

Utilizing level design artifacts to maximize fun

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Abstract

In video games, a change in difficulty is usually the biggest contributor to the enjoyment a player would face (alongside graphics, sound, etc.). However, the difficulty does not exclusively come from game elements such as the intelligence of enemy AI or the rarity of items. This paper is meant to examine how changes in the aspects of the level design itself would be a major change in enjoyment. We examine previous works and find that there is not much research on the effect of changing the level design can affect player enjoyment. We create a theory on player enjoyment and along with measures of enjoyment and how game level design elements could be changed, added, or removed, and by adding these changes to artifacts we could improve general enjoyment in a Minecraft custom level. We found that level design on its own was enough to increase player enjoyment and that the primary factor we identified for increased player enjoyment was immediately recognizable details concerning the goal of the level or stage.

Keywords: Game Level Design, Minecraft, Human-Computer Interaction

Introduction

As videogames had been researched for over 40 years, there is an extensive amount of previous work done in understanding what causes players to enjoy video games. One of the

most important elements in understanding player enjoyment is how difficulty should be paced. In general, the difficulty needs to fluctuate between being easier and harder while still not being too easy to get boring, or too hard to become tedious; this is called flow (Csikszentmihalyi, 1971, Csikszentmihalyi, 1990). Measuring player enjoyment is also critically important in its own right, as control variables such as tiredness, setting, time of day, and even which sort of test performed (Persona modeling, RITE testing, Qualitative questionnaires, etc.) could produce especially different results (Ganglbauer, 2009). A player's engagement to a game also directly correlates to their enjoyment, as some engagements outside of the game, such as competition for high scores, online discussions, and most importantly social connections, are powerful motivators to continue playing (Drachen, 2017). In levels designed to be explored (such as the sections designed for this experiment), it is important to consider that players might get bored when dragged into the same/similar looking areas (De Castro, 2016).

Theory

In most games that adjust difficulty dynamically, only minor, quantifiable, elements are changed. The most common changes are usually an increase in enemy intelligence or a change in the rarity of items. In our tests, however,

a change in objects and spacing are also used to either increase or decrease difficulty. With the prevalence of highly-changeable games such as Roblox (2008) and Minecraft (2009), it has become easier than ever to make direct edits to the level layouts and interactions themselves rather than simply changing stats. However, while there is a lot of research done online on the correlation between difficulty and enjoyment (Csikszentmihalyi, 1971, Csikszentmihalyi, 1990, Drachen, 2010, Wang, 2008), there is a largely lacking field in how changes in level design could make an impact on player enjoyment. Thus, we will largely be examining the level design and how the use of some of its artifacts would change the enjoyment players would accumulate when playing. In video games, an artifact is a design rule that is used to mold an element in the game. In level design, an artifact could be anything from how the level is presented visually (e.g. color composition, in-game time-of-day) to what sorts of mechanics would appear within it (e.g. presence of counter-operative elements such as Player versus Player (PvP), presence of co-operative elements such as keys and levers). Based on the results produced from this experiment (alongside results produced in other works), this paper will decide if changing these artifacts improve player enjoyment and out of these 4, which type of artifacts are the most significant in increasing the enjoyment of a level.

For our purposes, player performance would be measured by a counter inside of the server (e.g. death counter, timer, etc.) while the player impressions would be recorded by me. As analyzing player emotions is far more qualitative than quantitative, multiple methods of measuring satisfaction have been made (Abeelee, 2020, Rigby, 2007, Canossa, 2018, Sherry, 2006). Several external questionnaires have also been made such as the GIQ (Cheng, 2014), IEQ (Jennett, 2008), GEQ (Brockmyer, 2009). That we can use as a base for judging reactions qualitatively after the session has ended.

Design Rules for Changing Game Artifacts for Player Enjoyment

The design rules I have chosen came from a variety of aspects, from what publications & content creators (Bishop, 2015, Hanson, 2011, Desurvire & Chen, 2004) considered to be good level design to what experts in the field of game design have considered differentiating between good and bad level design.

We will propose four unique artifacts for our game design changes:

I. Introducing the player with agency

One method of hooking players into playing your game would be to give them a high level of agency from the start. This is important as a high level of agency would make the player feel more confident and have a higher opinion of the game.

