UFCFHQ-45-3 Comprehensive Creative Technology Project Production Document

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UFCFHQ-45-3 Comprehensive Creative Technology Project Production Document	
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Project Title:	Evolving Video Games with Complementary Geometries: Non-Euclidean Level Design

1. Introduction

The purpose of this document is to detail every decision made in the production of the project, including both the final deliverable and the “failed” subprojects. This document will not feature any new research as there has been enough gathered that the project can comfortably move into the next stage.

1.1. Subproject development

Each subproject will be developed in the Unity game engine.

The development of the subprojects will follow a simple plan:

1. Create an initial plan that covers a basic game design document.
    a. This will not be a full game design document as this project is not attempting to create a game yet. This will only establish the ideas behind what could become a game.
    b. Discuss the concept, gameplay and level design.

2. With the initial plan created, begin the development.
    a. Keep the development small in scale, only a single level is necessary.
    b. The subproject is only intended as a showpiece so complex mechanics are not necessary until the beta stages and final subproject.

These two steps are intended to set the guidelines of the subproject development and serve as a reminder to not get carried away with the subproject’s development, which is easy to do when developing something.

1.2. Alpha stage subproject ratings

Upon completion of a subproject, it will be rated on its potential via an average rating of five characteristics.

1. Scalability. Can additions be made?
2. Interest. Is the subproject interesting?
3. Entertainment. Is the subproject entertaining?
4. Accessibility. Is the subproject appealing to most audiences?
5. Originality. How unique is the subproject?

Regarding the alpha stage subprojects, all ratings are subjective to the developer. This is because no gameplay elements are focused on, meaning any comparisons made with video game elements would be inaccurate.

The criteria of each rating are similar but altered for specification. It is worth noting that a rating of three out of five does not represent the average of the ratings but *can* represent the viability of a subproject by working as the minimum target for each rating.

Here are the criteria for each rating specification.

1. Scalability.
    A rating of one would mean that the subproject could not introduce any additions outside of the currently implemented mechanics.
    A rating of two would mean that a few additions could be made but they would not enhance the subproject in any way.

A rating of three would mean that a few additions could be made but they would only enhance the subproject by a small amount.

A rating of four would mean that many additions could be implemented that would enhance the subproject alongside different final video game variations.

A rating of five would mean that the subproject could be developed and added to into the foreseeable future with no end in sight with a multiuser variation.

2. Interest.

   A rating of one would mean that let alone as a user, there was no interest in this subproject.

   A rating of two would mean that although the subproject cannot excite a general audience, there is still some interest.

   A rating of three would mean that the subproject can garner attention from a general audience and was interesting to develop.

   A rating of four would mean that the subproject created a sense of enthusiasm into what the future may look like if developed further due to its unique nature.

   A rating of five would mean that the subproject is unique enough that the future is unknown, it would only be discovered through further development.

3. Entertainment.

   A rating of one would mean that there is no entertainment value within the subproject. It was not fun to develop nor was it fun to playtest.

   A rating of two would mean that there is little entertainment value within the subproject. It was able to keep the attention of the developer for a little while with each playtest.

   A rating of three would mean that there is an average amount of enjoyment in developing and playing this subproject.

   A rating of four would mean that this subproject could easily become an enjoyable game and playtesting it remained entertaining throughout.

   A rating of five would mean this subproject could become a marketable game in the future that may develop a strong following from how fun it is.

4. Accessibility.

   A rating of one would mean that the subproject would not be accessible to an audience outside of a very specific clique.

   A rating of two would mean that the subproject could reach a specific audience regarding interests.

   A rating of three would mean that the subproject would be attractive and playable by a larger audience.

   A rating of four would mean that the subproject attracts the average video game enjoyer.

   A rating of five would mean that the subproject could potentially become a top listing indie game upon commercial release.

5. Originality.

   A rating of one would mean that the subproject has an almost identical premise as a known, released video game.

   A rating of two would mean that the subproject is very similar to a known, released video game.

   A rating of three would mean that the subproject is similar to a known, released video game.

   A rating of four would mean that the subproject has some parallels with a known, released video game but can still be said to be original.

   A rating of five would mean that the subproject is completely original and no parallels can be drawn with known, released video games.

Where an audience is concerned, it is a subjective view from the project developer when they attempt to look at the subproject from a casual video game user's perspective.

1.3. Beta stage subproject ratings

Upon completion of a subproject, it will be rated on its potential via an average rating of four characteristics.

1. Viability. Is the subproject viable as a commercial video game?
2. Interest. Is the subproject interesting?
3. Entertainment. Is the subproject entertaining?

Regarding the beta stage subprojects, all ratings are from comparing the subproject with available sources that will be noted within the rating explanations. This is because there are gameplay elements, meaning there is enough substance within the subproject to get an accurate comparison.

The criteria of each rating are similar but altered for specification. It is worth noting that a rating of two out of three does not represent the average of the ratings but *can* represent the viability of a subproject by working as the minimum target for each rating.

1. Viability

   A rating of one means that the subproject would become a subjectively poor video game.

   A rating of two means that the subproject would become a subjectively mediocre video game.

   A rating of three means that the subproject would become a subjectively good video game.

2. Interest

   A rating of one means there is a low amount of interest shown from 'Google Trends.'

   A rating of two means there is a medium amount of interest shown from 'Google Trends.'

   A rating of three means there is a high amount of interest shown from 'Google Trends.'

3. Entertainment

   A rating of one means that a similar video game on 'Steam' had poor reviews.

   A rating of two means that a similar video game on 'Steam' had mediocre reviews.

   A rating of three means that a similar video game on 'Steam' had good reviews.

1.4. Subproject combinations

The subprojects will each be focused on their specific combinations. This section will just be to list the combinations.

Alpha stage subprojects

1. Horror game genre with hyperbolic portals.
2. Adventure puzzle game genre with a dissolving environment.
3. Exploration game genre on a spherical world.
4. Exploration game genre within a sphere.
5. Puzzle game genre with shifting gravity and a scaling effect.

Beta stage subprojects

1. Tactical game genre with shifting gravity, a scaling effect, and within a sphere.
2. Shooter game genre with shifting gravity and portals (hyperbolic and otherwise,) on a spherical world.

2. Non-Euclidean implementation

2.1. Hyperbolic geometry

2.1.1. Portals

Portals allow for a hyperbolic-style implementation without changing the level's actual geometry. It does this by closing the distance between two spaces, allowing for the user to enter new spaces while feeling like they just walked through a doorway and remain within the same space.

Regarding portals, they can only be considered as a hyperbolic implementation if the rooms are connected in a way a doorway connects rooms. In this case, they can only be used to mimic connecting rooms, as opposed to, teleporting the user across an unconnected distance. A discussion on how portals work can be found in section '2.3. Portals.'

2.2. Spherical geometry

2.3. Portals

To implement hyperbolic portals it should first be discussed how they would be implemented theoretically, without mentioning actual code snippets to make the idea readable for all possible interested parties. Portals come in pairs. Each portal within the pair requires a camera that moves proportionally to the user position. The reason the cameras should do this is so that they are appropriately placed to get a view of what the character should see when looking through a portal at whichever angle. This view will then be rendered onto the portal game object, forming the visuals for the portal.

For movement when within the portals, the attached script should record the user's current position and then the position where they'll be teleported to. With this in mind, a check can be run that stops the user from teleporting back and forth. This code would be called once the user enters the portal collision area.

3. ‘Subproject beginning’

This section is to cover the initial resources given to each subproject to increase development efficiency, alongside a discussion on the Github repository that will contain these files and the full development folders of all the alpha stage and beta stage subprojects.

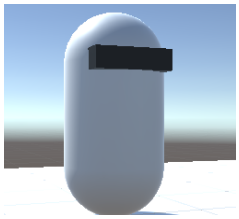
Due to the nature of this project, the subproject beginning repository, known as ‘UFCFHQ-45-3-Comprehensive-Creative-Technology-Project-Subproject-Beginning’ will only feature the files contained within the alpha and beta stage subprojects. In other words, it will not contain the final files used within the final subproject. Also, older subprojects will contain older files so that the evolution of the project is easily visible.

3.1. Playable character

A basic first-person character controller was created to establish the user’s movement for each subproject. This was decided as each subproject will require basic movement and it makes sense to have a prefab that skips the process of coding this every time a new subproject is started.

This playable character is just a capsule game object with a few child objects and the first-person movement script added on. A cube game object was placed at eye level to show where the user character is facing. The first-person movement script is called ‘PlayerController’ and allows for a smooth user and camera movement that should be effective in any of the planned subproject combinations.

The movement script underwent a couple of major changes throughout the project’s development but it has landed on the character containing a rigidbody and separate moving parts for optimised movement with the subproject’s mechanics.



3.2. Scripts & shaders

This section will discuss the scripts developed specifically for subprojects that played a significant role. The most simple way to discuss the scripts and shaders contained within the subproject beginning is through a list and brief explanations. The list is as follows.

General

- PlayerController
  - Controls the first-person playable character and camera movement.
  - Handles different gravities depending on selected booleans.
  - Override portal teleport script to match what the player needs.
- PlayerControllerEditor
  - The editor script for PlayerController.cs.
- ProjectileScript.cs
  - This script attaches to projectiles fired from the player that handles their gravity and collisions.

Characters

- EnemyFieldOfView.cs
  - This script allows for an adjustable detection field of view for game characters.
- EnemyFieldOfViewEditor.cs
  - The editor script for EnemyFieldOfView.cs.

Scaling

- ScalingEffect.cs
  - This script is attached to the player camera to allow for the scaling mechanic.

Portals

- Portal.cs
  - This script controls the portal visual effects and teleportation.
- PortalObject.cs

    - This script can be added to objects that are desired to be able to use portals.
- PortalCullBack.shader
    - This shader allows for the visual effect of the portals.

Dissolving floor

- DissolvingEnvironment.cs
    - This script handles desired dissolvable terrain through a list.
- ThrowSpirit.cs
    - This script handles the spirit that follows the player.

Spherical

- AngleToSphere.cs
    - This script rotates game objects to be the correct rotation based on their position on a sphere.
- innerSphereMaterial.cs
    - This script changes game object materials depending on whether the inner sphere effect is in use.
- InnerSphericalMaskShader.shader
    - This shader handles the inner sphere effect.

4. Alpha stage subprojects

Alpha stage subprojects, within this project, involve the subprojects that have only developed the mechanics without any gameplay beyond a superficial level.

There are five alpha stage subprojects within this section:

1. Horror with portals
2. Dissolving floor puzzle
3. Spherical exploration
4. Inside sphere exploration
5. Gravity changing scaling puzzler

4.1. Horror with portals

Horror games work very well with claustrophobic spaces but it can be an issue creating a claustrophobic map that does not turn out to be overly small or maze-like. This is where hyperbolic portals should be highly compatible since they can create more variety in room spaces whilst keeping the look and feel of the level the same.

