

How can the implementation of design pattern recognition help to improve level design and the overall experience of the player?

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Abstract

This report dives into the topic of **Design Pattern Recognition** within level design, this was done with a prototype made within Unreal Engine 5 of a dungeon crawler style game like **(From Software, dark souls 1, 2011)** the overall goal of this is to playtest this game on play testers and gather their feedback on how these design patterns can be further implemented to enrich the player experience within a level.

From the finding that were gathered I can conclude that the project was an overall success as it not only shows a clear understanding of design pattern recognition as intended in the players it also proved that players are more responsive to select design patterns within some cases I also believe further research could further expand this topic as I and others have had learned some elements of level design not otherwise thought of necessary when planning showing this project could be used to learn from.

Overall, I believe this was a topic rich with information that could be used within level design and could further be explored given more time to study a wider population of player base to see what a wider audience would say and what information would later be gathered.

Acknowledgments

I would like to take this opportunity to thank each of my friends who play tested and the new contacts that had taken the time out their day to playtest my project.

I would also like to thank my two readers **Franck Dhotel** and **Christopher Bailey** for teaching and supporting me and for being understanding when I needed.

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Finally, I would like to personally thank my partner **Sam Osborn** for being supportive of me during the hard time of this semester and when work got overwhelming thank you for all the encouragement.

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Introduction

Within this master's project I aimed to research into design pattern recognition within level design specifically what design patterns are, and how they can be used to further improve level design.

I aimed to create a project based around level design in a hack and slash dungeon crawler where I would research and implement these design patterns and test these areas of my level to gather research on how the player would react to minimal information only going off designs within the level.

I believe this topic is worthy of exploration as level design is one of the key pillars of what makes a good game and with further knowledge on what design patterns can be implemented to further enrich the player's experience and by using specific design patterns to minimize hand holding with unnecessary guiding markers within games as this ultimately takes the player's attention away from the level design.

Aims / Questions / Hypotheses

1. What effects do good implementation of design patterns have on a player's experience?
2. What elements of level design can be used as a design pattern to guide the player?
3. What is the most effective game design patterns that can be utilized within level design?

Literature Review

While researching into this topic for my project I investigated several academic papers covering the different elements of level design from the key fundamentals of level design and how this should be pre-planned and thought-out during production to key design patterns that are undertaken by major industry developers to improve their level design.

Firstly, I set out by researching how I could structure my project with all design patterns in mind that would be necessary within the project, during my research I found an academic paper based on **"Level Design, In Pursuit of Better Levels"** by (Kerri Nouveau, 2020)

I found plenty of insightful research on this topic with the goal in mind that level design was key to gain research, this means preplanning was crucial for my level design for this I looked at the paper's **"Concept Process"** section within paper as this strongly helped my process in the early stages of the project as I used this to help me structure the key points that make up the project some of the examples of how this helped my process are listed below.

- Justifying the game's metrics (**The size and scale of the level and items within**)
- Restrictions (**Things that the player is required to do**)
- Goals (**Things I wish to achieve such as the level's theme or overall feeling**)
- Context (**Things I should consider**)

I believe by looking at how a well-structured level is created from scratch and what things are considered when planning these design elements within a project helped strengthen the overall quality of the project.

Other examples of literature research I found are Denise Bacher's paper on **"Design patterns in level design: common practices in simulated environment construction"** by (Denise Bacher, 2008) within this paper the topic of design patterns are covered giving a clear description and break down on design patterns defining them as "reusable solutions to solve recurring problems" this paper then goes on to break down the key elements that make a design pattern within a level.

1. Name of the pattern
2. Context in which the problem is examined.
3. Complete Description of the problem and how it might occur
4. The solution to the problem
5. Any patterns that might work with the current design patterns implemented

While researching design patterns that could be utilized within my single player third person hack and slash prototype I found that I was not short on examples that could be used within my own work and research within the academic paper **"Level Design Patterns Looking for the principles of Unified Level Design"** by (Simon Larsen, 2006) within this paper several examples were made that are commonly used within large industry projects for level design as these patterns help define the level and improve player experience overall.

Multiple Paths

The use of multiple paths is one of the key design patterns used commonly to increase the playability of the level along with giving the player a more diverse experience allowing the player to make their own decision on how they wish to progress from point "A" to point "B" this poses its own benefits and problems.

Problems with this design pattern can be that the use of multiple paths does run the risk of leaving the player confused and lost if this is not implemented correctly, this could occur if these different paths are created without taken into consideration of the games "Critical and Golden Paths" (Kerri Nouveau, 2020)

- Golden Path – is the ideal path the player would follow intended by the developer
- Critical Path – The quickest route to finishing the level/object

Planning the use of multiple paths requires careful planning to predict how the player will react and making so that these paths have a purpose and entice the player to rather play again to explore the variety of options available to them.

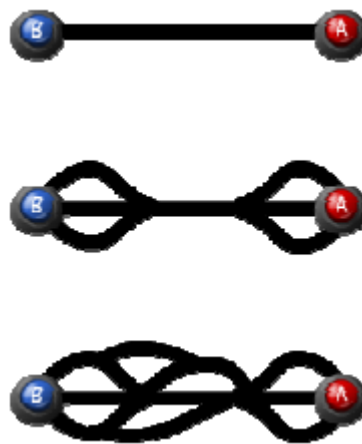


Fig 1. – Representation of multiple paths at play within a level

The design pattern of multiple paths are something that has been taken into consideration from the early stages of this project as my intentions are to provoke a response from the player within the confines of the level design and seeing the results of these design patterns.

Below are two examples of how multiple paths can be implemented on a large scale along with how this design pattern can be used through smaller and more suitable section of the games level providing a better gameplay experience.

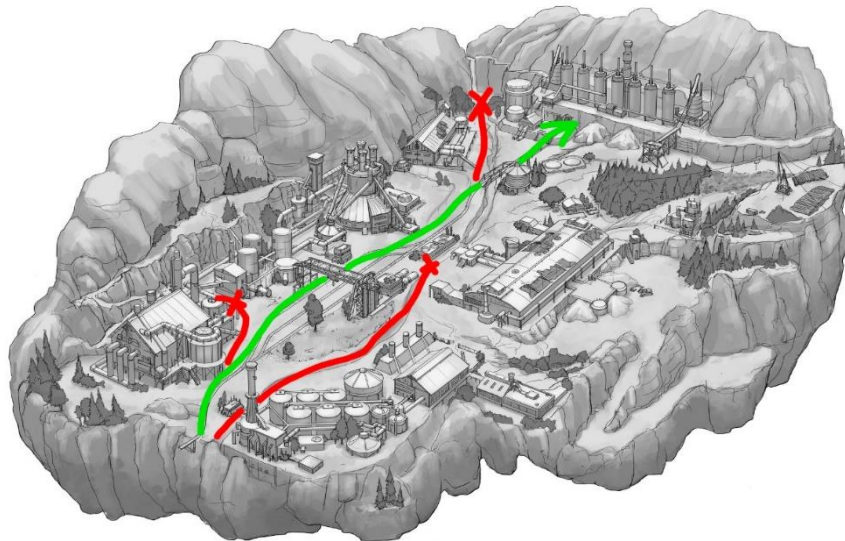


Fig 2. – Multiple paths used on a



Fig 3. – Multiple paths used on a small scale to provide multiple paths to the player enriching the experience of the player

Affordances

Looking at other methods that could be implemented into the levels design are affordances this is the use of specific assets being placed to draw the players attention and help as a guid line and indicate to the player that they should interact with this in some way.

While researching this I found an online article titled “**Level design: player navigation with an aid of affordances and obstructions**” by (Sergej Actalogic, 2021) that fully covers the uses of affordances in games such as **The Last of Us (Naughty Dog, 2013)** with clearly visible climbing sections.



Fig 4. – The Last of Us affordances indicating a climbable wall

While researching I found that there are two types of affordances to keep in mind when thinking of the players reaction, thanks to an article named “**Affordances in Game Level Design**” by an industry developer named (Nic Phan, 2021) this article lead on to list out the two affordances and their definition.

- **Cultural Affordance** – these are affordances that the player would expect going into the game this is something that the player has come to expect from games such for example broken boxes and vases can be smashed.
- **Inferred Affordance** – these affordances are things that the player has come to learn and work out from the game by using their logic work out the inferred affordance for example small cracks or holes within a wall would have a player lead to crouching.

Following on from this article I found another article of work titled “**Defining Environment Language for Video Games covering the use of affordances**” written by (Arti Burton, 2017) that shows how industry companies such as Naughty Dog use these design pattens to build a believable game environment that displays this information to the player.

Bread Crumbing

One other design patten that I had full intentions of utilizing within the project is the bread crumbing, while researching this design patten I found a video named “**Breadcrumbs in Level Design: Guiding your player from A to B**” by a channel named (timdoesleveldesign, 2022) this covered the definition of bread crumbing in level design explaining how this is the act of using items such as pickups or coins to guid the player along the golden path of the level.