II. Having the player do more than one "verb"

"Verbs" are the actions a player is allowed to perform in a game. Having players do only one verb can be immensely boring. If there's a long stretch of road where all that the player has to do is hold right, then the player would likely lose interest. Giving a player more verbs to do at once would, in theory, keep them more interested as they have to do more at once to succeed.

III. Having a skill ceiling to reward expert players

When the players claw through a game's challenge, they are expected to either get an intrinsic reward or an extrinsic reward. For extrinsic, this could be a new ability, better weapons, or just the rest of the game. Intrinsically, you could increase the skill ceiling to expand the margin of difference between a beginner and a master at the game. In that case, the player will know that he is performing much better than when he had just started the game, which gives them intrinsic satisfaction.

IV. Making sure to create immediately recognizable details

If every single room or corridor the player goes through has details that are nearly identical to each other, then there is a high chance the player might get confused and start to have difficulties trying to navigate around it.

V. Utilization of theory

The level tested for these concepts would be a non-linear adventure through a Halloween-themed level. Players are expected to traverse through a hedge maze to find keys, eat through spheres of cake to find an exit, use hidden levers to activate doors to collect ladders, and finally find a hidden exit from a demented version of the mansion. These objectives would be varied enough in their linearity to show us the effectiveness of these ideas in a variety of objectives.

Introduction to Initial Level

The level players would have to complete would be a co-op adventure map set in a Halloween-like setting. The level would comprise 3 different sections, with a new section starting for each player as they reach the exit of a given section. Figure 1 shows a flowchart giving a general overview of how the initial level would be structured.

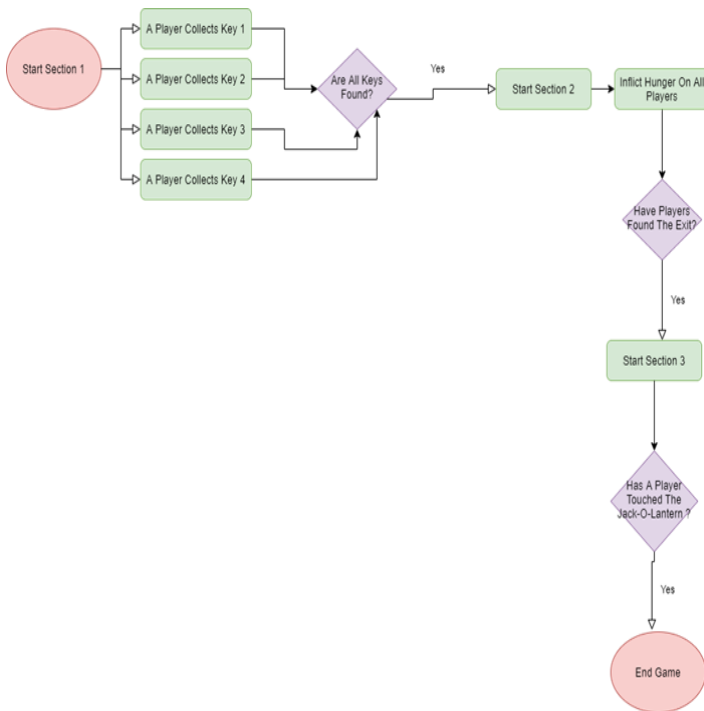


FIGURE 1. A flowchart depicting the layout of the initial level.

The Hedge Maze

In the first section, all players would spawn into the hedge maze. Here, players would run around the maze to find 4 keys (as shown by the beacons in Figure 2) to break a barrier that's preventing them from getting into the mansion. The challenge presented in this section would be one of persistence, as many of the most obvious routes lead to dead ends as depicted in Figure 3.

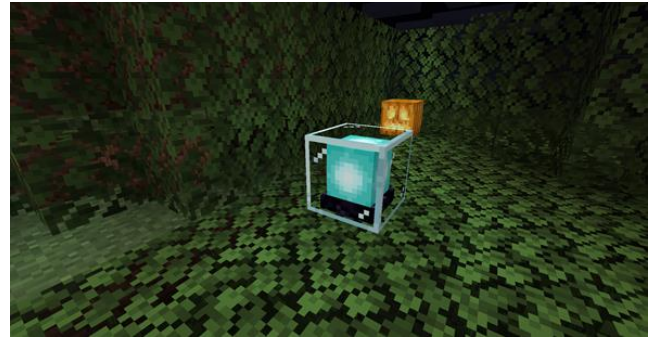


FIGURE 2. A Screenshot of a key in the Hedge Maze Section.