Euclid's third postulate is broken in this subproject as a circle is unable to be drawn in certain locations.

4.1.1 Initial plan

Concept

The concept for this subproject comes from the previously mentioned compatibility between claustrophobic spaces and hyperbolic portals. If a small-feeling level is made but is quite large, and there is an implied being chasing the user, it is believed that a high-potential subproject can be made.

Gameplay

Ominous background music and a dark visual effect should create an atmosphere that would make the subproject's potential stand out. Moving around the level, there would be jumpscares sparingly placed around and a (random) scary enemy that chases the user in darkly-lit areas. The randomness of the enemy would come from a random number generator that decides whether the enemy will spawn or if another event will occur.

Level design

With only a few jumpscares placed around the level, the design has to be quite good to assist with the atmosphere. As there will be a lack of textures, dark colours will be used with dim point lights to create dimly lit rooms. The corridor areas should be claustrophobic but large enough for the user to comfortably turn around. Larger rooms should only be partly lit. The user should only be able to see a few metres in front of them due to fog. This is because lights can increase visibility if atmospheric fog is used.

4.1.2. Development journal

05/12/2021

The Unity project that will be developed into a completed subproject was created and now contains all of the foundational materials from 'Subproject Beginning.' The subproject's files can be found within the subproject beginning Github repository mentioned in 'Section 3. Subproject beginning.'

06/12/2021

Progress was made on the hyperbolic portals, with research delving into how they work. This would then be broken down into a simple explanation that makes the hyperbolic portals understandable to any possibly interested individuals within the script created.

13/01/2022

After a lot of trial-and-error with programming, the portals now effectively look like doorways. While no teleportation has been added, the user can look through the door-like portal and glimpse into the next room, forming the visual basis of the horror

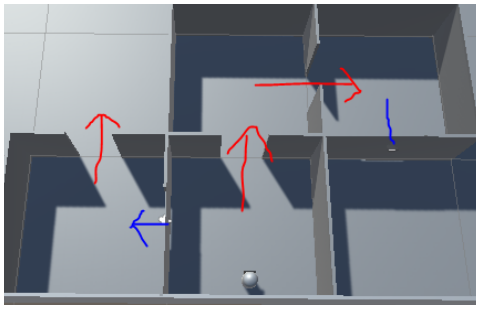
game. Next will be to get smooth teleportation working and then level design. After this, the subproject can be classed as completed and the next one can begin.

17/01/2022

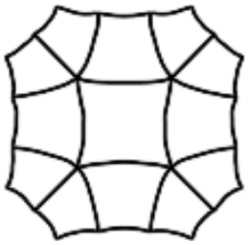
The collisions for the portals have been established in a way that allows any object with the appropriate script attached to be transported through the portal. While teleportation is smooth, there are some visual disturbances. There is visual clipping at the bottom of the portals and a cut-off point needs to be established for the teleporting game object as it sometimes appears for a brief moment before teleportation.

18/01/2022

A small example has been created to visualise what a map layout would look like in this subproject if developed into a larger project. In the image below, red arrows show where normal movement would take place while blue arrows show where a portal would cause movement.

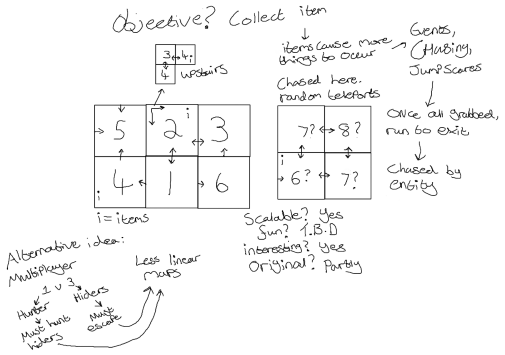


In this example, you can see that although the user has made three ninety-degree turns in square rooms, they do not end up in the same room that they started in. This is the basis of this subproject - the disorientating nature of hyperbolic geometry with the fear that comes with horror games. The portals would be hyperbolic in this case as the shape of movement matches that of a hyperbolic square.



19/01/2022

A basic game design document was drawn up to plan what the subproject can become, along with alternate ideas. What is said can be broken down into:



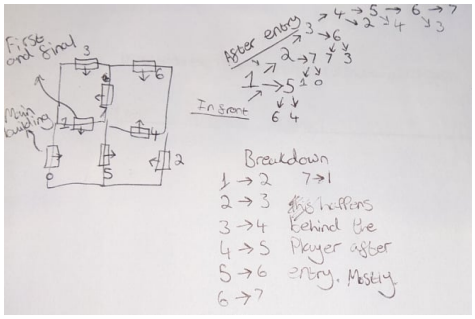
- What is the objective for users?
  - Collect items scattered around the map.
  - Collecting these items cause things to occur within the game
    - Events, chasing, jumpscares, etc.
  - Once all items are grabbed, the user must escape while being chased by an entity.
- Upon entering a divided area (area can be seen as the four connecting squares) the portals within that area could become randomised to create a sense of being lost for the users.
- An alternative direction for the game could be a one versus three situation
  - The lone user is a hunter while the group of three are hiders
  - The hunter must hunt the hiders while the hiders attempt to escape

- The maps would have to be less linear for this to work.

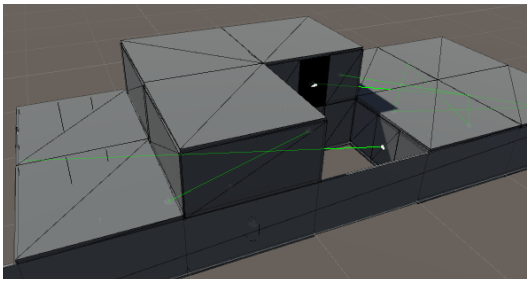
Another section discusses the attractiveness of the game to new users if it were to be marketed. Is the game scalable? Yes. Is the game fun? That is to be decided. Is the game interesting? Yes. Is the game original? Partly. Games like this have not used portals in the past but the game concept of collecting items that cause a more intense chase can be found in several horror games.

20/01/2022

After deciding that randomised portals would only be considered if this subproject was chosen for further development, a linear sense of randomisation was chosen. What this means is that the portals work more like a maze as opposed to purposely losing the user. The only issue here is that portal seven, which leads to the exit, can be found in the third teleportation. An item pick up can be required to allow teleportation here but that would be in further development.



This is the end of this subproject's development as it has already taken more time than preferred. The portals will be further developed in later subprojects to stop the clipping issue so only the very alpha-stage gameplay is being taken into consideration.



4.1.3. Subproject's potential

Scalability (5/5)

This subproject could very easily be scaled up into a larger project. Two paths have been discovered for this subproject's future. One is a single-user experience where the user collects items in a maze-like house as the level gets scarier and scarier.

The alternative idea is a multi-user experience where there are three hiders and one hunter. The hunter aims to find and kill the hiders while the hiders must complete objectives to be able to eventually escape.

Since these two ideas are similar but offer very different experiences, this subproject's scalability would have to be rated as a five out of five.

Interest (4/5)

This subproject features an interesting enough mechanic with the game genre to garner attention from a general audience. This audience may be enthusiastic in following video game changes, making this subproject's rating for interest four out of five.

Entertainment (4/5)

This subproject's non-Euclidean mechanic of portals has a lot of potential and few constraints. The added horror genre forms a unique video game that would be focused on portal-based gameplay. This subproject would be fun to play and could form a very strong video game.

This subproject is rated five out of five for entertainment.

Accessibility (3/5)
This subproject is believed to be able to attract a larger audience with specific interests if developed into a full game. Due to this the accessibility of this subproject is rated three out of five.

Originality (4/5)
This subproject has some parallels with other games but can still be said to be original. With this in mind, this subproject's originality can only be rated a four out of five.

Summary (20/25)
With an overall rating of twenty out of twenty-five, this subproject has a large amount of potential and will almost certainly be selected for a beta stage subproject.

The highest potential can be found in this subproject's scalability and interest ratings but this is offset by the low accessibility rating.

Due to the breaks between entries in this subproject's development journal, it appears to have become far more in-depth than the other alpha stage subprojects. This has occurred due to the development journal containing notes in each entry for the following entry to gather details from.

4.2. Dissolving floor puzzle

Adventure games are highly compatible with mechanics and video game elements that alter how the user traverses the map. Puzzle games work in tandem with mechanics that make the game more difficult. This is why I believe a subproject that combines these genres with a mostly-Euclidean dissolving environment would be appropriate and interesting.

Euclid's second postulate is broken in this subproject as a straight line is not indefinite.

4.2.1. Initial plan

Concept
The concept for this subproject follows the previously mentioned combination, whilst including some very unique mechanics. Forming an adventure puzzle game using a dissolving environment that can only be seen within a certain radius of the user, and the user's ability.

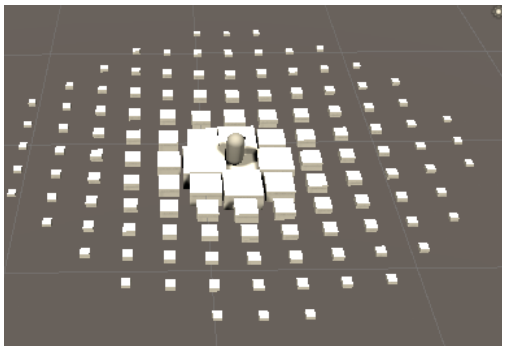
Gameplay
With a spooky but small open world to traverse, the user must explore the map whilst figuring out how to stay within the light. Scattered around the level are beacons that offer light to the user. The dissolving environment makes up the darkness and the user's ability allows for traversing within the darkness. Light and dark are only filler terms, in this case, to make the game more understandable. Visually the game will differ between light and dark.

Level design
With beacons placed sparingly around the map and stationary objectives in the map, there will be more darkness than light. With some beacons being temporary, others moving as if alive, and some permanent, the level should feel alive and immersive.

4.2.2. Development journal

21/01/2022
The Unity project that will be developed into a completed subproject was created and now contains all of the foundational materials from 'Subproject Beginning.' The subproject's files can be found within the subproject beginning Github repository mentioned in 'Section 3. Subproject beginning.'

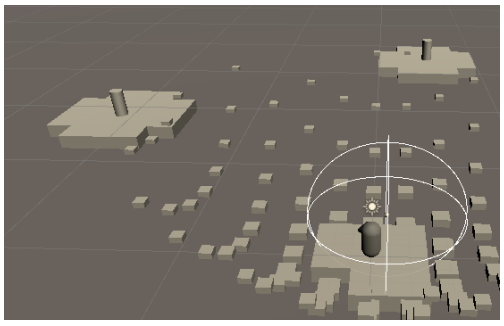
A very simple display of this subproject's goal was designed, offering visual information on what is meant through the terms "darkness" and "light." Once appropriate lighting has been added, the only luminosity will be granted through the visible environment, forcing the user to venture into unknown areas.