Along with this a blog written by (Tom Pugh, 2018) titled “**Level Design Tips and Tricks**” that along with other useful design pattens covers and shows examples of Bread crumbing in games and how this is used to subtly guid the players attention.



Fig 5. – (Insomniac Games, 1998) “Spyro” use of bread crumbing to guid the player

Development Work

Pre-Production

Initially when planning the approach of this project it was decided on that Unreal Engine 5.03 would be used to create and test this project this decision was made as Unreal Engine 5 lighting system could be used more effect with what I aim to achieve within this project in finding out what design elements of level design provoke the most reactions out of the player.

Planning out the games main mechanics and functions was my first step before getting into designing the levels for this project I aimed to create a game with a similar feeling as **(From Software, 2011) “Dark Souls”** in both terms of level design and gameplay.

List of gameplay mechanics

- **Combat** – Basic mela sword attacks
- **Enemy AI** – Basic AI to be used within the level
- **Dodge/roll** – useful ability for player use
- **Crouch** - useful ability for player to navigate level
- **Breakable objects** – Objects intended to be broken **(Should look fragile)**
- **Switches/Buttons** – Device that indicates it should be interacted with to open a gate
- **Gates** – gates that brake up level flow and give the player time to find a solution
- **Collectables** – to encourage the player to explore further around the level

Pre-Production – Blueprints and mechanics

As a part of this project, I undertook several mechanical endeavours to help give the project a better feel with gameplay this was not the focus of the project although dose warrant mentioning of how and what was done in terms of blueprinting and design of gameplay mechanics.

Animations

The use of animation are a big part of the player and enemy movement within this project as this display's information to the player from when attacking and when receiving damage along with falling animations and a set off attack animation to keep a verity.

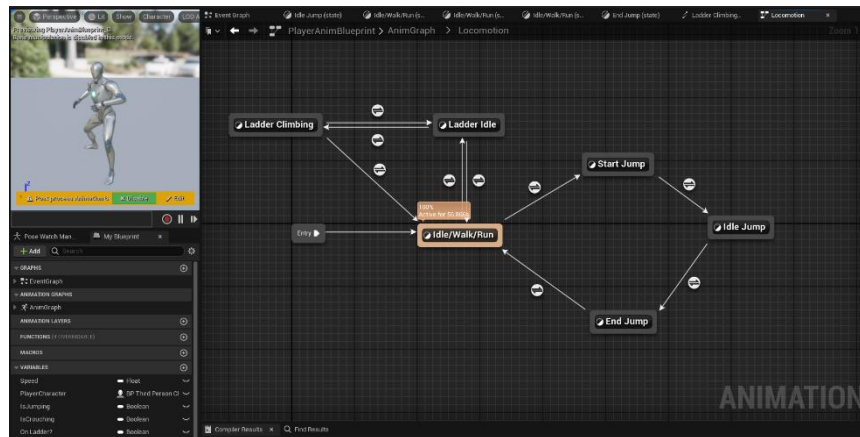


Fig 6. – Animation blueprint

Player Mechanics

The players mechanics where a more important element of the project although not the focus it was crucial to carefully plan out what it is I wanted my player to be able to do within game, for this I created a set of basic mechanics that allowed the player to move more freely with jumps and rolls along with creating systems that would be used for combat.

Within the figure below are the players mechanics are set out within blueprints within the player character listed below are the mechanics covered in the player character.

- **Stamina/sprint system**
- **Health system**
- **Death function**
- **Fall damage**
- **Dealing damage**
- **Movement**
- **Climbing ladder mechanic**
- **Interact mechanic**

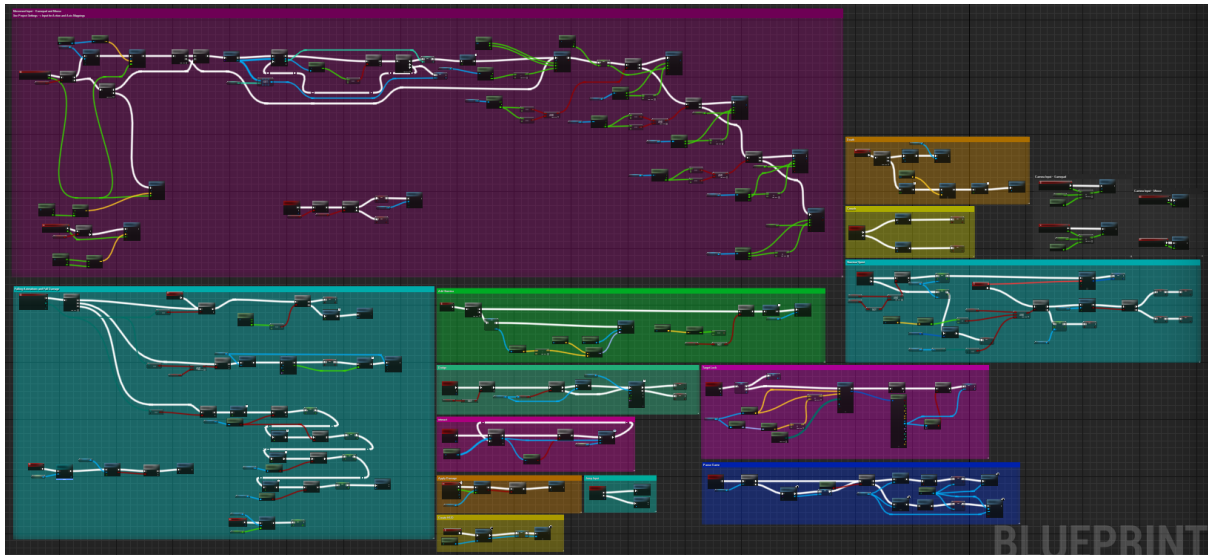


Fig 7. – Player blueprint mechanics

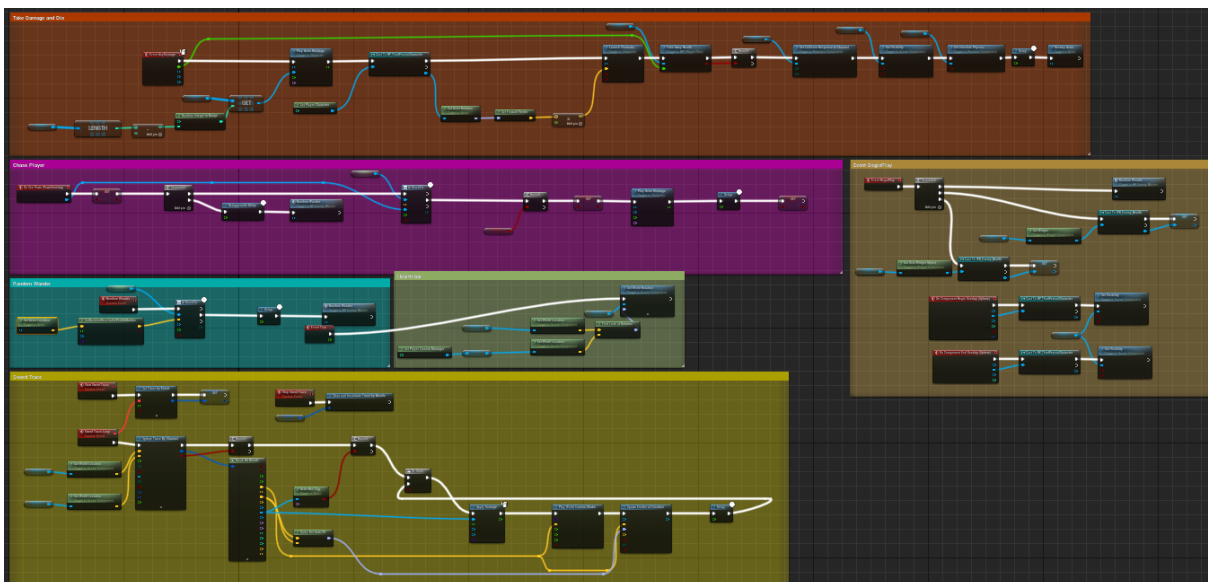


Fig 8. – Enemy AI blueprint mechanics

Pre-Production – Level design patterns

The focus of the project is the level itself and the design patterns that I intended on implementing into the game within this section I cover what pre-production steps I took when approaching my level and the how I planned for implementation of several design patterns and techniques.

Gameplay Affordances

Firstly, when planning my games affordances, I looked at the assets that I was using in the creation of the project these are three asset packs from **Synty Studios**, for this I carefully selected assets that best represent themselves and act as an inferred affordance as the player will gradually be introduced to these affordances.