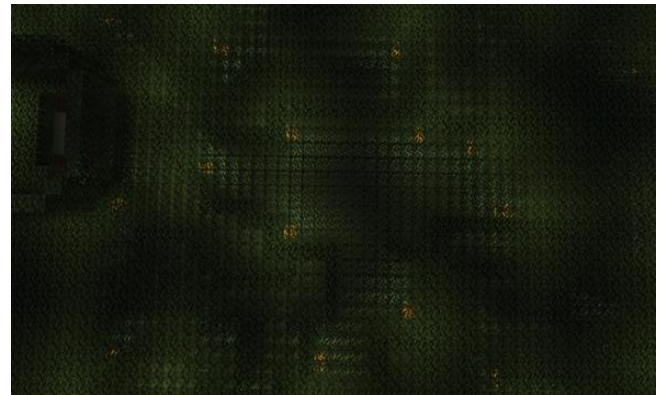


FIGURE 3. A top-down Screenshot depicting a part of the maze layout in the hedge maze section.

The Cake Pit

Once they enter the mansion, players fall into a pit, where they are teleported to the cake pit shown in Figure 4. Here, the players are expected to eat through all of the cake to find an exit. The players' hunger rapidly drops, thus they need to constantly eat cake to stay alive.



FIGURE 4. A screenshot of the initial 3x4 cake grid in the Cake Pit section.

The Pumpkin Hunt

Once players complete the cake pit, they are dropped into the mansion. The goal in this section is to collect a special Jack-o-Lantern, shown in Figure 5, which is placed behind an unbreakable glass wall. To reach the lantern, players are expected to adventure around the mansion to find a hidden path through.



FIGURE 5. (From left to right) A screenshot of the room holding the Jack-O-Lantern, an opening through the third floor window, and the hidden passage accessed through the ceiling.

Methodology

The test subjects were eight children aged 10 – 13 years, who joined a Tokyo Coding Club (TCC) hosted online sessions twice a week and played the same level in each session for a total of four sessions. Permission for research was granted through parental agreements with TCC. Here, I joined the session as a spectator and recorded their whole playthrough as a video file. This allowed video evidence of their real-time behaviors and progress and would show me evidence of their immediate impressions.

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Criteria

To decide how much of a change to enjoyment these design decisions employed, a specific set of criteria shown in Figure 6 was determined. The criteria used would be effective in showing whether design decisions taken during the initial level design were better or worse than the re-design. The criteria were:

- The time it takes to clear a set-piece;
- Number of people taking a different route;
- # Of Deaths;
- Player responses during play (with voiced commentary);