Currently, the user can move around a small area, lighting up the way. This is enough to showcase what one of the core gameplay mechanics of the subproject would be like.

25/01/2022

The finalisation of this subproject happened today, with many additions into foundational work for if the subproject gets developed further.



Lights that show areas of the dissolved floor were implemented alongside a floating character that follows the user. These would serve as additions to the core gameplay mechanic as the lights would help guide the user while the floating character would allow the user to have some agency in their decisions. A level of strategy is implemented through the decision of checking what is in the distance or venturing into the darkness yourself.

For further development, level optimisation will be required as the current map size is the limit before the framerate gets heavily impacted. Perhaps there is a future with procedural generation.

4.2.3. Subproject's potential

Scalability (3/5)

This subproject may run into a few issues when increasing its scale. The mechanics within the subproject are limited to only a few video game genres. Also, this mechanic could only be utilised in a cooperative multiuser experience which would not change the gameplay. A few additions could be made but there is a clear limit before additions begin to detract from the subproject's playability.

Since this subproject's gameplay would be unaltered with either single-user or multi-user, this subproject's scalability can only be rated three out of five.

Interest (4/5)

This subproject features an interesting enough mechanic with the game genre to garner attention from a general audience that may be enthusiastic about following updates. This makes this subproject's interest rating a three out of five.

Entertainment (3/5)

This subproject's mechanic, if paired with the correct gameplay, could form a unique video game that would be fun to play for a wide audience. On the other hand, the mechanic in its current state is not an interactive one. This subproject's entertainment rating is three out of five because of the potential but the missing interactive features.

Accessibility (3/5)

This subproject is believed to be able to attract a larger audience with specific interests if developed into a full game. Due to this the accessibility rating of this subproject is a three out of five.

Originality (5/5)

This subproject aims to be unique. Due to there being no known parallels with this subproject's mechanic, the originality rating is five out of five.

Summary (18/25)

With an overall rating of eighteen out of twenty-five, this subproject has an above-average amount of potential and may be included in a beta stage subproject.

The highest potential can be found in this subproject's originality rating but this is offset by the average scalability, entertainment, and accessibility ratings.

4.3. Spherical exploration

Exploration games rely on unique mechanics and world-building to keep the user's interests. With this in mind, spherical geometry should introduce a new style of traversal that keeps the user from seeing possible situations from a distance, allowing for unpredictability.

Euclid's fifth postulate is broken in this subproject as parallel lines can not be drawn.

4.3.1. Initial plan

Concept

The concept for this subproject follows the previously mentioned combination of a spherical world with exploration game elements. These would be supplemented with additional mechanics that perhaps cause a shift in how the resulting video game would be played. This subproject would aim to be a relaxing experience.

Gameplay

With an unfamiliar and open world to traverse, the user would casually explore implemented areas in a relaxed way. The world would be a small planer that has distinctively unique areas.

Level design

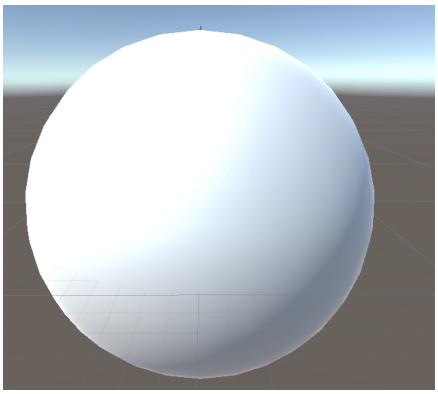
The playable level would be a pre-constructed sphere that mimics a tiny planet. Roughly, the aim is to take two minutes to traverse around to end in the same spot. The level can be expanded through many ways, one of which consists of there being more than one planet.

4.3.2 Development journal

22/02/2022

The subproject's files can be found within the subproject beginning Github repository mentioned in 'Section 3. Subproject beginning.'

Development on this subproject began with a simple, non-functional visual representation of what the user would look like on a spherical object.



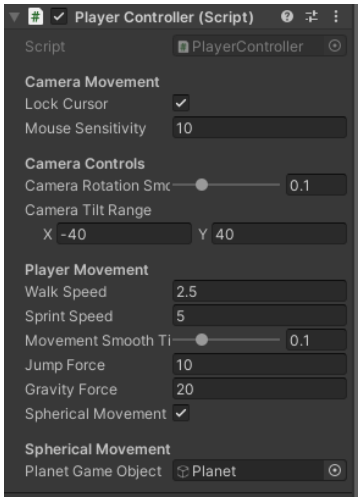
After some failed experimentation and research, it was discovered that the previously created first-person character controller script would not be suitable going forward as it relies heavily on the vertical axis is zero. This restricts many possibilities in subprojects so a new script is needed to be created.

23/02/2022

The redevelopment of the first-person user controller script was completed today, with the movement and rotation functionality required for this subproject. Gravity has been implemented. With that, this project is nearing completion and should only require another day.

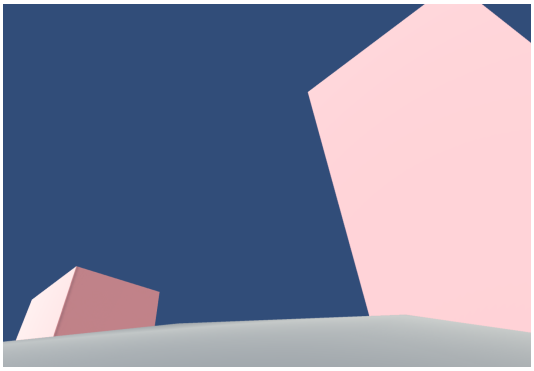
Formatting this script will take priority as it will be essential in all subprojects going forward as more complex non-Euclidean implementations are tested.

An editor script will be made shortly as it would be nice to hide irrelevant features based on the subproject. An example of this would be hiding the 'Spherical Movement' tab while the 'Spherical Movement' boolean is false.



24/02/2022

A minor fix was required as the user movement became increasingly inaccurate as the user model rotated more and more. Alongside this fix was the addition of some objects to get a perspective view of what exploration within this game would look like.



The spherical perspective causes an interesting change in how the distance of an object is assumed by the user. With some development, this could become a very interesting addition to exploration games.

4.3.3. Subproject's potential

Scalability (5/5)

This subproject could very easily be scaled up into a larger project. This is due to the nature of the mechanic, which allows the subproject to be highly adaptable.

There is a possible gameplay evolution of switching between multiple spheres/planets. However, this would make this subproject similar to the 'Mario Galaxy' video game.

Due to the endless possibilities, this subproject's scalability is rated five out of five.

Interest (2/5)

This subproject features a mechanic that is rarely seen in video games but does not seem interesting enough to stand out and excite a general audience. This makes the interest rating a two out of five for this subproject.

Entertainment (4/5)

This subproject has a lot of potential and few constraints. The mechanic provides a unique type of gameplay that could be very interesting in an exploration game. A very strong video game could be formed.

The entertainment value for this subproject is rated four out of five.

Accessibility (4/5)
This subproject could be enjoyed by a wide but casual audience, attracting the average video game enjoyer. The accessibility of this subproject is rated four out of five.

Originality (3/5)
This subproject revolves around a simple mechanic that is seen rarely in other developments but could not be considered unique as parallels can be drawn with other video games. This subproject's originality is rated three out of five.

Summary (18/25)
With an overall rating of eighteen out of twenty-five, this subproject has an above-average amount of potential and may be selected for a beta stage subproject.

The highest potential can be found in this subproject's scalability but this is offset by the low interest rating.

4.4. Inside sphere explorer

This subproject relies on a third-person camera with a spherical mask added on to create a visual of the user being inside a sphere. This effect would add to the exploration genre as it creates a new and unique way to view the created world.

Euclid's second postulate is broken in this subproject as a straight line is not indefinite.

4.4.1. Initial plan

Concept
The initial concept for this idea was the user moving around inside a sphere, blocking geometries from forming outside of a spherical space. The visuals would aim to be similar to an object moving inside a snow globe.

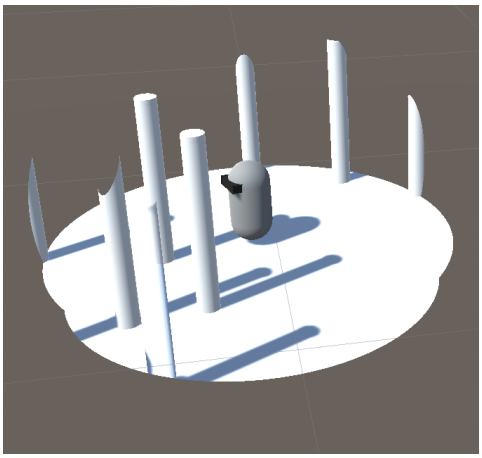
Gameplay
The gameplay in this subproject would have the user searching around for objects that allow them to escape the level.

Level design
The level design would consist of an open forest with a few interesting things scattered around that could serve as landmarks. These would allow the user to find their way around intuitively

4.4.2. Development journal

01/03/2022
The subproject's files can be found within the subproject beginning Github repository mentioned in 'Section 3. Subproject beginning.'

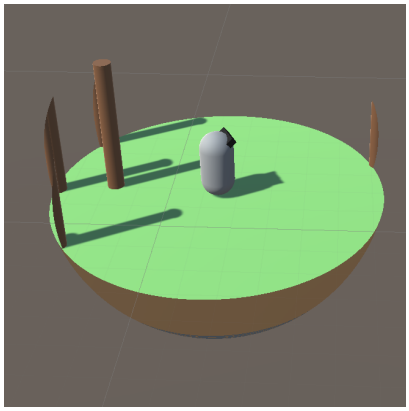
Development on this subproject began with a surface shader inside a quickly made map to establish a very basic spherical effect surrounding the user.



The issue with this effect currently is that it is only a surface shader and as such, only works on the surface of objects. It has allowed for a basic understanding of Unity's shader language, however. A new shader will have to be made if this effect is to look nicer.

02/03/2022

After some experimenting today, it was found that a new shader was unnecessary and multiple game objects with the same material create the same effect as the intended one.



4.4.3. Subproject's potential

Scalability (3/5)

This subproject could be scaled into a larger project with some considerations made. The impact that this subproject's mechanic has on gameplay heavily constrains the possible game genres that it is compatible with.

This effect would work well in a scary exploration game or even a cooperative puzzle game. With this in mind, this subproject is rated three out of five for scalability.

Interest (3/5)

This subproject features a unique mechanic that could garner attention from a general audience, making the interest rating three out of five.

