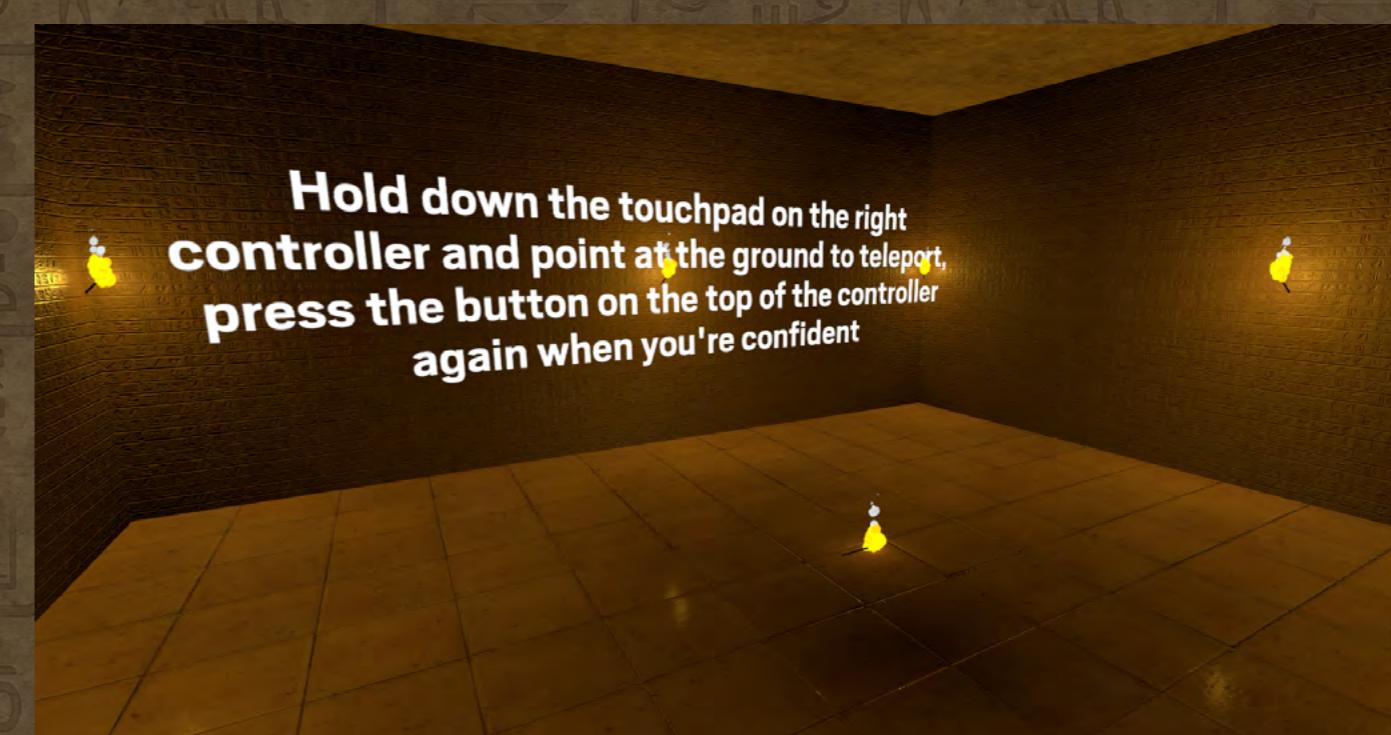
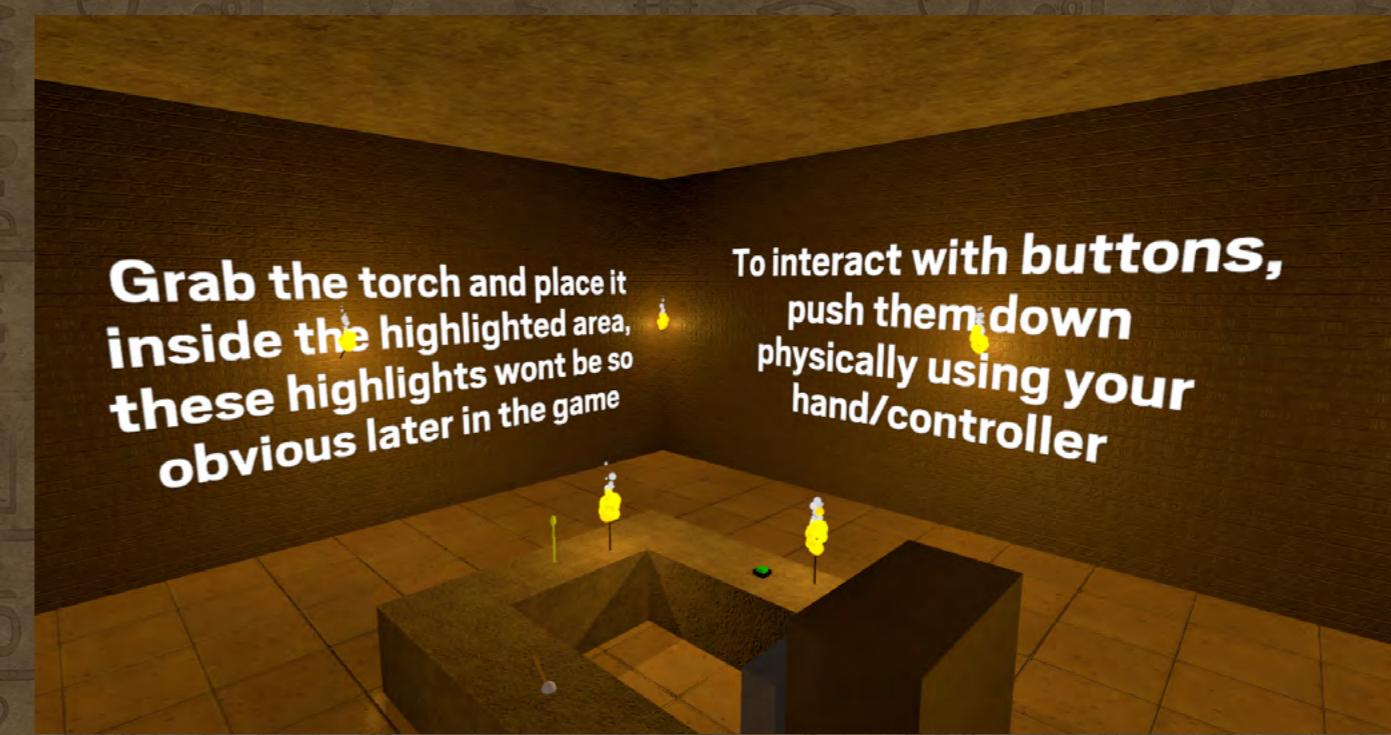