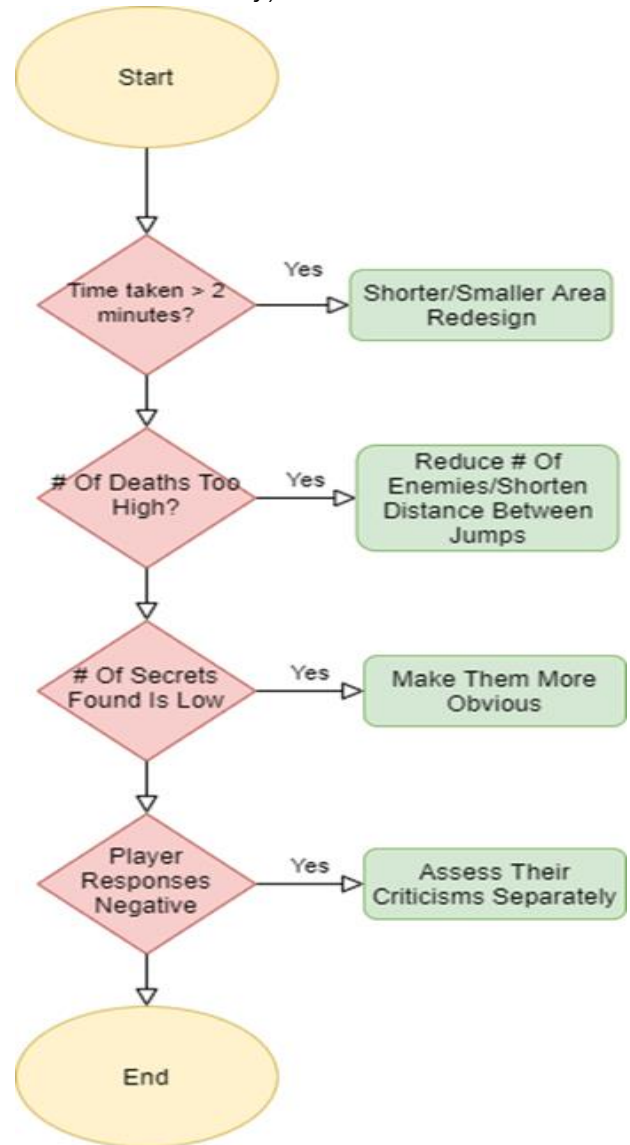


FIGURE 6: A flowchart showing the criteria used to evaluate player satisfaction and steps needed to address negative areas.

Player Impressions of Initial Playthrough

From the initial playthrough, there were several issues. Generally, the most prominent issue was the length of each section; they were either too long or too short, making it difficult for players to invest enough interest to fully enjoy a section.

Section 1: The Hedge Maze

The hedge maze was the most successful, as it met most of the criteria between all 3. By working together, players were able to finish the section in less than 2 minutes and 20 seconds. Players however found the section to be monotonous towards the end, mainly due to a lack of any obstacles throughout (e.g. enemies, pits). While all the players found the design of the maze to be interesting, many repeatedly commented on their annoyance with some players, as they would repeatedly harass and hit them. This harassment decreased the overall enjoyment of the maze.

Section 2: The Cake Pit

The cake pit was too short and easy. Only 15 seconds in, players were able to find the exit. Due to how shallow the pit was, other players were easily able to jump down and follow other players, defeating the entire purpose of the section. Players didn't comment during the playthrough of this section at all, as nearly all players had quickly entered section 3.

Section 3: The Pumpkin Hunt

The major issue with the pumpkin hunt was that it was too vague in design. Right after players had completed the Cake Pit, the lack of an immediate objective (as the Jack-O-Lantern was placed on the second floor when players entered the mansion through the first floor) and any sort of clear directions. Even though players saw their objective, the Jack-O-Lantern behind the glass wall, all of the players gave up trying to search for a path through. Less than 1 minute after the section had begun, a majority of players began to change their focus from finding the secret pathway to fighting each other (PvP was unintentionally activated). It wasn't until one player had begun to search around that the game was completed 5 minutes later.

Summary of Player Observations

There was a multitude of issues that were discovered in this first playthrough; all of the 3 sections had their difficulties.

For the hedge maze, while players were able to complete within the allotted time and understood at a glance what their objective was, players' overall enjoyment was significantly damaged due to harassment caused by PvP being enabled. For the cake maze, it was especially difficult to decide what players' impressions were as most players had quickly finished with this section and moved on to section 3 before any meaningful commentary could be given. Finally, a general lack of direction and amount of open space given to players led to them feeling visibly confused, and most resorted to killing each other as a source of enjoyment.

TABLE 1. Average player performance and impressions for each section for the initial playthrough.

Criteria/Section	Hedge Maze	Cake Pit	Pumpkin Hunt
Time Taken	Within Allotted Time	Too Short	Too Long
# of People Taking an Alternate Route	0	0	0
# of Deaths	3	0	7
Player Responses During Session	Mostly Negative	Unknown	Very Negative

Introduction to Revised Level

Because the results in enjoyment expected in the initial level were far worse than my expectations, a couple of major changes in artifacts and section length was needed. Generally, each section was extended with either more space, had additional obstacles, was completely new, or had additional mechanics players had to interact with. Different changes

were done for different sections to see which artifacts increased the most amount of enjoyment.