Entertainment (4/5)

This subproject's mechanic, while passive and intrusive to the user, creates an atmosphere that, when paired with the combination genre, enhances gameplay. As this subproject could develop into an enjoyable game, the entertainment rating is four out of five.

Accessibility (4/5)

This subproject can be admired and played by the average video game enjoyer. This makes this subproject's accessibility rating four out of five.

Originality (4/5)

There were very few research materials on creating a spherical shader like the one featured in this subproject. During the research, only one source was found that featured what this subproject aimed to achieve, suggesting that it is a very unique mechanic. No video game could be found with the same mechanic but a few contain similar ones, meaning this subprojects' originality can only be rated four out of five.

Summary (18/25)

With a rating of eighteen out of twenty-five, this subproject has an above-average amount of potential and is likely to be selected for a beta stage subproject.

The highest potential can be found from the subproject's high originality, accessibility and entertainment ratings but this is offset by the low scalability and interest ratings.

4.5. Gravity changing scale puzzler

A puzzler game with changes in gravity is by no means non-Euclidean as everything in the world still exists in Euclidean space, even if it is rotated. To make this subproject non-Euclidean, the puzzler will contain a scaling effect.

None of Euclidean's postulates is broken in this subproject but the scaling effect, coupled with the gravity changes, adds a new perspective to how users perceive the Euclidean space they find themselves in.

4.5.1. Initial plan

Concept

To make this subproject non-Euclidean, the puzzler will contain a scaling effect that changes the scale of intractable objects based on the user's perspective. The idea is to have the user resize objects to access the adjacent room.

Gameplay

The user will be moving around applicable surfaces and accessing interactive objects that can be resized in their corresponding gravities, The user will use these resized objects to access the next room.

Level design

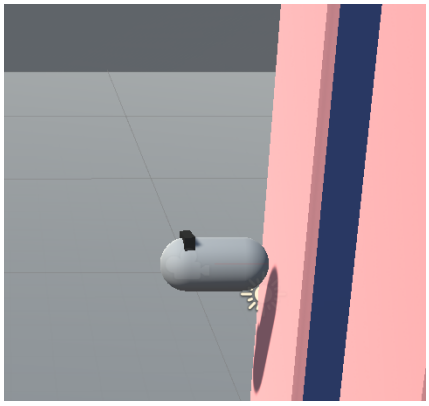
The level design of this subproject would just be connected rooms with walls (both walkable and regular) and objects to resize.

4.5.2. Development journal

03/03/2022

The subproject's files can be found within the subproject beginning Github repository mentioned in 'Section 3. Subproject beginning.'

Development on this subproject has begun with basic programming that causes the user to rotate to the desired wall based on ray cast hits.



After a bit of refining, this will form the secondary mechanic of the subproject, with the primary focus continuing to be the non-Euclidean scaling effect.

The scaling effect was also complete today but in an unpolished state. The ray cast method used does not work when the ray is unable to hit anything (E.g. looking at the sky.) If this project were to be further developed, this would have to be refined more.

4.5.3. Subproject's potential

Scalability (3/5)

This subproject showcased a very compatible combination of puzzle and complex mechanics, both Euclidean and non-Euclidean. While these mechanics may not be compatible with many other game genres, this subproject could have many additions made to its gameplay that would enhance the play experience.

The above paragraph means that this subproject's future development would be quite linear as there are not many variations that could be made regarding the core gameplay loop. With this in mind, this subproject is rated three out of five for scalability.

Interest (3/5)

This subproject features interesting enough mechanics with the game genre to garner attention from a general audience, meaning its rating for interest is three out of five.

Entertainment (5/5)

This subproject's non-Euclidean mechanic of scaling has a very strong parallel with a video game 'Superliminal' that can be used as an example for the interest in a puzzle game with this mechanic. The added puzzle effect of being able to move on walls could add to the gameplay enough to evolve the gameplay and allow for more experiences.

This subproject is rated five out of five for entertainment as the previously mentioned game was a top listing indie game.

Accessibility (4/5)
This subproject is believed to be able to attract the average video game enjoyer if developed into a full game. Due to this the accessibility of this subproject is rated four out of five.

Originality (2/5)
Mentioned previously was how this subproject has a major parallel with the video game ‘Superliminal’ meaning that the mechanic is not very original. This is not to mention that several video games feature either scaling or wall-changing gravity, but none could be found that featured both.

This subproject is rated a two out of five.

Summary (17/25)
With a rating of seventeen out of twenty-five, this subproject has an above-average amount of potential and is likely to be selected for a beta stage subproject.

The highest potential can be found from the subproject’s high entertainment rating but this is offset by the low originality rating.

4.6. Discussion

Development on this project’s alpha stage subprojects was a unique experience to increase game development skills and non-Euclidean knowledge. It allowed for a view of possible non-Euclidean mechanics and game genres.

The initial plan going into production was that non-Euclidean mechanics would be tested in multiple game genres and linked to the most compatible. The alpha stage subprojects showed that this was unnecessary as the gameplay in them was not developed enough to make understanding how the non-Euclidean mechanic in other game genres difficult. The alpha stage subprojects were designed in a way that multiple game genres could be tested and then they were labelled with the one thought to be the most compatible.

The summary rating of each project is as follows:

1. Horror with portals *20/25*
2. Dissolving floor puzzle *18/25*
3. Spherical exploration *18/25*
4. Inside sphere explorer *18/25*
5. Gravity changing scale puzzler *17/25*

In a personal aspect, the alpha stage subprojects that were the most enjoyable to create were ‘Horror with portals’ and ‘Gravity changing scale puzzler.’ Though, the alpha stage subproject that I find most interesting is ‘Inside sphere explorer.’

Now that all the alpha stage subprojects have been developed and linked with the game genre thought to be the most compatible, the beginning of the beta stage subprojects can begin.

5. Beta stage subprojects

Beta stage subprojects, within this project, involve the subprojects that have been developed to include basic gameplay elements and multiple non-Euclidean mechanics. These subprojects are to be built from the mechanics demonstrated within the alpha stage subprojects, to further demonstrate the enhancement provided by non-Euclidean game development to the video game genre.

There are two beta stage subprojects within this section:

1. Gravitational tactical scaling
2. Gravitational sphere shooter

5.1. Gravitational tactical scaling

Featuring mechanics shown in alpha stage subprojects ‘Dissolving floor puzzle,’ ‘Inside sphere explorer’, and ’Gravity changing scale puzzler,’ this subproject will focus on the tactical game genre.

5.1.1. Initial plan

Concept

This subproject will focus on the user utilising multiple non-Euclidean mechanics to achieve a goal. The tactical genre will dictate how the resulting video game plays.

Gameplay

With the ability to scale walls and modify the size of interactable objects, the user must grab a protected item. The visual mechanic from ‘Inside sphere explorer’ will be present as a handicap against the user.

Level design

The user will have to operate within a large warehouse with multiple possible paths for them to take. Within the level will be objects that operate as guards, with their sightline being a visible red cone.

5.1.2. Development journal

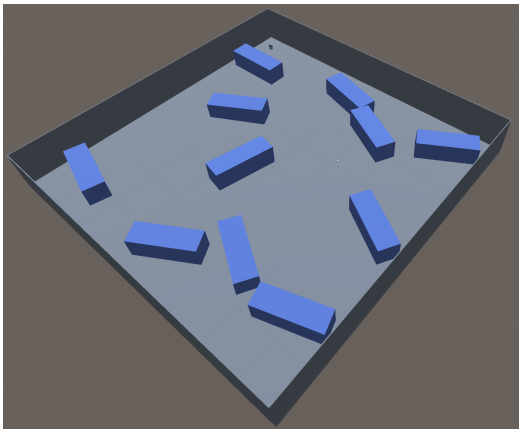
11/03/2022

The subproject’s files can be found within the subproject beginning Github repository mentioned in ‘Section 3. Subproject beginning.’

Starting off this subproject, the user controller script was updated to include the ‘Inside sphere explorer’ subproject’s visual mechanic.

To complement the user controller update, a script for the ‘Inside sphere explorer’ subproject’s objects was created. This “InnerSphereMaterial” script follows the boolean within the user controller script for the inner sphere visual effect and changes the object’s material accordingly.

A basic gameplay map has been created in preparation for the gameplay additions. This map is subject to change but currently, everything shown is an object that can work as the ground for the changing gravity.



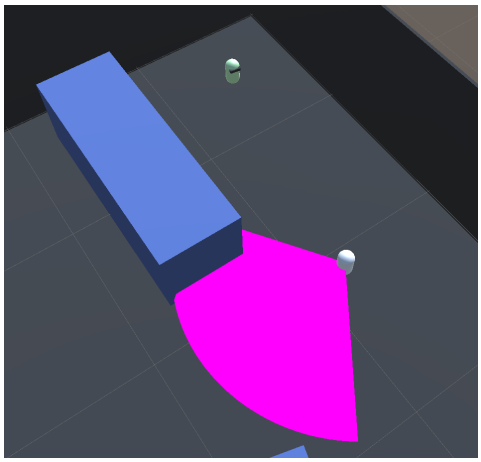
The blue objects are intended to be shipping containers within the warehouse, providing alternate routes the user could take to reach the gameplay objective.

12/03/2022

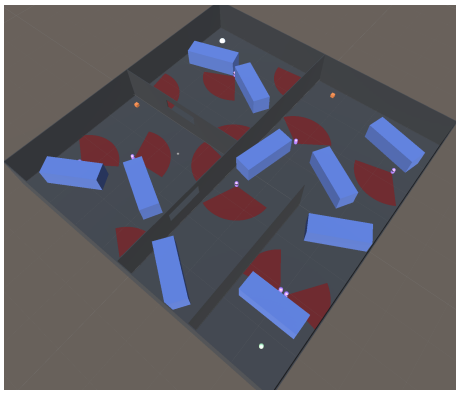
The enemy field of view mechanic was implemented through the use of raycasting onto layer masks. This allows only the user to be spotted while objects can be used as obstructions. As this subproject is not intending to offer a full gameplay experience,

the user game object will be deactivated upon detection.

An in-game visualisation of the detection radius was then implemented in a basic form using a new mesh following calculated vertices.



After a few final modifications, the development on this subproject is complete and has created a tactical video game with non-Euclidean elements. The image below shows the final product for this beta stage subproject. The user must attempt to reach the sphere without being (red) detected by (pink) guards. To do this they must scale (black) walls and use the (orange) scalable interactable objects to get through holes in the wall.



5.1.3. Subproject's potential

Viability (2/3)

This subproject could become an interesting video game if developed to completion but the inner sphere effect does not contribute much to the gameplay unless more gameplay elements were added. As it stands, this subproject can only be rated a two out of three for viability as it could only be seen currently as a video game with mediocre viability.