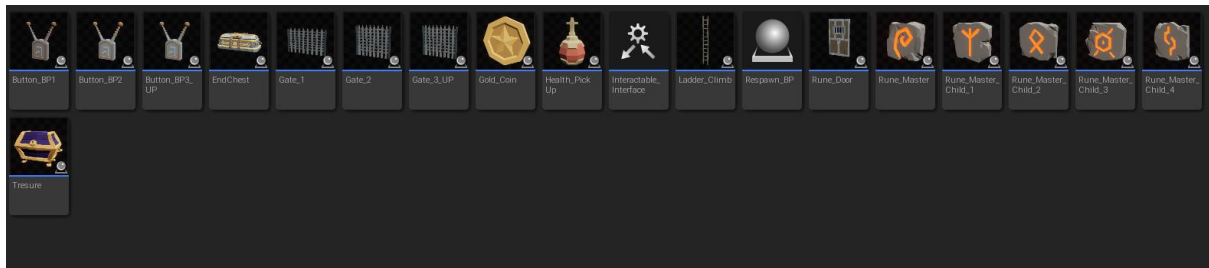


Fig 9. – Intractable affordances

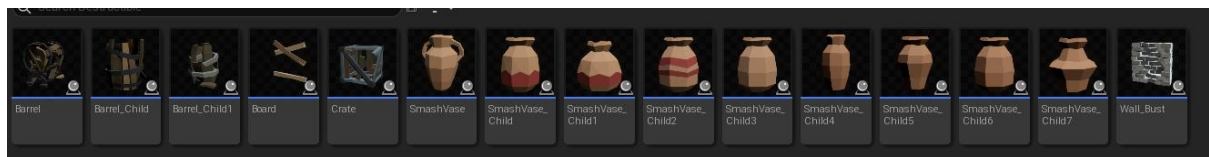


Fig 10. – Destructible affordances

Production

During early stages of the project a tutorial level was created to gather research as quickly as possible for this small level I wanted to demonstrate the games mechanics quickly by using the research I had found and implementing design patterns I would then be latter on use within the projects main level.



Fig 11. – Top-down view of tutorial level

While laying out this level I kept in mind the overall goal for this level, as this safe space is intended to teach players the key elements within the game while relaying on the same methods and techniques researched to gather information on player reaction before approaching the games main level.

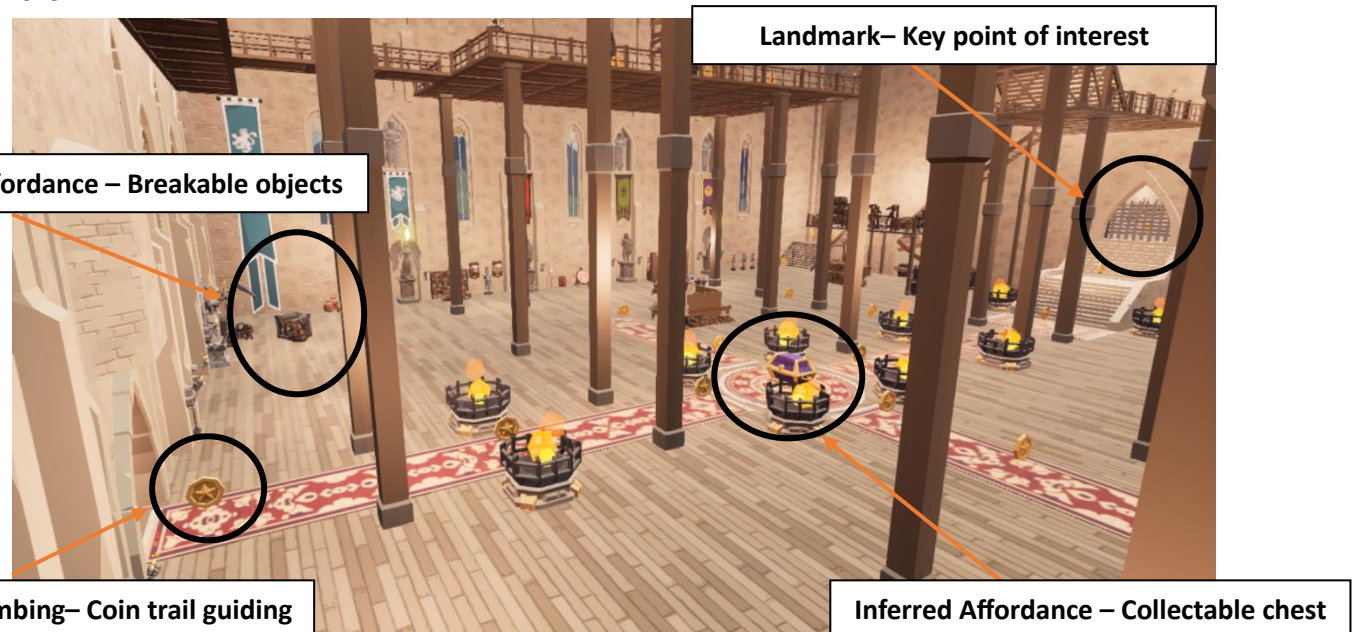


Fig 12. – Entrance into tutorial level

Within the entrance of the level my goal of creating a small space where the player can learn the mechanics while I gather data was complete as when given to small participant groups for feedback on this area of the project it was shown players found each of theses key design pattens and had recognised their objective within the level without ever being told or shown.



Fig 13. – Lower level in tutorial – Players first encounter with

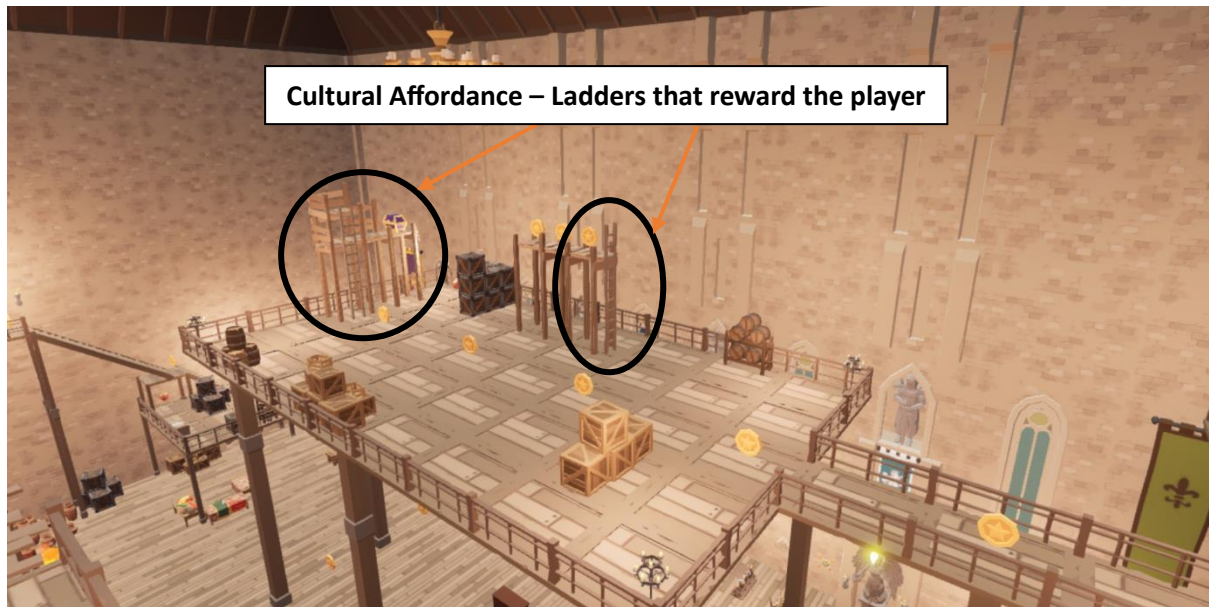


Fig 14. – Introduction to climbing mechanic

This placement of the game's mechanics can be seen thought out each section of level overall the creation of this small play space help in additional research and helped with my question of how these design patters can be implemented and how to show this to the player viva level design.

Production – Main Level

The production of the main level took a lot of time to create and fix to get right for playtesting, firstly when starting the level my first major decision was picking a setting and creating a list of assets that I will stick to be consistent.

Choosing to create my level based on a dungeon crawler I set the level at night in a burning medieval village to maximize the use of Unreal engines lighting system as this was a design patten intended to attract the player with light placement.