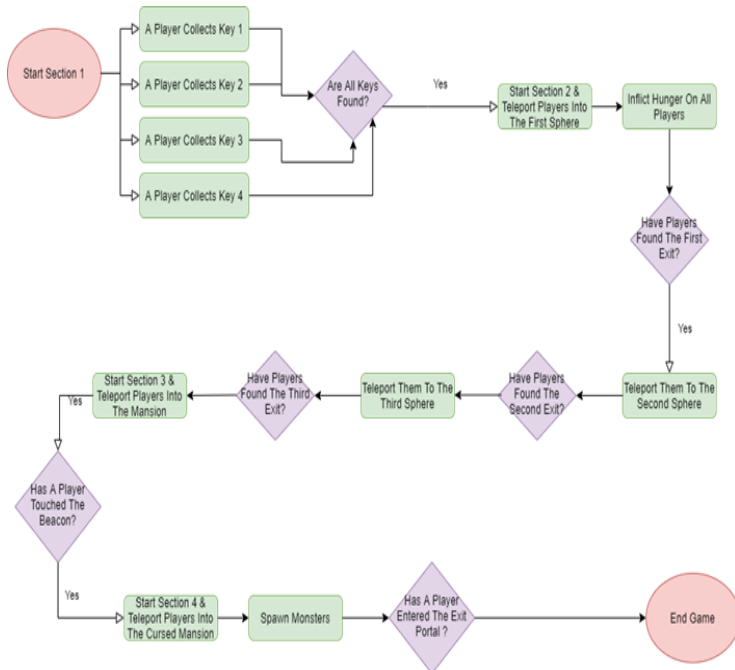


FIGURE 7. A flowchart depicting the general construction of the layout in the revised level.

The Hedge Maze

The hedge maze had the least amount of changes, as the complaint was of the lack of challenge in moving round rather than the placement of the keys. Thus, while the key placements and the maze design were left the same, additional challenge was added through a multitude of pits for players to carefully jump over as shown in Figure 8.

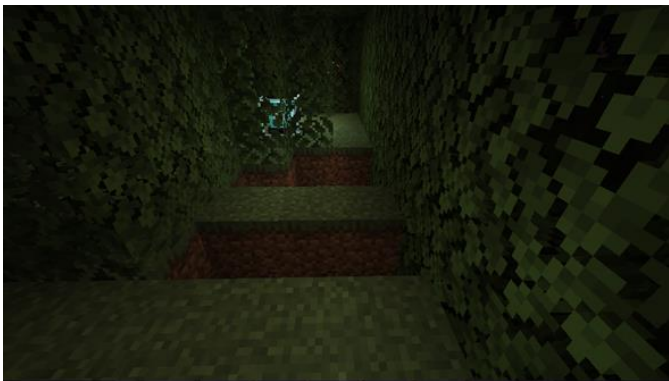


FIGURE 8. A screenshot of two consecutive pits in the revised Hedge Maze section.

The Cake Pit

The cake pit had a complete overhaul. While initially, the cake pit was a 3x3 square pit that wasn't all too deep, the new cake pit takes place between 3 giant floating spheres shown in Figure 9 and Figure 10. Players would fall into the original pit the cake pit was placed in and get teleported to the first of these spheres. Because of the much larger area afforded here, layers would spend more time looking around for the exit for each of the three spheres before finding the final exit and transitioning into the mansion.



FIGURE 9. A screenshot of the greatly expanded Cake Pit section.

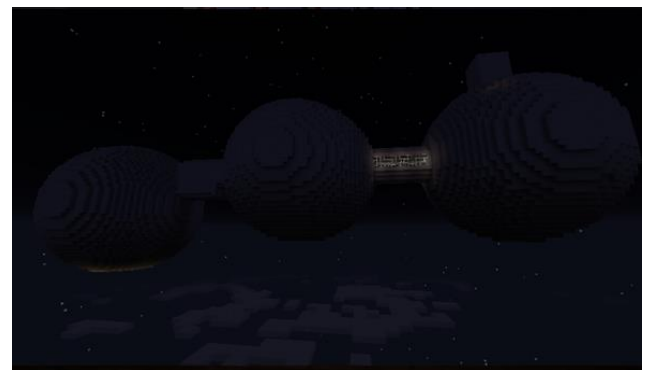


FIGURE 10. A screenshot of the exterior of the greatly expanded Cake Pit section.

The Lever Puzzle

After finding the exit to the cake hunt, players are dropped into the mansion. Here, the focus is changed towards using levers to unlock rooms as shown in Figure 11. In those locked rooms, there are chests that either contains

additional levers, ladders, or simply nothing. By collecting ladders, players would be able to climb up a stack of golden blocks to reach the beacon at the top shown in Figure 12.



FIGURE 11. A screenshot depicting an open door with a lever in the “OFF” position next to it.