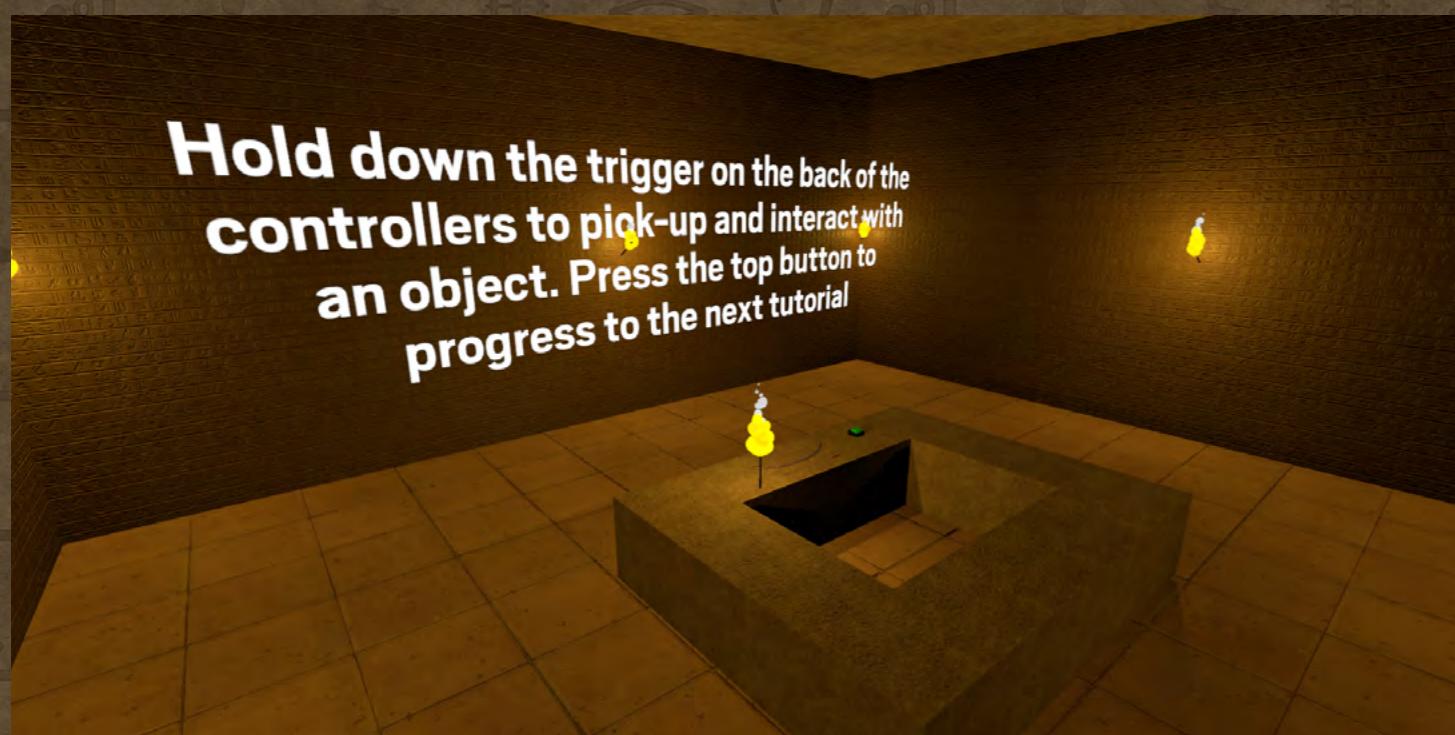
DEVELOPMENT - FINAL LEVEL DESIGNS - BOW