Fig 14. – Player spawn location within main level

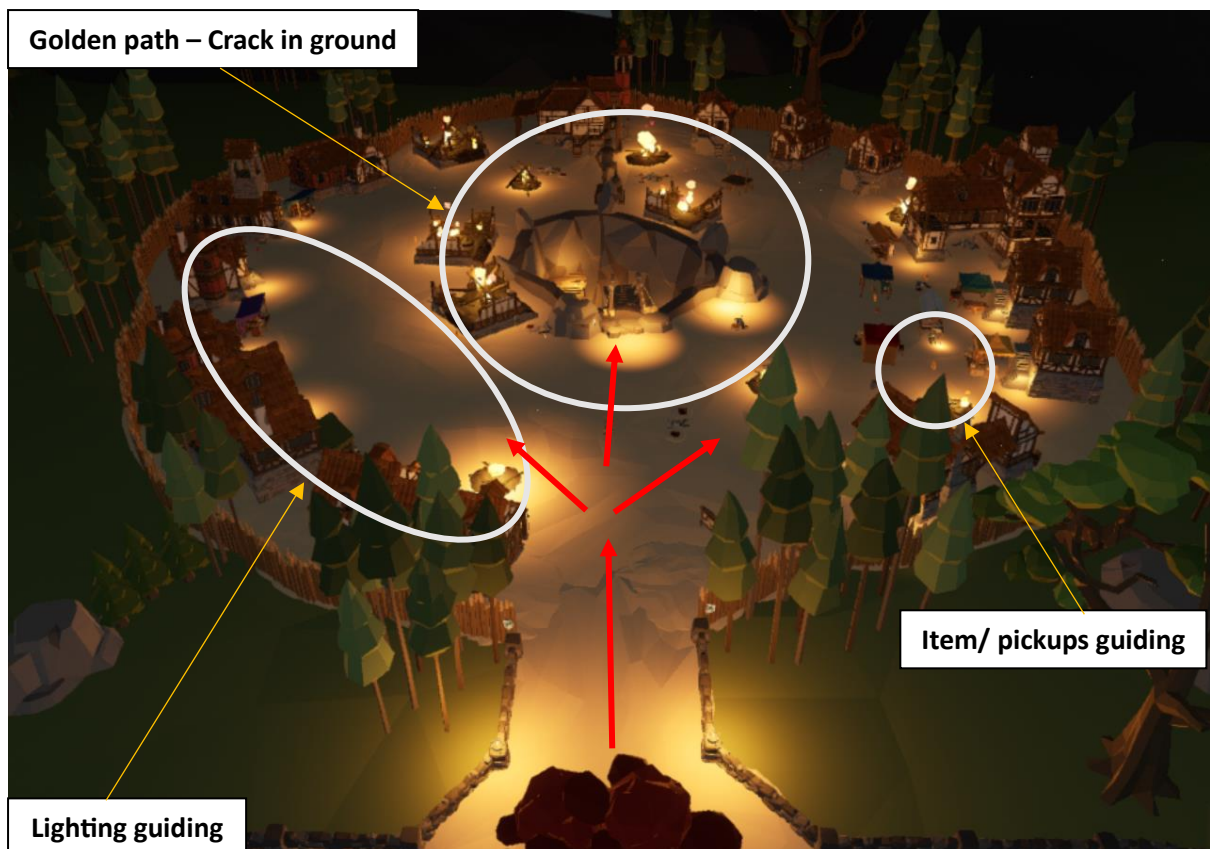


Fig 15. – First section of level

Within the first section of the level lighting was a key design element that was intended for one half of the village as the opposing side had a clear view of items placed along a market, this was an intentional design to see the reaction of players when given three clear design patterns to follow and when reviewing players reactions to this, rarely did players jump down the pit right away instead both sides were equally explored by a range of players in testing.



Fig 16. – Wooden planks being used as an affordance to guid the player where to jump

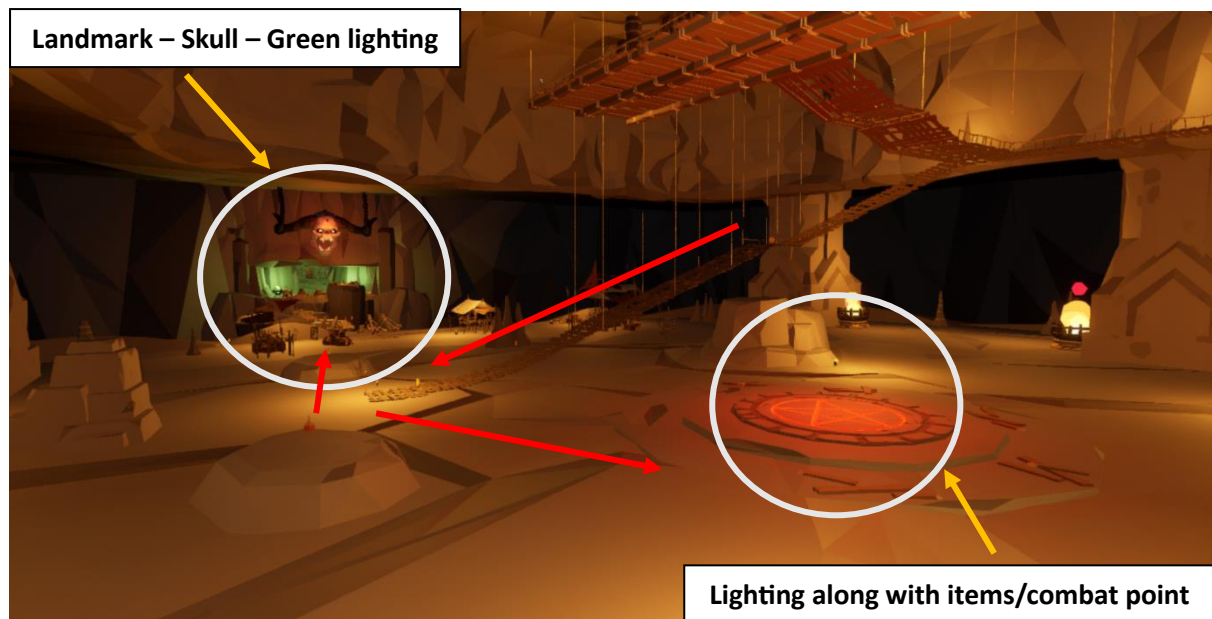


Fig 17. – Dungeon entrance stage



Fig 18. – Guiding lines

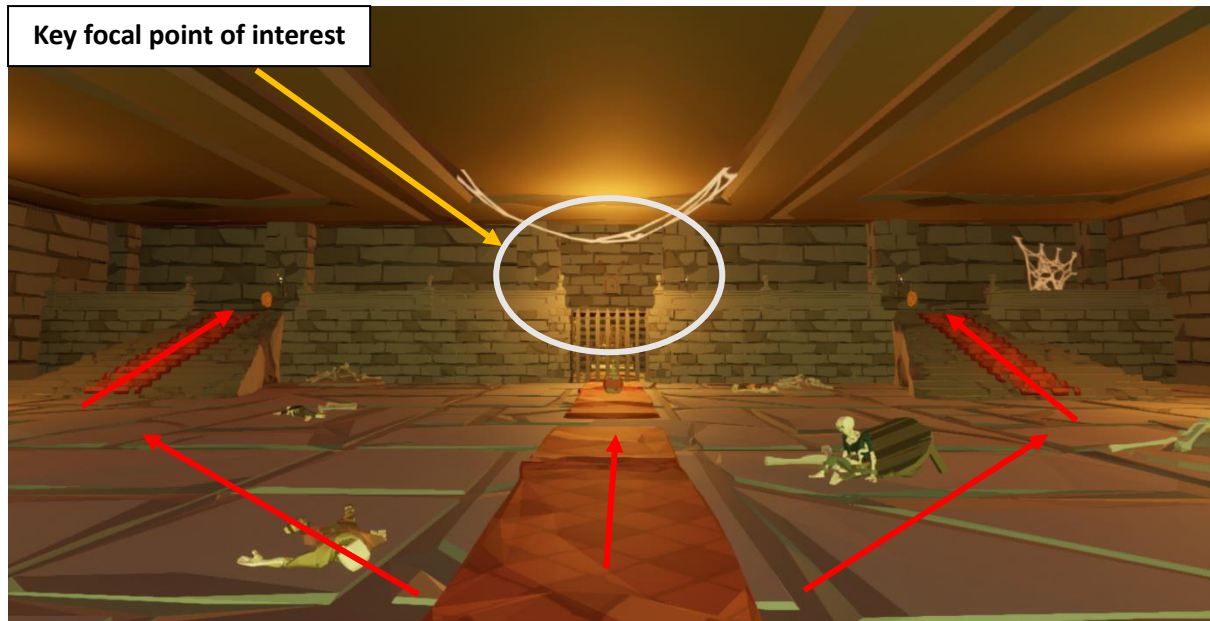


Fig 19. – Guiding lines pointing out a switch teaching the player they will open gates that block progression

At this stage in the level the player has seen almost all the design patterns that they will need to recognise to navigate the level and collect runes to complete the game, the section below tests this on players only allowing players who have recognised these key patterns to continue.

This section proved that my design patterns were working and being recognised by the player as in playtesting almost all players found the way to progress.