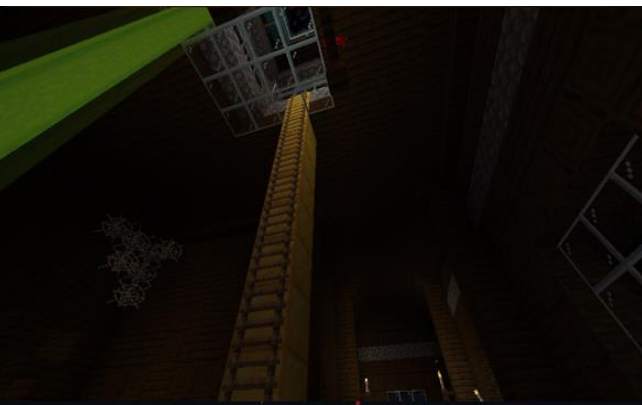


FIGURE 12. A screenshot of the ladders placed on top of the stack of golden blocks.

The Final Escape

Another section had been added in the revised level. In a darker version of the mansion, shown in Figure 13 and Figure 14, players are thrown into a gauntlet of enemies. The goal is for players to navigate through the gauntlet to find a secret exit, shown in Figure 15, and finally escape the mansion. Enemies spawn at a rapid rate, and the lack of any health items should make this a difficult final section.



FIGURE 13. An outside screenshot of the “cursed” mansion.

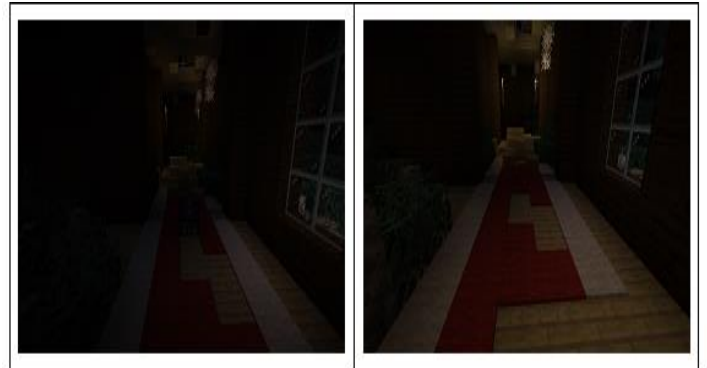


FIGURE 14. A comparison shot between the lighting in the normal mansion (right) and the cursed mansion (left).

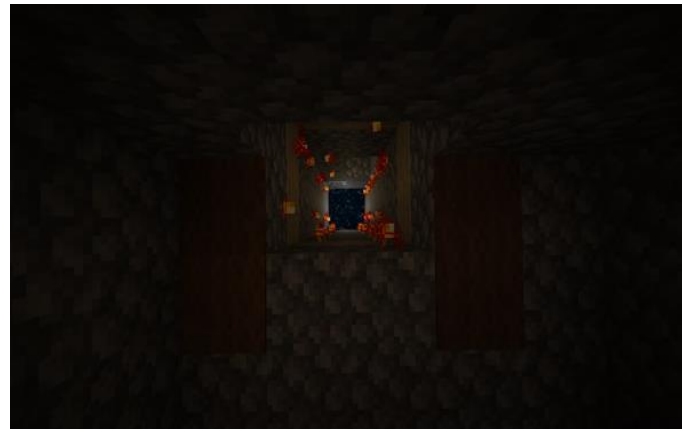


FIGURE 15. A top-down view of the secret exit.

Mechanical Changes

While these additions don't directly correlate to the level design changes to the revised level, they were added to supplement the players' experience.

The Information Tab

The information tab is a space on the mid-left of players' screens. It was added as a response to players' getting so easily/quickly confused during the pumpkin hunt. Now, specific details, objectives, and tips could be shown to players whenever they enter a new section.

Removal Of PvP (Player Versus Player)

PvP wasn't meant to be used so extensively during the playthrough. Immediately after the game began in the hedge maze, some players had begun to hit each other, which created frustration with others who were simply trying to do the task at hand. Because of the constant problems PvP created in this adventure map, it was decided that PvP should be removed.

Player Impressions of the Second Playthrough

Player impressions in the second playthrough were marginally better than the first playthrough. The biggest improvement was seen from the removal of the biggest mechanical obstacles encountered in the first session such as PvP and lack of clear direction.