DEVELOPMENT - FINAL LEVEL DESIGNS - PUZZLE



DEVELOPMENT - FINAL LEVEL DESIGNS - TUTORIALS



DEVELOPMENT - FINAL LEVEL DESIGNS - FINAL



Thanks for playing!

BRAND IDENTITY

BRAND IDENTITY - NAME DEVELOPMENT

In the previous semester, I had wanted to name the project “DISCOVR”, a slight change to reflect the virtual reality portion of the project. Due to my idea changing slightly, I felt a redesign was in order.

With the start of developing, I started off with the name “Carter”, named after the famous explorer “Howard Carter”. Famous for discovering the tomb of Tutankhamun, a very famous finding that is well known for spawning a lot more other excavations of tombs nearby. As this name developed, the idea that this version of the escape room could be called “Carter”, which would then be part of a series of versions.

This went really well with the idea I had of it being able to be included in different museums. This then brought the name ‘The “Carter” Odyssey’, where the “Carter” section of the name would change dependant on the theme of the escape room. Odyssey being chosen due to if it was in different museums it would tell a differnt story with each theme.

BRAND IDENTITY - LOGO AND COLOURS

FONT

The font that I will be using for the final design is Air Americana, a font that I am incredibly fond of.

I have used it in some personal designs and it really gives off a professional look to it, I will be keeping it at large size to the rest of the project.

The title fonts are in Air Americana if you are interested.

The main text used inside the game is Scout (the font being used here), it is incredibly easy to read and is perfect for more reading heavy sections of my game.

THE CARTER ODYSSEY

THE ODYSSEY

BRAND IDENTITY - LOGO AND COLOURS

BACKGROUND/ COLOURS USED

For the background and colours of the promotional material, I will be using a part of a texture that I obtained for my VR project.

Keeping this in mind, I would change this dependant on what the theme would be, for example a medieval theme could be planks of wood.

The main colour of the font used will be white due to it standing out the most against the background, this also keeps in theme of my main game where text is white unless against a normal background which will then be dependant based on the background image.