Interest (3/3)

The term "tactical game" has had a high amount of interest within the last twelve months. The term "non-euclidean" has had a medium amount of interest within the last twelve months. The term "gravity game" has had a high amount of interest within the last twelve months.

With this in mind, the interest rating of this subproject is a three out of three.

Entertainment (2/3)

There have been no recent video games with similar mechanics outside of the tactical game genre.

A large tactical video game 'HITMAN 3' has received mediocre reviews and was released within the past two years.

A tactical indie video game 'GTFO' has a more intense nature to the gameplay but has received good reviews and was released within the past two years.

With these in mind, this subproject is rated a two out of three for entertainment.

Summary (7/9)

This beta subproject offers insight into how a tactical video game in Euclidean space with non-Euclidean elements would play out. The non-Euclidean scaling adds a layer of strategy that would otherwise not be present.

5.2. Portal sphere shooter

Featuring mechanics shown in alpha stage subprojects ‘Horror with portals’ and ‘Spherical exploration,’ this subproject will focus on the shooter game genre.

5.2.1. Initial plan

Concept

This subproject will focus on the user traversing a sphere, utilising non-Euclidean mechanics to be able to shoot specified targets.

Gameplay

With the ability to travel through portals, the user must shoot specified targets on a planet-like sphere.

Level design

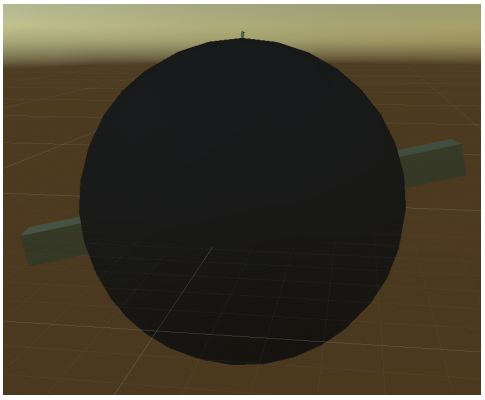
The level of this subproject will be a large, developed sphere with multiple points of interest and landmarks. On this sphere, there will also be targets for the user to shoot but they will only be able to be hit from the correct location.

5.2.2. Development journal

15/03/2022

The subproject’s files can be found within the subproject beginning Github repository mentioned in ‘Section 3. Subproject beginning.’

A basic game world has been designed alongside a script that automatically rotates objects to match the desired planet. To make the subproject more interesting it has been decided that multiple planets will be utilised.



Due to the changes made in regards to changing the player game object from having a character controller to a rigidbody, an issue occurred when attempting to implement portals. The issue was found to be the player structure and the script conflicting with one another. The teleportation coding just needed to be updated to suit the current state of the player game object prefab.

16/03/2022

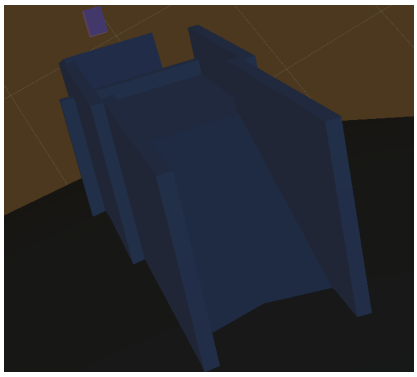
An addition to the planet object script was made that causes moved objects to be positioned on the local y-axis position on the planet.

Shooting has been implemented with availability for both flat planes and spherical planes. The next implementation consisted of implementing targets to shoot for the user objective.

17/03/2022

Today only required the small implementation of targets and establishing what happens upon their collision with the projectile.

Regarding level design, structures were implemented to work as platforms for the user and provide access for projectiles to hit targets.



5.2.3. Subproject's potential

Viability (1/3)

This subproject could not develop into an entertaining video game unless a lot more features were implemented. As it stands, this subproject can only be seen as having low viability, making its viability a rating of one out of three.

Interest (3/3)

The term "shooter game" has had a high amount of interest within the past twelve months. The term "non-euclidean" has had a medium amount of interest within the last twelve months. The term "spherical" has had a high amount of interest in the past twelve months.

With these in mind, the interest rating of this subproject is a three out of three.

Entertainment (2/3)

No recent video games with spherical shooting and portals could be found but one game with similar features was found.

A strategy video game 'Dyson Sphere Program' has received good reviews and was released within the past two years.

While this game received many good reviews, its gameplay is completely different from this subproject's gameplay.

With this in mind, this subproject is rated a two out of three for entertainment. This was decided because while the gameplay with the example video game differs, the mechanics specifically are a point of interest within the reviews.

Summary (6/9)

This beta subproject offers insight into how a shooter video game in a spherical world with non-Euclidean elements would play out. The non-Euclidean portals add another movement methods that would otherwise be impossible.

5.3. Discussion

These beta stage subprojects were developed to focus more on gameplay than the combination of the non-Euclidean mechanics as a form of discovery. The discovery was that for gameplay to be optimally entertaining, the used non-Euclidean mechanics must be compatible with each other and the style of gameplay.

In regards to this, certain mechanics could be turned off based on a trigger collider that gets hit whenever the user enters a room. This trigger would require a script specifically for disabling certain mechanics but it would improve the cohesiveness of gameplay.

The 'Gravitational tactical scaling' subproject showcased the incompatibility between the 'Inside

sphere explorer' mechanic and the tactical game genre. This is because area awareness is an important part of tactical planning, so removing the user's ability to gather knowledge detracted from the gameplay experience.

The 'Portal sphere shooter' subproject showcased how if there was too much compatibility between a game genre and non-Euclidean mechanics then the gameplay experience would feel boring as it does not feel like much has changed. The mechanics should be used in more clever ways to increase their effectiveness in altering gameplay.

The knowledge gained from these beta subprojects will play an important role in the development of the final subproject and how to showcase all subprojects.

6. Final subproject

The Final subproject for this project serves as the core of the deliverable artefact. This will include a brief gameplay experience as a kind of demo for what a game could become from the knowledge gained throughout the whole subproject.

Due to the time requirement of this subproject, it was decided that models would be very simple in nature and rooms would only be decorated to a basic level. This means objects will feature low polygons, lacking details, and basic colouration.

6.1. Initial plan

The final subproject will be a puzzle game that is broken up into different segments. The first segment will feature an introduction to the project with narration and basic user interface information.

The second segment will feature all the previous subproject implementations in their levels, acting as an interactive slideshow. These would also feature narration and user interface information. Each room will contain a simple objective that the user must achieve to proceed as a form of gameplay. The level design here will be basic, befitting the alpha and beta subproject's development.

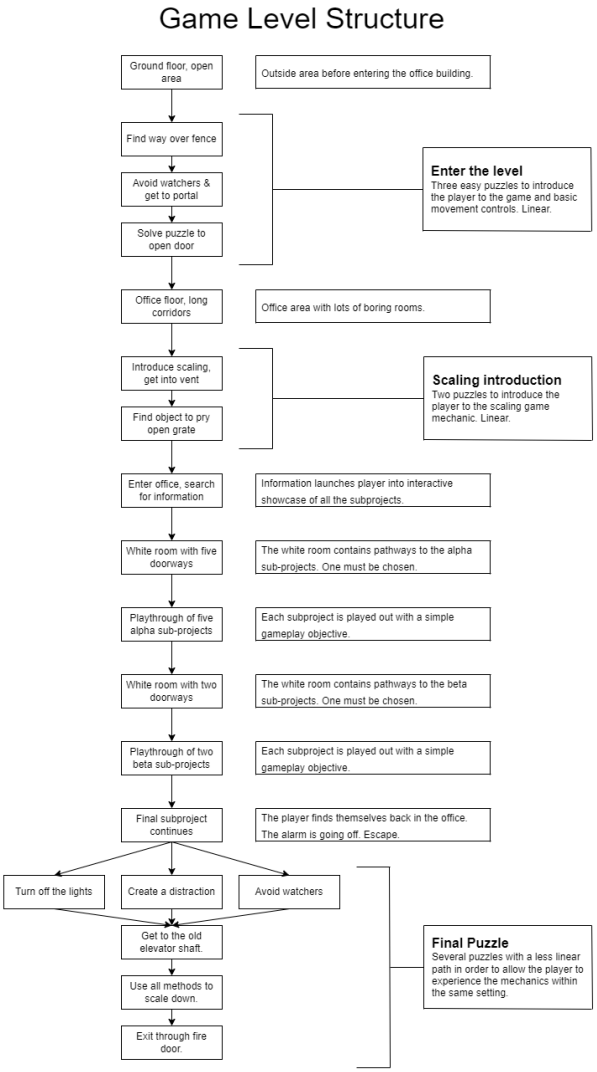
The third segment would be a single map that features all introduced mechanics with multiple gameplay objectives featuring less linear gameplay.

6.2. Development journal

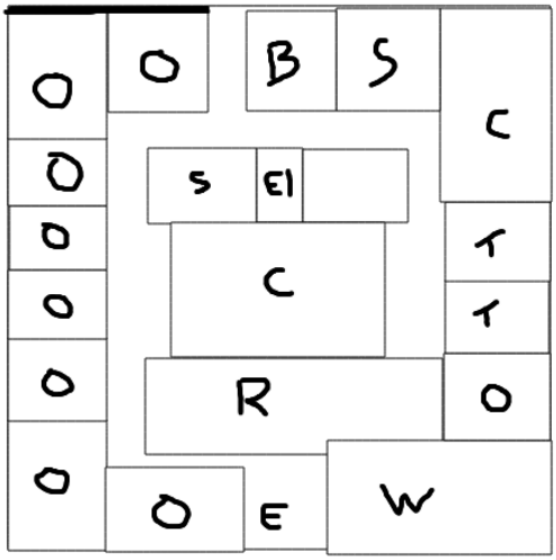
22/03/2022

The subproject's files can be found within the Github repository referenced under 'Appendix B.' Diagrams and plans created within this subproject will also be found within the repository.

A simple flow chart that plans out the timeline of the deliverable was created. This was important to figure out just how the gameplay would be chronologically played out for the user.



To follow this puzzle timeline plan, a plan for the mentioned "office floor" was drawn up simply so that the gameplay map is coherent when constructed within Unity.