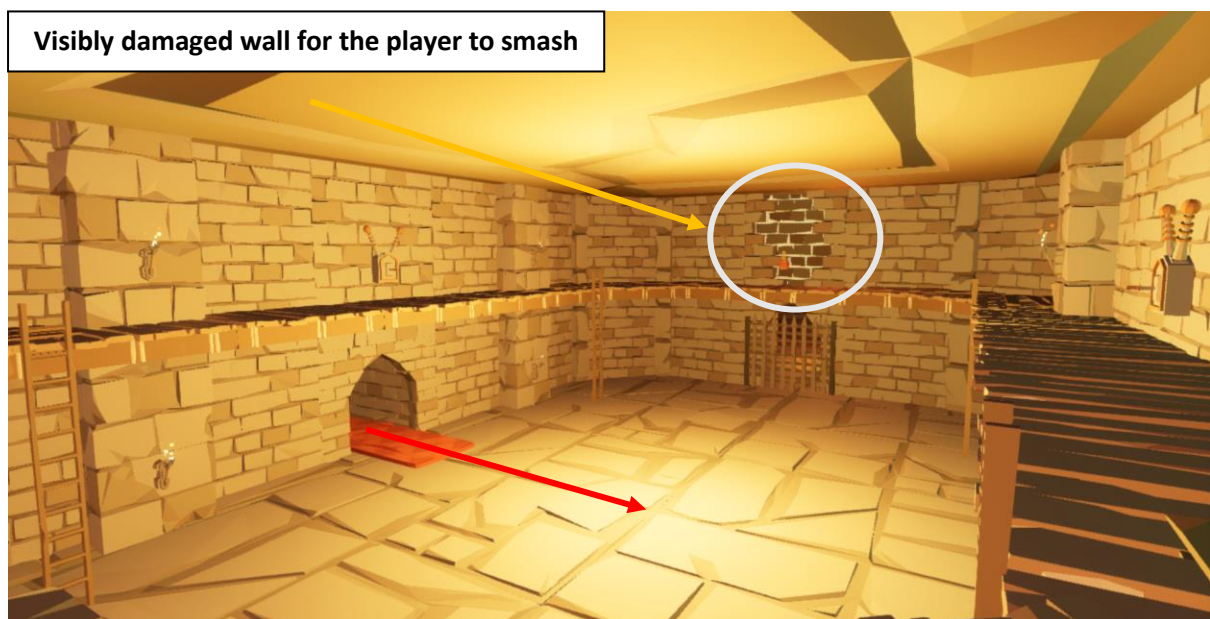


Fig 20. – Breakable walls introduced, and player recognition tested for new and already introduced design patterns

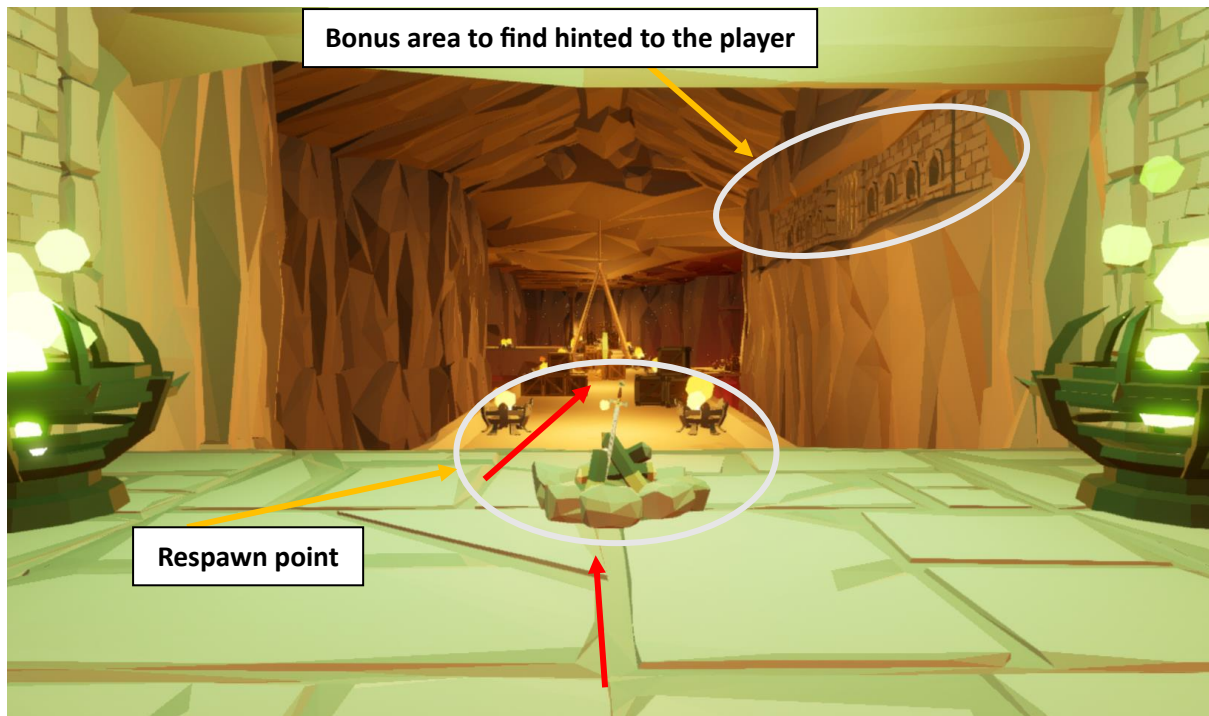


Fig 21. – Dungeon Bridge section

Unintentionally the respawn points within my level called attention from the player as a few players did mention that this felt like a Dark Souls reference giving the feeling of a safe point allowing the player to respawn and have a moment to plan their next move.



Fig 22. – Bonus area with rewards for player

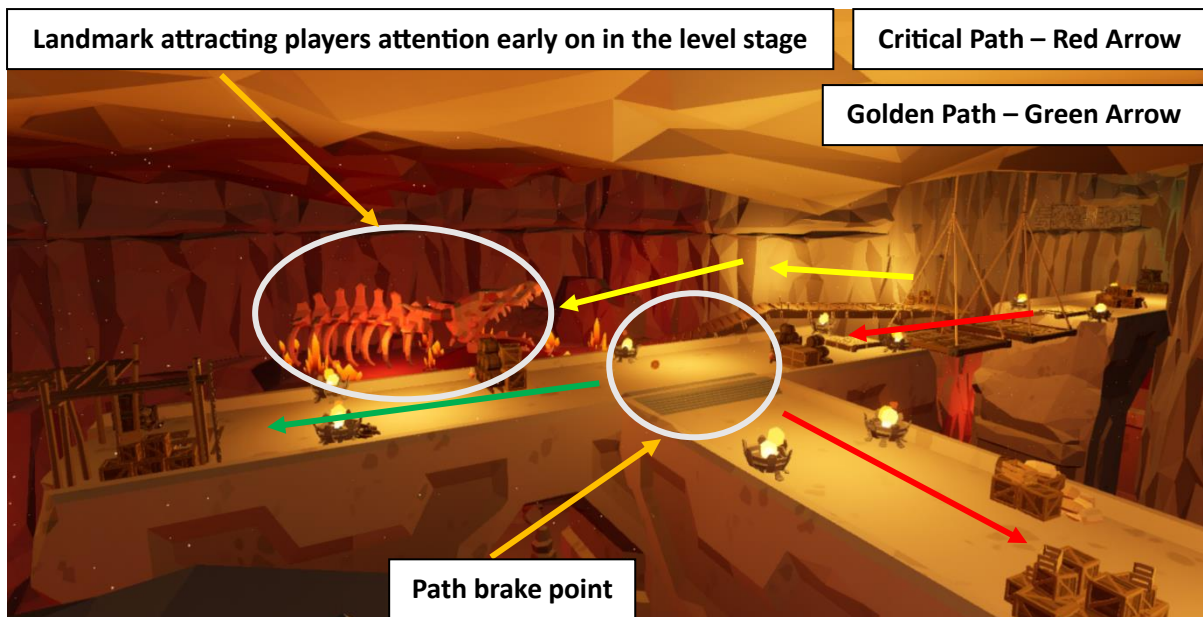


Fig 23. – Main part of dungeon and multiple path option



Fig 24. – Golden Path cave section

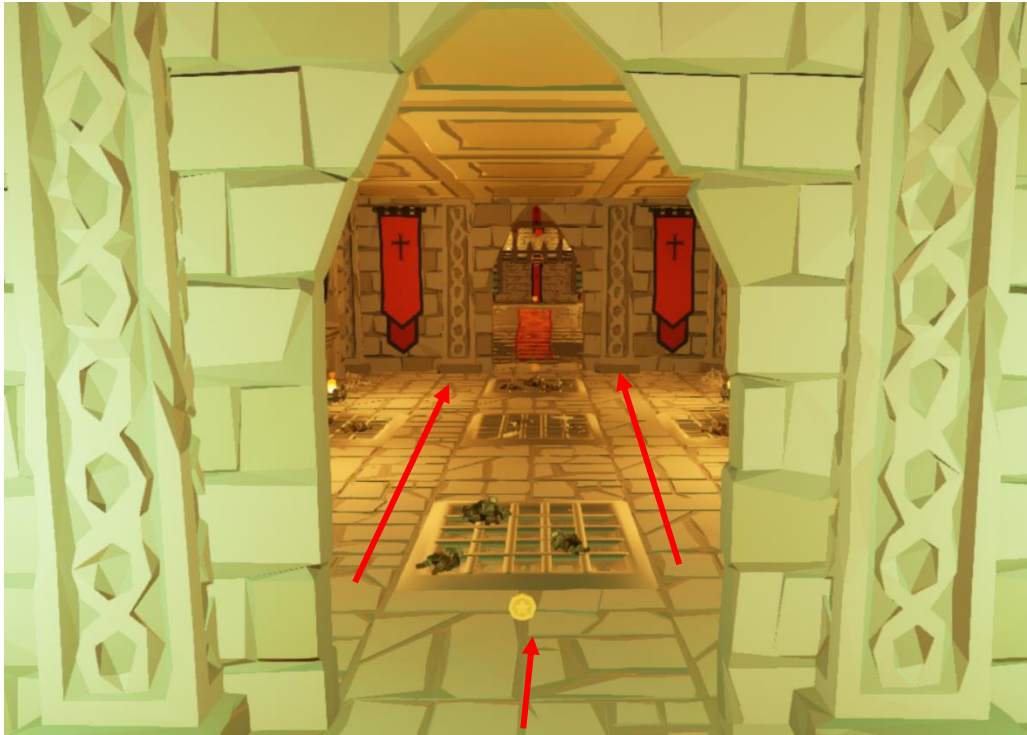


Fig 25. – Critical Path and traps being show with dead body piles indicating danger