BRAND IDENTITY - LOGO AND COLOURS

LOGO

For the logo, I wanted to keep it as basic as possible, for this I wanted a text based logo using the main font of my project.

Changing the colour of the themes name was a later consideration that may change depending on it could be.

The main The Odyssey brand would be similar to the front page of this document, portraying someone opening a story book and them all being told through VR.

BRAND IDENTITY - LOGO AND COLOURS

FINAL LOGOS



THE CARTER ODYSSEY

TCO

VIDEO DEVELOPMENT

VIDEO DEVELOPMENT – PLANNING AND PROBLEMS

For my original video, I wanted to have it laid out where the player would be green screened out on one side and having the gameplay on another, with various cuts to the other people watching the footage on another screen.

The problem with this was that there wasn't a proper way to film both at the same time and still get genuine reactions from it.

As this wasn't something that I had wanted to result with for the final submission, I wanted to create a more cinematic like trailer for my game that would advertise it better.



VIDEO DEVELOPMENT - NEW PLAN

Using a plugin for Unity called CineMachine; which allows for a cinematic like camera movement inside of Unity, I believe this will be effective and give a high quality to the project and video. I will be using voice overs and cinematic views to show off the game and its features. I will be mixing this in with gameplay potentially.

VIDEO DEVELOPMENT – AUDIO

While I am confident in my producing skills throughout my time at university, I have this time decided to pick a soundtrack that I know I can use to create something that I will be happy with.

The soundtrack that I decided to use was the instrumental to Blockbuster Night Part 1 by Run The Jewels, I chose this track as I had wanted a high intensity beat to accompany my video.

I am a large fan of this track due to its general aggressive feeling while listening.

A large amount of large companies and films use these types of soundtracks to generate interest in the product. These include cuts in a fast motion and using this inside my video will generate a lot of viewer interest.



VIDEO DEVELOPMENT - CINEMACHINE

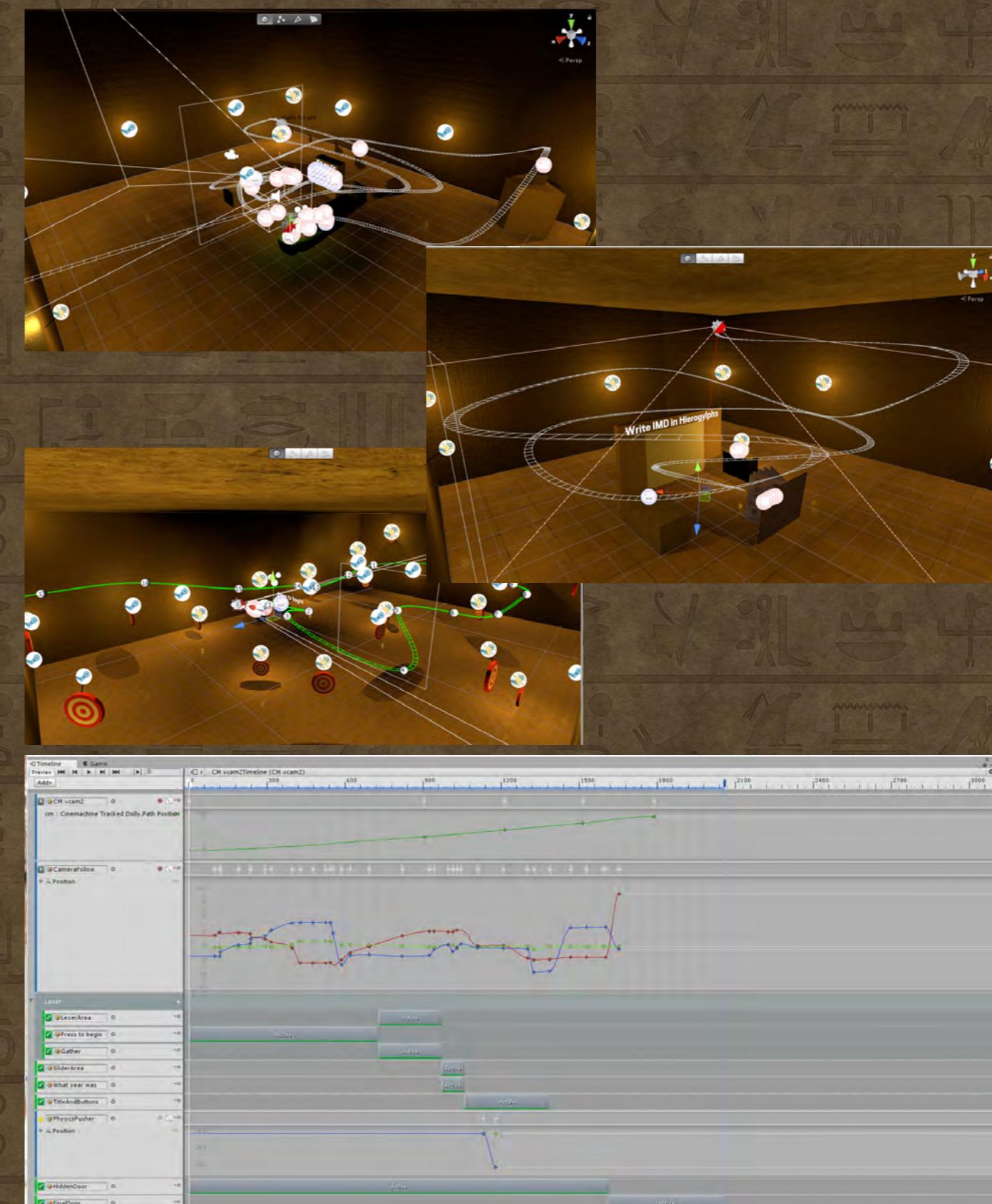
Cinemachine has proved to be incredibly useful this project and am very happy that I came by it when I did. For the filming I utilised a dolly inside Unity that uses a designated camera to move along a track that I had set.