The level plan is very basic and requires a key to be read. The letters on the plan are as follows:

- O = Office
- B = Break room
- E = Level entrance
- S = Storage room
- C = Conference room
- T = Toilets
- R = Reception
- W = Waiting area
- El = Old elevator shaft

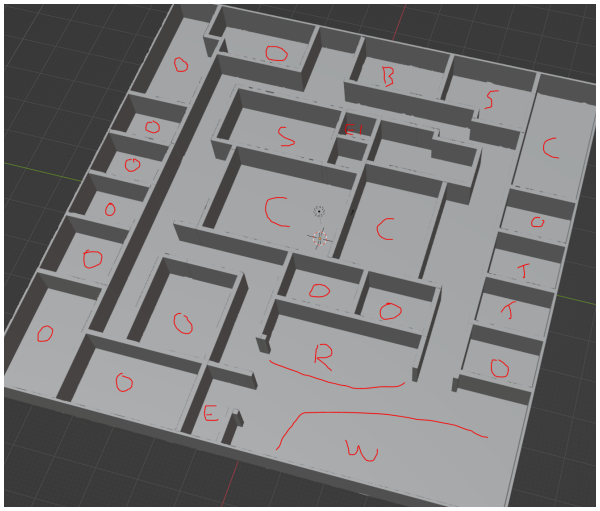
Blank areas would indicate corridors. The borders to the square shapes do not indicate hard walls, just room boundaries.

The level is intended to be a simple square shape overall alongside square rooms to make basic map development simple. It is important that modelling is focused on decoration rather than whole maps, to save time.

Some models were also created today ahead of level development in order to allow for the basic creation of the level in the coming days.

23/03/2022

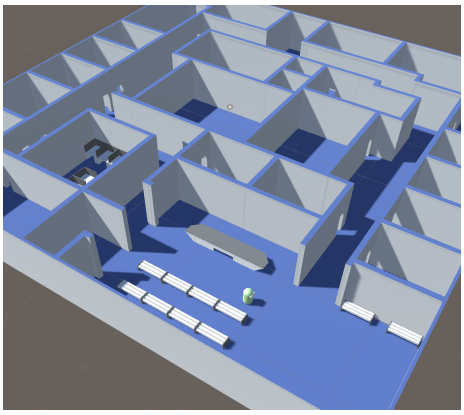
Development within Unity began today, alongside the modelling of the office level. The level model is more detailed than the basic room plan but follows the same concept.



There are more offices to work with and blank rooms in case of changes in future plans. The map is designed to feel more claustrophobic and effectively uses long, skinny corridors.

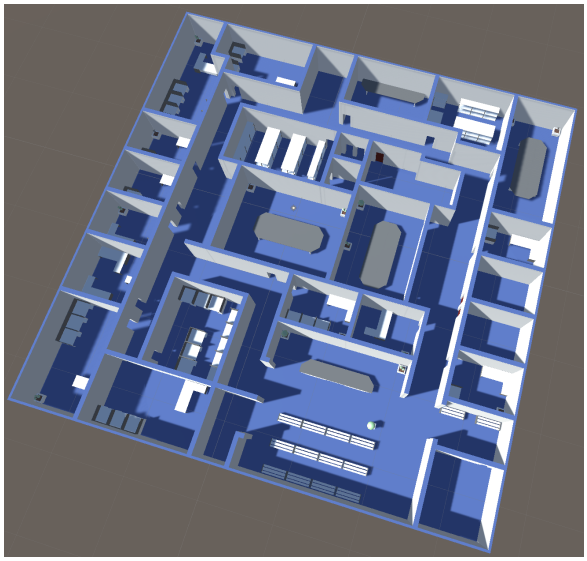
Doorways were then implemented to allow for full map usage and the model was halved in size on both the X and Y axis, as the offices appeared to be comedically large.

With some additions having been made, the office level is beginning to take shape.

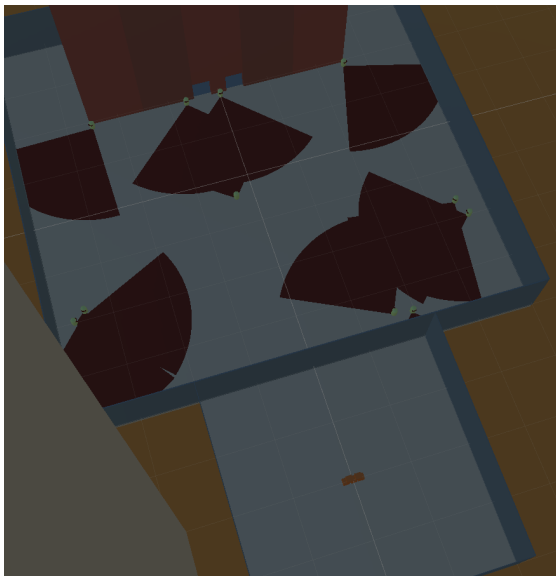


A dead plant and two alive plants were created to add some decoration to an otherwise very dull office building. From this point on, new models will not be discussed and will only be shown in more key development entries. This is because this subproject will require many more models than initially thought.

The office level has been filled with furniture with room for possible additions. Now that the office level is filled, the vents through which the user will have to crawl to explore the map will now be created. The empty rooms have currently been blocked so the user can not enter them.

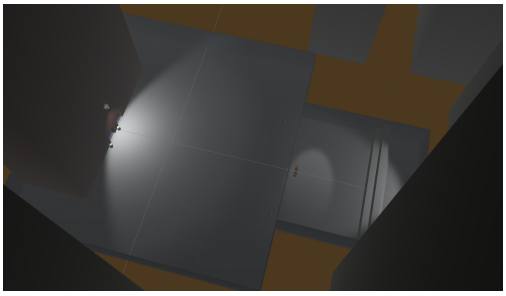


The starting outside area has been partially developed to include an introductory puzzle using scaling cubes and an introduction to the guard detection system that will be prevalent within the subproject. It is intended that other obstacles will be added to ensure this smaller area works as a tutorial area.

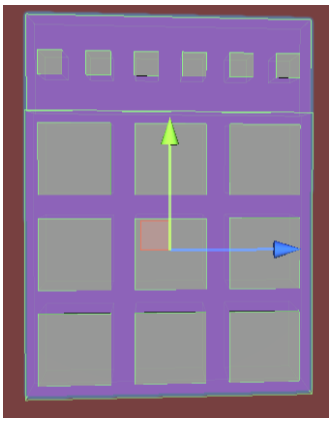


24/03/2022

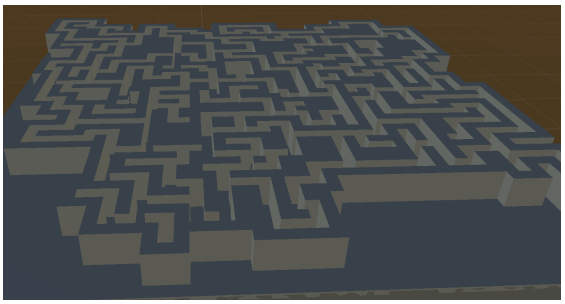
Today the tutorial area received an overhaul on its lighting and some modifications on how it would handle for the user . No tutorial elements have been implemented yet but now there is an atmosphere.



The door puzzle that allows the user to enter the office level will be a simple ‘Simon Says’ game to introduce puzzle elements to the user. It was more difficult than expected to implement within a three-dimensional environment alongside other mechanics but eventually, it was added and optimised. With the implementation of this ‘Simon Says’ puzzle the introductory area is complete feature-wise and only requires the user-interface implementations.

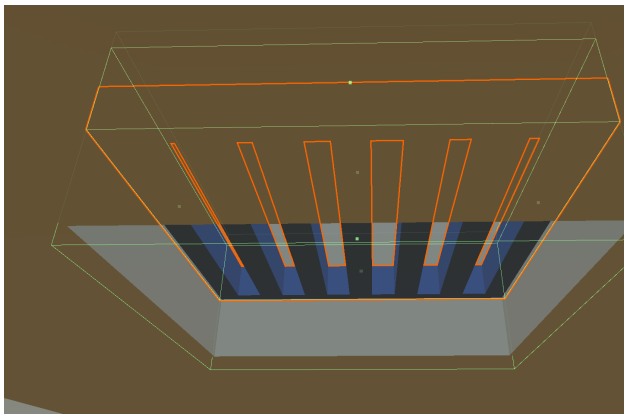


The vent map for the office was completed today. The intention behind it is to act as a pseudo-maze that allows the user to get to where they want by moving in the general direction of their destination. There are a couple of intentions in mind for these vents but for now, it helps confuse the user on its own.



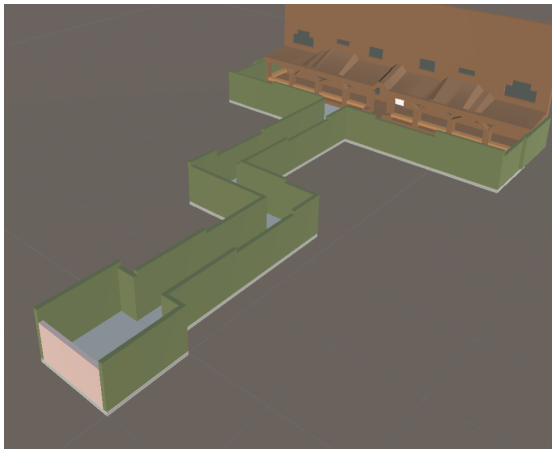
Vent colliders were implemented with a simple script that allows the user to enter and exit the vent system

via touching the vent and inputting the appropriate key code.



25/03/2022

Work on the ‘Horror with portals’ alpha subproject level occurred today. A couple of issues from the beginning came from the portal clip planes. There was visual stuttering and miscalculated clipping points. These were fixed and a level design was created featuring the front of a large house that will be obscured with fog.

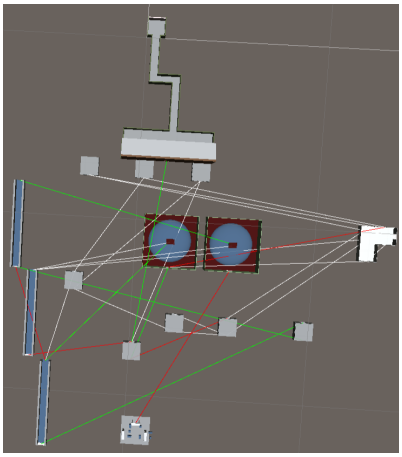


The decided upon gameplay for this alpha subproject would be to figure out the correct pathway of portals to reach the end of the level while jumpscares occur. The rooms will contain numbers that guide the user . There will be a total of fourteen portal rooms but the user will only see twelve of them as the other two will be identical to other rooms to confuse the user and the room order will be the following:

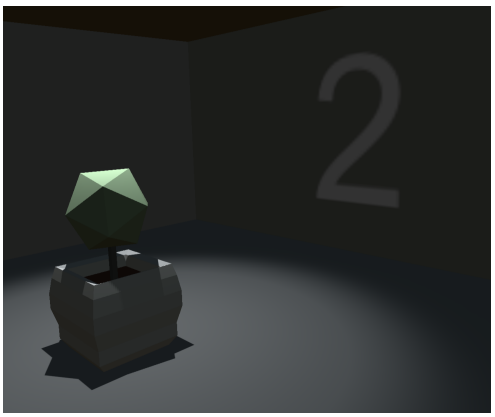
1. Room 1
2. Room 3
3. Room 6
4. Room 12
5. Room 14 (‘Room 6’)
6. Room 13 (‘Room 3’)

With only six rooms as the correct pathway with twelve total rooms, alongside a guiding object in each objective room, this level should be completed relatively quickly.