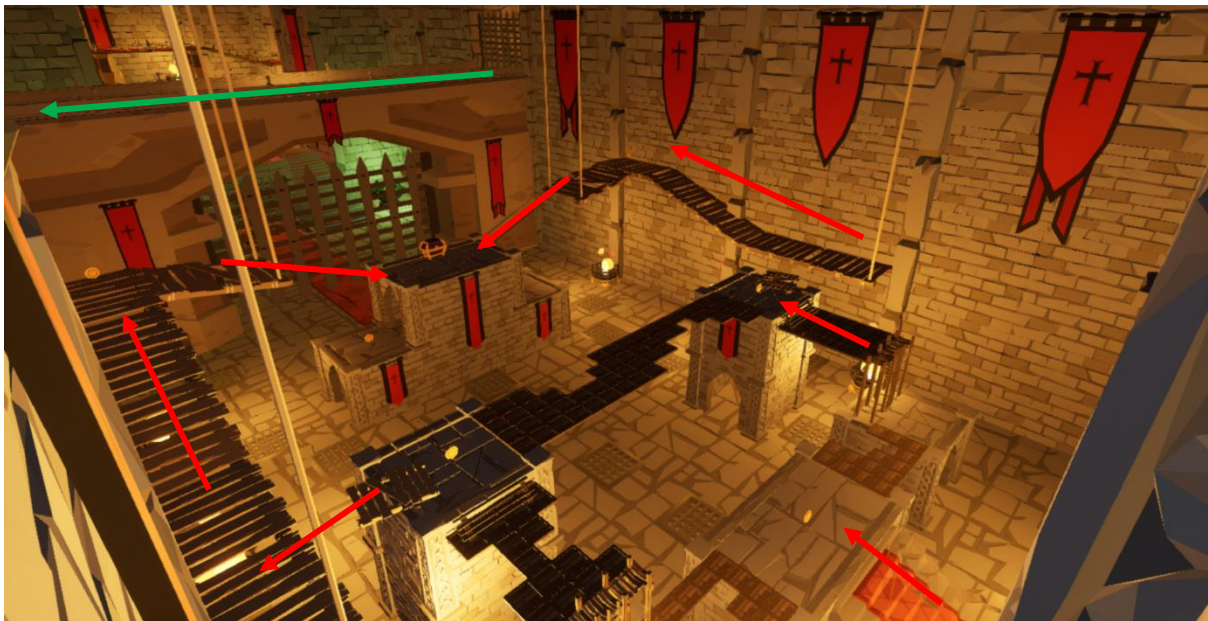


Fig 26. – Grand hall section



Fig 27. – End dungeon entrance

Before the player can enter the final stage of the dungeon the player must have activated all switches to lower the gate along with collecting all the runes in the level.



Fig 28. – End section

Results

A playtest feedback form was created to gather finding on my project and see the results of my work within this report several people had given me their feedback in this form and others have directly spoken to me on elements of the project.

Playtest Feedback Form

Thank you for playtesting my masters final year project, within this feedback form it be taken only information about your personal experience with the project and using this information to gather data to see how well my overall level design was planned as my main focus of this project was design pattern recognisable within level design.

When Exploring the level how often did you find yourself lost and looking for a path of progression?

☐ I was able to find my way around the level - Intended path was made clear

☐ Finding the direct path was clear after some exploring - Intended path was easy to find

☐ The intended path was found within a reasonable time - Intended path was found

☐ The intended path was not made clear - Intended path was difficult to find

☐ Lost and could not find intended path - Intended path was not found leaving player lost

From the options below please select what design patterns you felt you recognised and best helped guide you on your path throughout the level.

☐ Lighting (Lighting of the level guided you around the level)

☐ Asset placement (Affordances such as specific assets that drew attention)

☐ Guided lines (Path was made clear by visually seeing where is intended to go next)

☐ Enemy placement (The use of enemies spawning giving an indicator of the direct path)

☐ Other...

What design patterns do you feel could be worked on in order to improve on the level?

Long answer text

When playing the game what design patterns were made clear that the player could interact with within the level.

☐ Switches (Switches that open gates)

☐ Breakable walls (Walls the player can smash)

☐ Runes (The collectable runes)

☐ Floor Splines (This only in one section of the level)

☐ Treasure chests (Collectable chests)

☐ Breakable Objects (Rocks, Wooden boards, Broken crates, Broken barrel)

☐ Ladder (Interactable object)

☐ Other...

What interactive Design patterns did you recognise and how could other interactive objects be made more clear and recognisable to the player?

Long answer text

When playing within the level what would you rate the interactive design patterns in terms of them being clear and the player should be drawn towards.

☐ Extremely clear that objects should be investigated and interacted with in order to progress

☐ Interactable design patterns are clear and easily recognisable once introduced in the level

☐ Design patterns can be recognised although do not always catch the attention

☐ Design patterns are unrecognisable and should be worked on to make more clear

If you played the games tutorial level did you find it to be helpful in introducing some of the games overall design patterns?

☐ I did not play the tutorial level

☐ Yes - this helped introduce the design patterns along with making them more recognisable

☐ No - this did not help make the design patterns clear within the games levels

Do you feel that the games main level is designed well? Please give a description on what you liked and did not like about the overall level design.

Long answer text

If you completed the main level how many collectable treasure chests did you find?

Short answer text

Did you stray off the intended path to explore any of the levels secret areas? if so what did you find and did you did this make you feel finding these bonus areas.

Long answer text

Overall how do you feel about the Design Patterns within the project?

Please give a full breakdown on how you feel about the Design patterns that help guide you around the level any good key points and any key points for improvement.

Note - any design patterns you found stood out within the level please make mention and give a description of what you found worked within the level and what did not.

Long answer text

Did you find the level layout to be confusing?

1 2 3 4 5 6 7 8 9 10

Not at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Yes I was completely lost

How would you rate the introduction to the games design patterns? where they easy to recognise and identify?

1 2 3 4 5 6 7 8 9 10

Bad (hard to identify) ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Good (Easy to identify)

Finally, how would you rate the games main level in terms of enjoyment and design on a scale 1 from 1-10

1 2 3 4 5 6 7 8 9 10

Drastically Needs Work ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Enjoyable and Well Designed