Moving through my levels, I decided to keep the camera tracking on main or certain locations such as the whiteboard and central area inside of my whiteboard level.

When moving into the last puzzle level, I had created a moving following target for the camera that I was moving through the scene completing certain puzzles such as the question surrounding pharaohs.

The timeline in Unity allowed me to achieve this, as it allows for complex components being completed I was able to solve some of the difficult puzzles such as the perspective puzzle.

I had a large amount of fun setting up the dolly for the track as it was extremely satisfying when I set it going and recording.



VIDEO DEVELOPMENT - FINAL VIDEO

The video is available here: <https://youtu.be/cI6OqGI9hqY>



FURTHER DEVELOPMENT

FURTHER DEVELOPMENT

Taking this project further will be complicated as I have already completed it to a position where I am comfortable with, I will be running through the game multiple times and attempting to get any bugs out of the game.

More development will be creating a more defined identity behind the game, potentially creating large banners to advertise the game more publically.

For the final show, I plan to take this into a slightly new theme potentially, the theme yet I am unsure of but I am interested in taking it into an Ancient Greek or Roman theme, I will have to investigate this further first. Something that I have found recently is an asset pack for Ancient Egypt but using the CryEngine rather than Unity. I will be looking at this further.

Some general development that I will be taking into this is trying to carry the players score throughout the game, this at first glance looks to be incredibly difficult, but I will have to investigate and test this.

I will be scouring my project extremely heavily to make sure that it is as perfect as possible for in time for the degree show, things such as moving the wall buttons into a more themed location.

DEGREE SHOW CONSIDERATIONS

DEGREE SHOW CONSIDERATIONS

Some considerations that I will have for the degree show is how it will be seen by the public, due to our space not being overly large to use.

I will be setting up a screen for the public to view the players perspective, I tried to create this using another camera but the performance had heavily dropped so as a good balance this is just as good.

Another consideration is around having multiple students who have developed VR projects, I will be trying to create a system that allows for easy and simple navigation throughout the projects.

I have a good idea on how to do this but due to the scripts used, their may be compatibility problems which I will have to investigate.

EVALUATION

EVALUATION

I am extremely proud of the work I've put in for my final project. I have produced something that I believe could work well inside the real world for the public to access, that is if it had more levels and the polish I will give to it before the degree show.