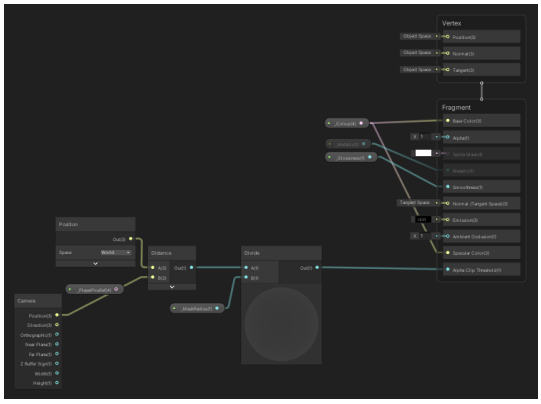
The map was completed with a number of different rooms that have yet to be furnished and numbered. So long as the user selects the correct portal in ‘Room 3’ then they will be able to just walk straight and reach the exit easily. This was done for marking and easy progression reasons.



The drawn lines have their own meanings. White means that the user has been brought into the maze and sent to a room where progression will not occur. Red means that the user has regressed and has been sent to a room that is connected to a progressive portal. Green means the correct path is chosen and progression will occur. Lighting, furniture and room identification was then implemented.



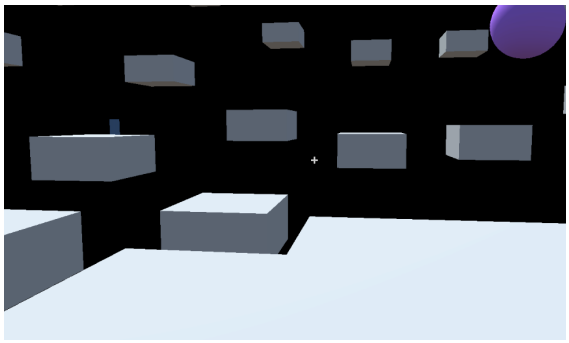
The render pipeline used within the subproject was changed for performance and shader-based reasons. This led to the ‘Inside Sphere’’ shader requiring a change and caused the portal shader to form a couple visual problems. Below is the shader graph for the ‘Inside Sphere’ effect.



26/03/2022

The ‘Universal Render Pipeline’ package being used within Unity caused a major memory leak in the fixed version of the portal script. This was solved by adding a proximity detector and rendering the cameras through Unity. The lighting also needs to be adjusted within the portal level.

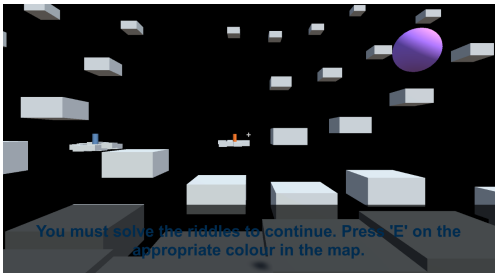
In the ‘Dissolving floor’ level, the spirit object has received an update to its movement code to allow it to always aim to sit at the top-right of the user’s screen unless thrown. This coincided with changes that caused floor creation based on distance to look a lot smoother than it did previously.



More changes were made to allow for the user to remain on an island of land that will reduce in size if the user moves.

Since the dissolving floor effect was created with a puzzle game in mind, a lot of thought went into a puzzle idea that would suit the effect. The end result was that the user should explore to find clues and then using those clues, they find the exit. This also led to a realisation that no horror gameplay elements were added into the horror portal level.

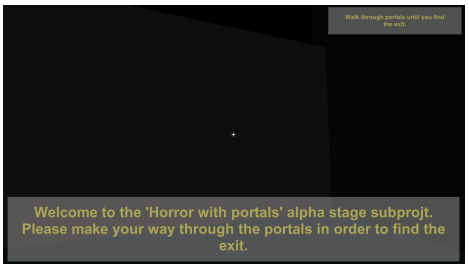
With the additions of temporary text and a win objective, the dissolving level is done.



27/03/2022

Jumpscares were added into the horror map today following the creation of a skull drawing that does not look intimidating. The colours below have been inverted to show the skull shape.

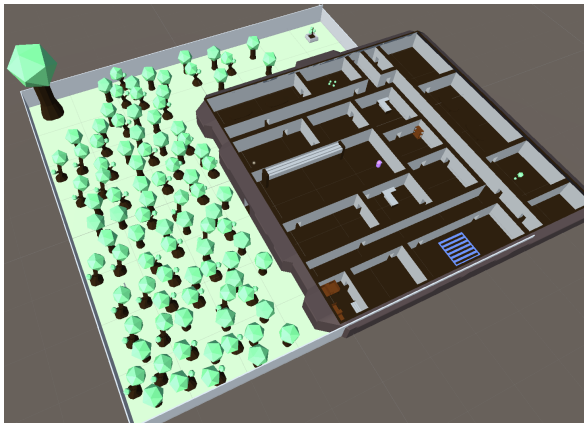
Some tutorial text was also added so that the user understands their objective for the level, alongside a general static objective text that sits at the top right of the user’s screen. The sizing will be changed shortly to appropriately fit a full-size game screen.



28/03/2022

With a new week of development comes a new alpha stag subproject to work on. To begin with, more changes were made to the 'Inside sphere' to allow for a modification of the radius float. Now it can be changed dynamically through the Unity inspector and scripting.

The map was then created for the level with the gameplay of exploring the map and meeting characters that tell a short story.



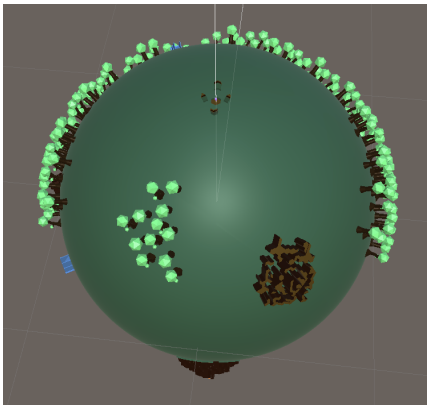
The map is designed to be simple to traverse with three of the four characters being in corner areas - making them easy to find as users tend to find borders to explore first as a form of navigation.

The 'White room' was also given functionality and was essentially completed.

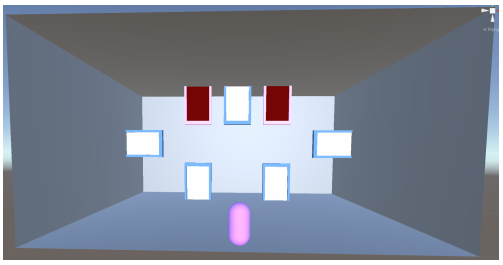
29/03/2022

Today the gravity scaling puzzler was created using the tactical scaling beta stage subproject's map. This was decided upon as it better suits the early stage subprojects than the further developed beta stage subprojects.

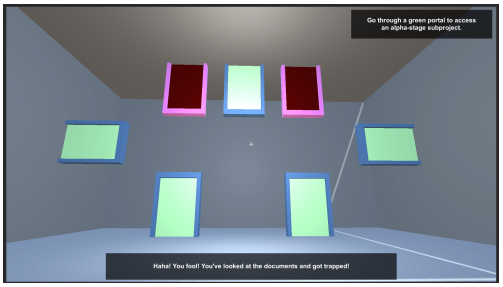
The spherical exploration map was created with some interesting landmarks that house the grabbable objectives to really feed into the exploration game genre. There is a lack of content at the moment however, so this subproject will be revisited later on.



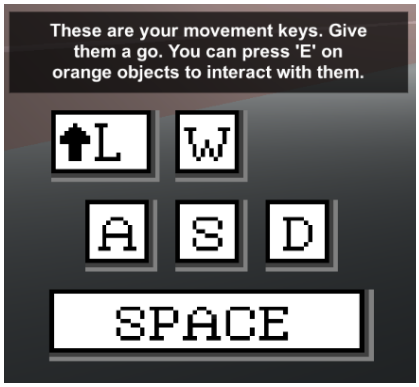
The white room that works as a kind of hub for the user in regards to presenting the subprojects was created and implemented today. The portals disappear after being used.



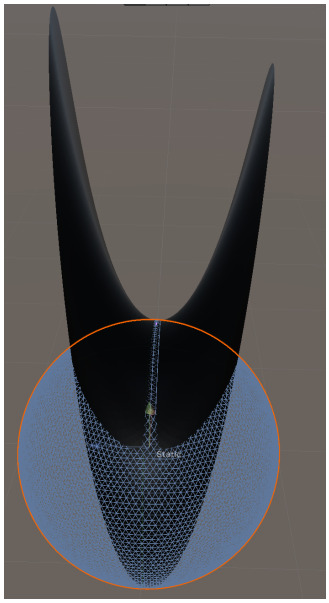
Text was altered to be more visible and better fit a full high-definition resolution.



A tutorial system was added in the first game scene to introduce movement within the project. This is in case someone accesses the subproject without knowing much about modern day video game traditions.

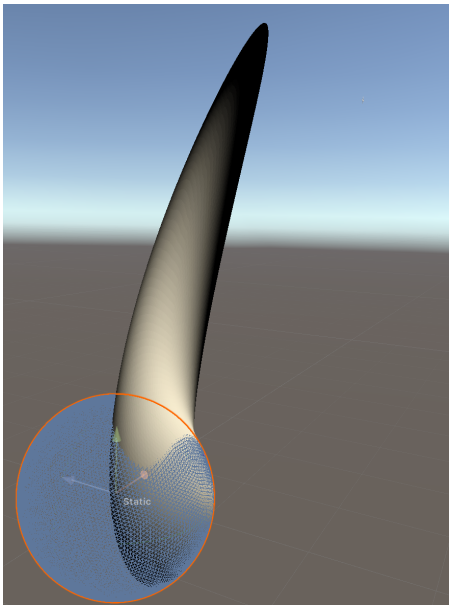


With the addition of the ‘Universal Render Pipeline’ into the project it is easier to achieve certain visual effects. One that has been implemented is a visual effect to warp objects into appearing spherically curved based on the user’s position within the scene.



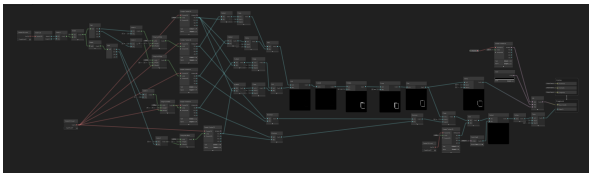
Due to this visual effect using the shape’s vertex positions and the inner sphere effect using the material’s alpha clip threshold, the two effects can be put together to make this effect compatible with inner sphere materials.