Date

Month, day, year

Name

Short answer text

Fig 29. – Feedback Form

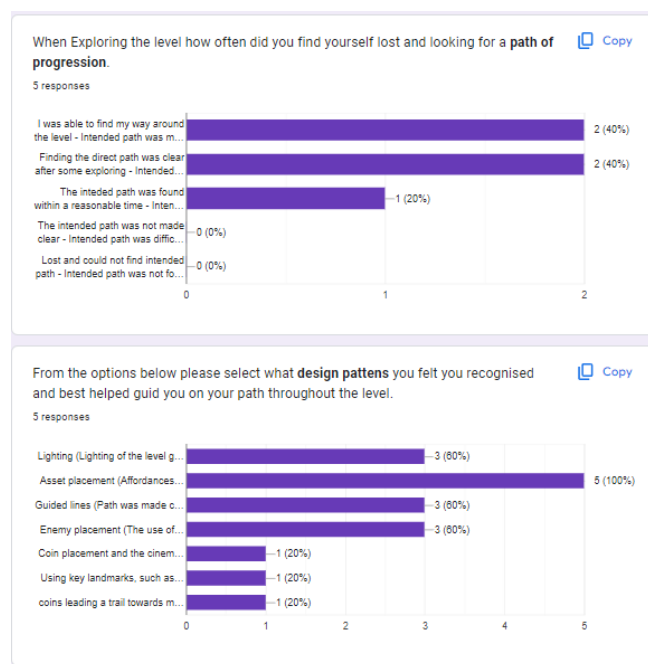


Fig 30. – Feedback responses #1

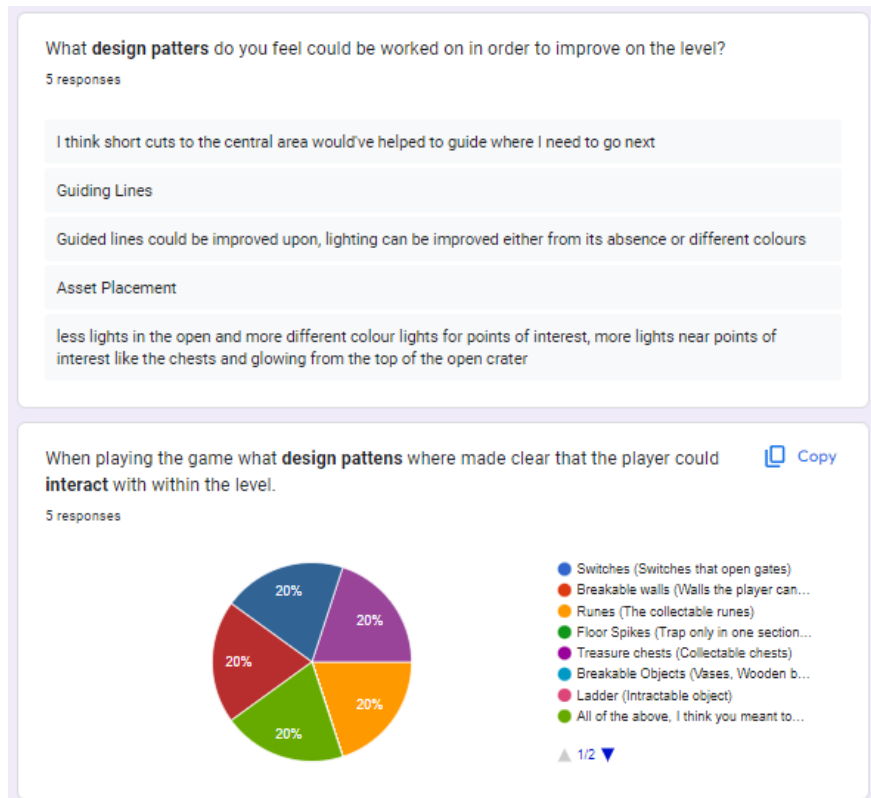


Fig 31. – Feedback responses #2

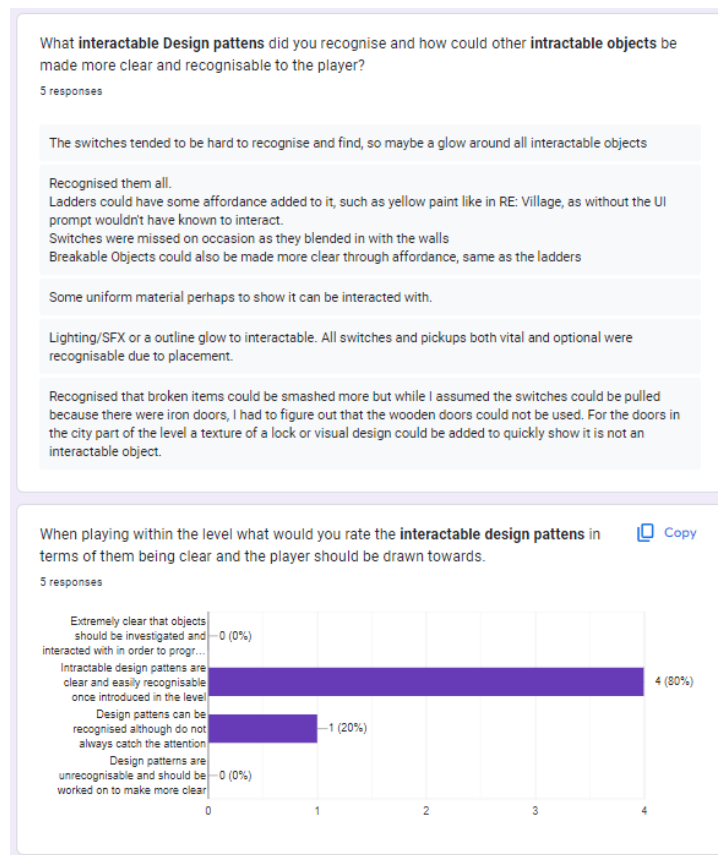


Fig 32. – Feedback responses #3

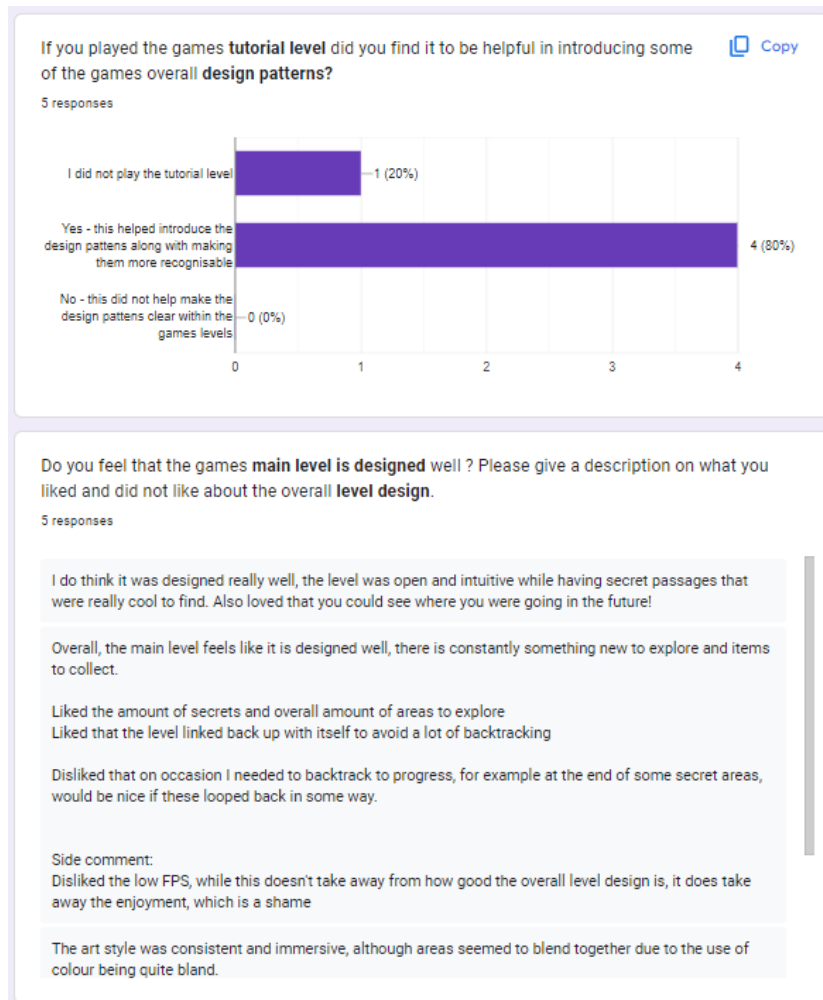


Fig 33. – Feedback responses #4

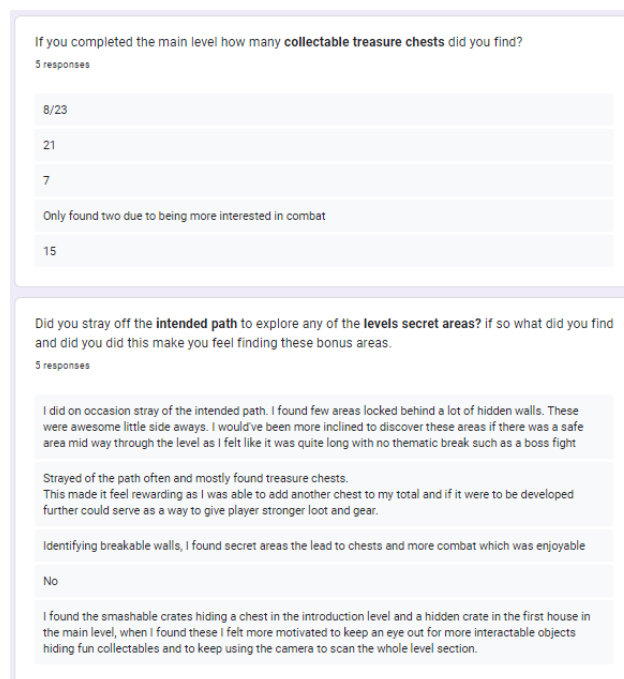


Fig 33. – Feedback responses #5

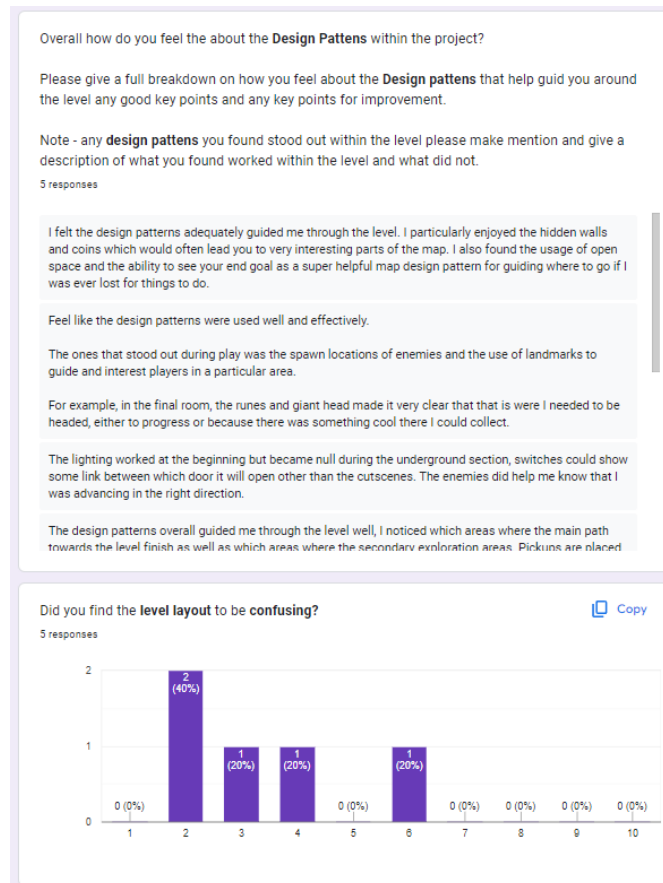


Fig 34. – Feedback responses #6

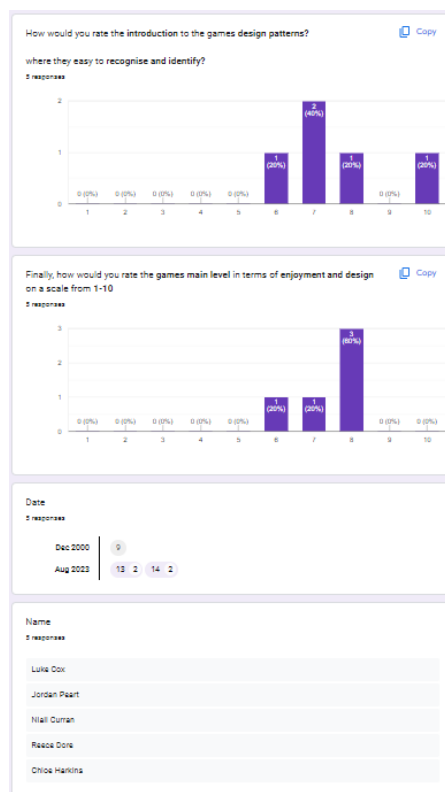


Fig 35. – Feedback responses #7

Although only a select number of partisans responded to the feedback form, I believe the data gathered shows a clear understanding within the games design patterns as responses remain consistent with what I had hoped, players recognised the game patterns and responded accordingly within play session I believe with even further research I can see what design patterns cause what responses within the player.

Reflection

At the end of this project, I am proud to say that my research holds up when put to playtesting as I had gotten a lot of useful information on my level design knowledge over this project learning how to engage the player more subtly and finding myself being able to actively show people and explain to them the elements of design patterns within levels design.

Overall, the project was a success with research being obtained and responses to the games level being positive although I did find towards the end of the project due to technical difficulties some elements of the project that were intended in the game had to be removed entirely due to them causing fatal crashes within the game.

The level received positive feedback overall although as pointed out to myself there are some locations within the level that do feel unnecessary or that the player can soft lock themselves and end up trapped this is a slight design oversight that I fully intent to improve on and fix along with adding some paths to avoid unnecessary backtracking.

Finally, I would say am pleased with my findings as it did help my understanding of level design along with shine some knowledge on the topic to others within the process although in future, I would look towards world partitioning as during the project things such as lighting and the size of the level did cause FPS drops.

References

- (2005) *University of California, Santa Cruz*. Available at:
<https://users.soe.ucsc.edu/~ejw/papers/smith-tanagra-fdg2010.pdf> (Accessed: 16 August 2023).
- (2014) *Improving level design through Game User Research: A comparison of ...* Available at:
https://www.researchgate.net/publication/265688449_Improving_Level_Design_Through_Game_User_Research_A_Comparison_of_Methodologies (Accessed: 25 July 2023).
- 1, S. (2019) *Level design patterns: Looking for the principles of Unified Level Design, Next Level Design*. Available at:
<https://www.nextleveldesign.org/index.php?%2Fcontent%2Farticles%2Flevel-design-patterns-looking-for-the-principles-of-unified-level-design-r173%2F> (Accessed: 03 August 2023).
- Bacher, D. (2008) *Design patterns in level design: Common practices in simulated environment construction, DSpace Angular*. Available at:
<https://dr.lib.iastate.edu/entities/publication/1fc5dc40-a2da-488f-94f9-f6c3b63ae257> (Accessed: 27 July 2023).
- Design, W. of L. (2023a) *Easy 11-steps guide to planning your game environment and level design projects, UPDATED: Preproduction Blueprint: How to Plan Game Environments and Level Designs*. Available at:
<https://worldofleveldesign.com/store/preproductionblueprint.php> (Accessed: 10 July 2023).
- Design, W. of L. (2023b) *How to plan level designs and game environments in 11 steps, How to Plan Level Designs and Game Environments in 11 Steps Tutorial*. Available at:
https://worldofleveldesign.com/categories/level_design_tutorials/how-to-plan-level-designs-game-environments-workflow.php (Accessed: 10 July 2023).
- Fairbairn, K. (2020) *In pursuit of better level design, Developer Forum*. Available at:
<https://devforum.community/t/in-pursuit-of-better-level-design/67> (Accessed: 22 July 2023).
- Larsen, S. (2006) *Level design patterns - simon lund larsen*. Available at:
<https://www.simonlundlarsen.com/wp-content/uploads/2015/06/Level-design-patterns.pdf> (Accessed: 18 June 2023).
- Level design patterns* (2012) *leveldesignpatterns.com*. Available at:
<https://www.leveldesignpatterns.com/#GameDesignPatterns> (Accessed: 01 August 2023).
- mark daviesBloggerMay 12, 2009 (2009) *Examining game pace: How single-player levels tick, Game Developer*. Available at:

<https://www.gamedeveloper.com/design/examining-game-pace-how-single-player-levels-tick> (Accessed: 26 June 2023).

Pre-production (2023) *Pre-production - The Level Design Book*. Available at: <https://book.leveldesignbook.com/process/preproduction> (Accessed: 07 July 2023).

Tim Ryan April 23, 1999 (1999) *Beginning level design part 2: Rules to design by and parting advice*, *Game Developer*. Available at: <https://www.gamedeveloper.com/design/beginning-level-design-part-2-rules-to-design-by-and-parting-advice> (Accessed: 20 June 2023).

Tom Pugh Blogger October 22, 2018 (2018) *Level design tips and tricks*, *Game Developer*. Available at: <https://www.gamedeveloper.com/design/level-design-tips-and-tricks> (Accessed: 02 July 2023).

Tyler, D. and About Dustin Tyler Initially focused on web dev (2023) *Guides: Game design level creation for beginners*, *Video Game Design and Development*. Available at: <https://www.gamedesigning.org/learn/level-creation-tutorials/> (Accessed: 05 July 2023).

Writer, G. (2022) *A beginner's Guide to Level Design*, *Game World Observer*. Available at: <https://gameworldobserver.com/2022/07/08/beginners-guide-to-level-design-for-game-developers> (Accessed: 30 July 2023).

Burton, A. (2020) *Defining environment language for video games*, *80lv*. Available at: <https://80.lv/articles/defining-environment-language-for-video-games/> (Accessed: 29 June 2023).

Phan, N. (2019) *Affordances in game level design*, *nicphan*. Available at: <https://www.nicphan.com/post/affordances-in-game-level-design> (Accessed: 19 July 2023).

Sergej_Actallogic (2021) *Level design: Player navigation with the aid of affordances and obstructions news - wayfarers: Call of osiris*, *Indie DB*. Available at: <https://www.indiedb.com/games/wayfarers-call-of-osiris/news/level-design-player-navigation-with-an-aid-of-affordances-and-obstructions> (Accessed: 23 July 2023).

Synty *TM store - 3D assets for games (unity + unreal)* (no date) Synty Store. Available at: https://syntystore.com/en-gb?gclid=Cj0KCQiA-JacBhC0ARIsAIxybyOyEeOV8fTO-pQOoFABx1LhnBRR3NFYunsAPylspo8N8qNSpaxMfd0aA19LEALw_wcB (Accessed: 20 June 2023).

timdoesleveldesign (2021) *Breadcrumbing in level design: Guiding your player from A to B*, *YouTube*. Available at: <https://www.youtube.com/watch?v=IyKgZ56IGzw> (Accessed: 01 August 2023).

Appendix – Beauty Shots