I said at the end of the first personal project evaluation that the AR project was the most enjoyable project but that has been completely overshadowed by this project, as it was my final project at Northumbria I really wanted to throw everything I have had at it and create something that I am truly proud of. I have achieved everything that I set out to do for this project and felt like if placed inside a real museum it could gather a large amount of traffic.

The fact that this is my first time producing and developing a game in VR, I feel like I have excelled my expectations of the project. I have had friends and other students try it out and seeing their responses to my work has given me a large amount of confidence in my ability to create something better to built on this project.

A large obstacle I had to overcome in this project was the difficulty of some aspects of developing in a players perspective where every placement of an object had to be considered. Due to my tracking of my development it became clear how rapidly I had both prototyped, tested and built my game.

Alongside another student we are the only 2 students so far in our course to create something in VR I feel like we have set a good standard with our projects.

I am currently planning on how I will be taking this project on to the degree show and how I will be keeping it fresh for new and repeat users.

I am very happy with my finished video, it encapsulates both the general gameplay of the game and myself as a designer.

For the final presentation I wish I had done the demo myself or let somebody that I know had played before, as it was a rather large disaster.

Thank you for reading through this, hopefully you didn't skim through as everything inside this document has been used, considered and altered with a large amount not making the final cut.

Have a great day wherever you may be.

Matthew Chaplin - w15020879

WIKI & RESOURCES

WIKI

Rigged - Having an object have movable parts inside a game engine

GameObject - Generic object inside of Unity

VRTK - Virtual Reality Toolkit

Rigidbody - Control for the weight, gravity and other types of movement of a gameobject

RESOURCES

https://en.wikipedia.org/wiki/Virtual_reality

https://en.wikipedia.org/wiki/Mixed_reality

<https://www.qualcomm.com/invention/cognitive-technologies/immersive-experiences/extended-reality>

https://store.steampowered.com/app/218620/PAYDAY_2/

https://store.steampowered.com/app/722230/LA_Noire_The_VR_Case_Files/

https://store.steampowered.com/app/515020/The_VR_Museum_of_Fine_Art/

https://store.steampowered.com/app/327140/Tilt_Brush/

<https://www.lego.com/en-gb/starwars/games/videoexperience>

<https://www.ubisoft.com/en-us/game/ode>

<https://www.theverge.com/2017/11/20/16678438/star-wars-secrets-of-the-empire-virtual-reality-disney-the-void-ilmxlab>

<https://findthekey.ca/>

https://en.wikipedia.org/wiki/HTC_Vive

https://en.wikipedia.org/wiki/Oculus_Rift

https://en.wikipedia.org/wiki/PlayStation_VR

<http://www.virtualrealtypulse.com/2017/samsung/?open-article-id=7488928&article-title=samsung-odyssey-windows-vr-headset-now-available---everything-you-need-to-know&blog-domain=roadtovr.com&blog-title=road-to-vr>

<https://unity3d.com/>

[https://en.wikipedia.org/wiki/Unity_\(game_engine\)](https://en.wikipedia.org/wiki/Unity_(game_engine))

<https://www.unrealengine.com/en-US/what-is-unreal-engine-4>

https://en.wikipedia.org/wiki/Unreal_Engine

<https://www.cryengine.com/>

<https://en.wikipedia.org/wiki/CryEngine>

<https://www.youtube.com/user/McBacon1337/videos>

RESOURCES PT.2

<http://UNDEADdev.com/hey-kid-put-this-on-your-face/>

<https://www.reddit.com/user/heltidsluffare>

<https://assassinscreed.ubisoft.com/game/en-gb/news/detail.aspx?c=tcm:154-319359-16&ct=tcm:154-76770-32>

<https://museumnext.com/insight/how-can-museums-use-virtual-reality/>

<https://www.uxofvr.com/>

<http://vremedylabs.com/blog/2017/7/31/loco-motion-the-ridiculous-state-of-vr-movement>

<https://www.gametextures.com>

<https://www.youtube.com/watch?v=1PUIXX5xuTE>

<https://assetstore.unity.com/packages/essentials/cinemachine-79898>

<https://youtu.be/cI6OqGI9hqY>