A limitation to this effect is that it works individually on models instead of all due to it modifying the material object’s shape. Through some more tinkering, a distance based version was created that allows for non-Euclidean visuals while walking about, which could serve well as decoration for otherwise Euclidean environments.

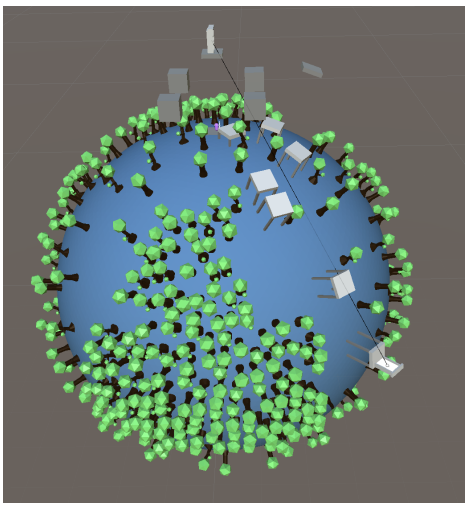


30/03/2022

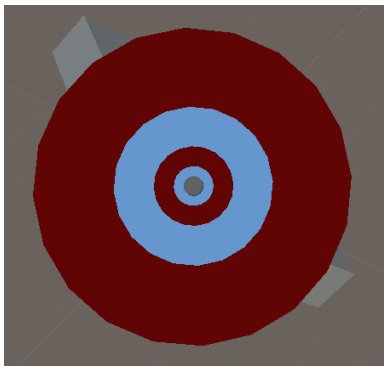
A pixelated shader was added into the subproject today with the intention of implementing geometric visual effects that slowly unravel the perceived space of the gameplay scenes.



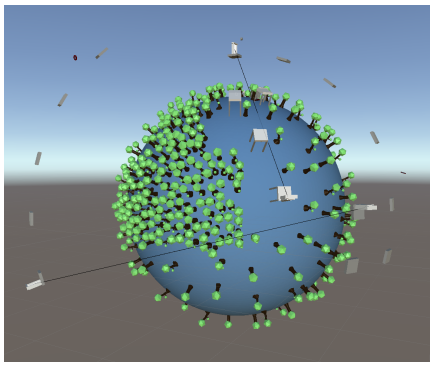
It was decided that for the spherical shooter with portals that platforming would be included alongside a time limit to increase the pressure on the user. The world had to fit with this idea so one was created with some initial basic platforms implemented.



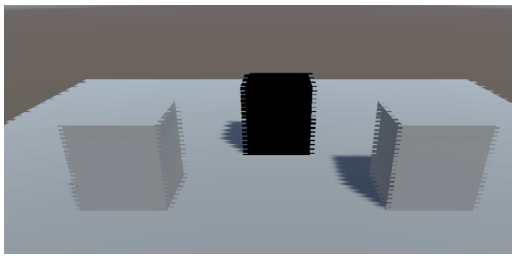
Targets were then implemented to allow for the win condition. These were made using Unity's package 'Probuilder.'



Shortly after, the scene was complete with the addition of the timer. To avoid sudden scene changes upon hitting a loss condition, a game over screen will be implemented.



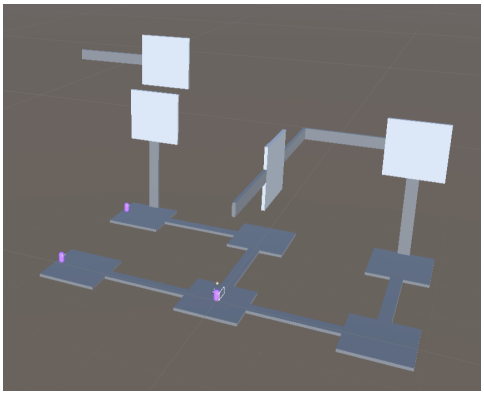
A distortion shader has been created with it being able to present graphical disturbances, such as glitches, purposely. This will serve to enhance the atmosphere of the final subproject where geometry appears somewhat unraveled.



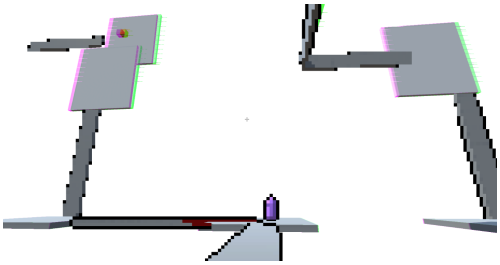
31/03/2022

Today focuses on the beta stage subproject, Gravitational tactical scaling, which will be going through some changes from how it was created previously.

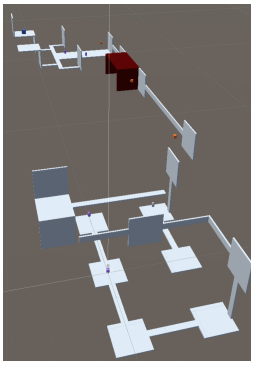
Since the map used for this subproject was used in Gravity changing scale puzzler, there needs to be a new map that isn't too similar. With this in mind, it was decided that the tactical element of this subproject will be focused on planning a path before its taken. The ground will disappear after being left and the user must take the correct paths while also avoiding enemies. A very basic model was created to demonstrate how the gameplay would handle but the implementation of the non-Euclidean scaling effect is still a question.



With the addition of previously mentioned visual effects, the perceived space can receive a number of changes.

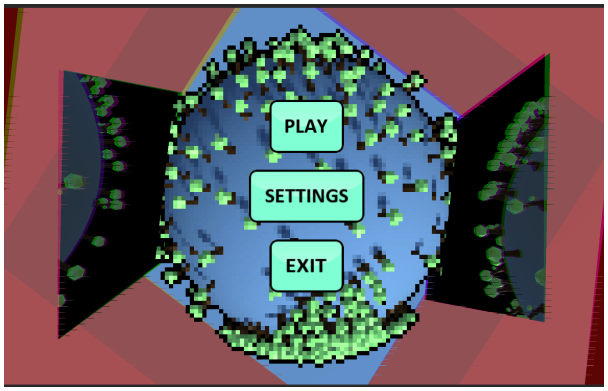


With a few more object placements, this subproject is complete. The map is required to be this simple because the user is expected to have to attempt it many times in order to reach the objective.



With all the subprojects complete, a hotkey to escape each subproject and return to the white room was created. Now is the development of the finale scene and a few polishes here and there and this artefact will be completed.

A main menu was implemented with the intention of allowing for audio settings changes. The next steps would be creating audio and an in-game menu.



01/04/2022

Changes were made with the player controller script today so that rotations do not get muddled between different mechanics. This stops the portals from overcorrecting the user's y-axis rotation.

Some very simple background music tracks were made to fit three different themes. These themes being general use, spooky, and odd. These will have footsteps and ambient sounds to create a soundscape that should make the game more enjoyable.

A music manager script was created to ensure the correct song plays in each scene. With this, the music part of the game is complete. Following this was an addition to the player controller script to allow for footsteps to be tied to the player game object.

An in-game menu was implemented as the final task of the day. This menu allows for the changing of, and muting of audio within the subproject. Continue resumes the game, white room send the user to the white room to progress the game, settings open up the settings menu, and exit game closes the application.

02/04/2022

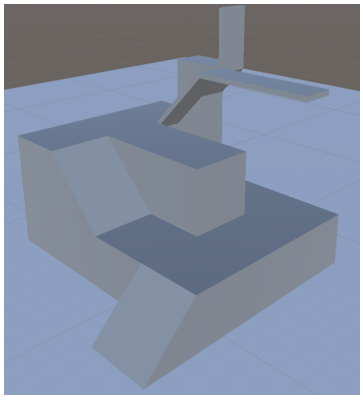
Work began on the finale scene today with an initial fix to the portal system. It appears that while a rotation issue was somewhat fixed and rotated portals worked, two differently rotated portals on the X and Z axis would not rotate the user correctly. This took a lot longer than expected due to the intricacies of the player game object.

For the level design within the finale scene, inspiration will be taken from M.C. Esher's impossible room featured in his painting 'Relativity.' This can be accomplished through the wall scaling mechanic and portals. The intention is to use both in separate rooms while changing the visuals.

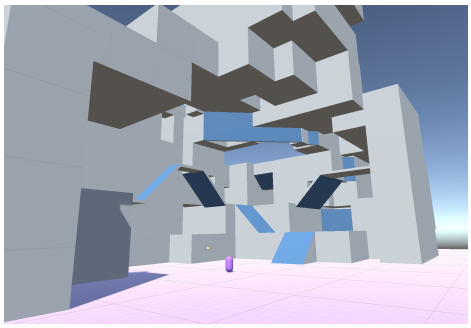
The genre for the finale scene will be an exploring puzzler. The user must traverse throughout a building and solve puzzles. Due to time constraints, the whole building will be accessible from the start and the user must explore around through doorways and portals to find the puzzles.

03/04/2022

Today features designing the finale level. A number of issues are rising to prominence but slow progress is being made. Part of the beginning section has been made.



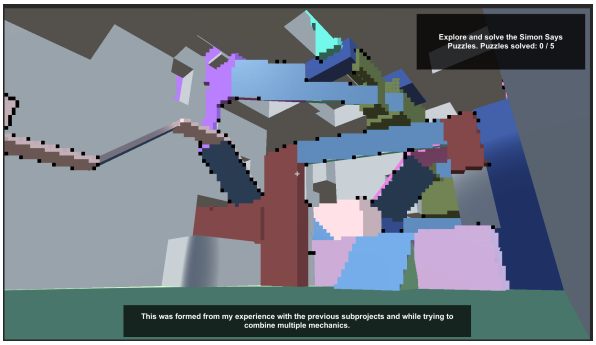
As the map develops, it is clear that the whole level can not be designed this way, due to time constraints. With this in mind, it was decided that the level will be split into three differently designed sections.



04/04/2022

The first activity completed today was fixing the player controller's rigidbody movement. Due to the camera being in fixed update, the late updated portals would fight over the camera rotation. This was fixed by moving camera rotation into update and interpolating the rigidbody to stop camera jittering.

The first draft version of the final subproject was made and will be polished within the following days. A number of fixes occurred within the whole project to improve playability.



8. References

[1] Easterbrook, C. (2022) GoatBandit/CCTP-Subproject-Beginning [online]. *Github*. Available from: https://github.com/GoatBandit/CCTP-Subproject-Beginning.

[2] Easterbrook, C. (2022) GoatBandit/UFCFHQ-45-3-Comprehensive-Creative-Technology-Project-Final-Subproject [online]. *Github*. Available from: GoatBandit/UFCFHQ-45-3-Comprehensive-Creative-Technology-Project-Final-Subproject (github.com)