Section 1: The Maze

The maze had the least amount of changes between all three, but players still appreciated the clever and complex designs of the maze. However, the removal of PvP meant that players weren't being attacked by each other, and thus the annoyance that had significantly detracted from the enjoyment of the level was removed. While the addition of pits had a slight increase in player impressions, as players were required to pay more attention, the removal of PvP had a far greater impact than the changes in the level design itself.

Section 2: The Cake Pit

The cake pit, however, was still received rather poorly. Multiple players expressed irritation towards the tedium of the challenge. Many of the players commented about how unforgiving the hunger bar was (as the players' health would deplete rapidly when not eating) and how annoying it got to eat through so much cake (as a single block of cake required 4 clicks to be fully

eaten). Moreover, players felt immensely confused about where to go, with 2 of the players still being stuck in the first chamber by the time all of the others were able to find a path out and had entered section 3. Even with some strategically placed lanterns around to guide players, the overcompensated space caused players to feel too confused, and quite a number of them gave up within 2 minutes until one of the players was finally able to find a path out.

Section 3: The Lever Puzzle

In contrast to player impressions in the revised cake pit, player experiences during the lever puzzle were much improved. By telling the players what to do through the information bar and spawning them next to a box of levers, players were able to immediately understand their objective, and were given the necessary tools at the start to begin exploring tools. With these changes, players were able to finish the level within the allotted time, and all of the players expressed a high level of satisfaction towards the completed task.

Section 4: The Final Escape

The final section was the only entirely new section, so I didn't have a previous point of reference to see whether player impressions were either positive or negative compared to the original. Overall, most players weren't exceptionally pleased with the section. The problem most players cited was the stark increase in difficulty between the past 3 sections and the final section. The game's internal difficulty was set to "Hard" and a multitude of enemy spawners was placed to prevent players from simply swerving around enemies. It was intended that the players would have to find new strategies to either get by or confront the enemies in the corridors. However, the difficulties became too much for many players, and by the end, only 4 of the 8 players were able to complete this section.

Summary of Player Observations

Overall, players had completed with a marginally increase in satisfaction in comparison to their initial playthrough as seen in Table 2. While the addition of some of the artifacts (do more than one verb, create immediately

recognizable details), had big improvements onto the amount of enjoyment gained, players had still had a multitude of difficulties in understanding objectives and would still give up only a couple of minutes into a section if they see no immediately visible progress is being made.

TABLE 2. Average player performance and impressions for each section for the revised playthrough.

Criteria/Section	Hedge Maze	Cake Pit	Lever Puzzle	Final Escape
Time Taken	Within Allotted Time	Too Long	Within Allotted Time	Too Long
# of People Taking an Alternate Route	6	0	4	0
# of Deaths	2	8	0	7
Player Responses During Session	Very Positive	Very Negative	Very Positive	Mostly Negative

Conclusion

In conclusion, a difference in level design can produce an exceedingly large change in the enjoyment of players. However, there is a large difference in artifacts that were changed due to player responses and ones that weren't. Section 1 and 3 had numerous player criticisms, which when rectified in the redesign, greatly improved player impressions. Meanwhile, sections that had artifacts added without sufficient/none player impressions (Sections 2 & 4) were still received poorly. Thus, player feedback is crucial for improving enjoyability in level design.

Every level design artifact exercised in this test didn't yield the same number of results. The artifact with the least amount of effect was having a skill ceiling. In both playthroughs of the level, players felt more than comfortable simply following each other through different sections. While some players did begin to split up in their paths whenever they were presented with a non-linear goal (collect ladders, find keys), most of the time players were more than happy simply copying each other's paths. Thus, those hidden routes and items that were placed around the level were never found during both playthroughs. Granted, there were only two playthroughs, so

there still is the possibility that players may begin to experiment in later sessions. The second least effective was introducing the players with agency. Different from the other artifacts, agency was removed in the revised level to increase the dedication needed to complete a section. Even after the difficulty of each stage was either increased or decreased to be more homogenous, players didn't have a visible increase in enjoyment due to a purposefully easy first section. The artifact with the second biggest impact on enjoyability was forcing players to do more than one verb. While in small amounts, players had begun to have more enjoyment as they were forced to do more than one action at a time (e.g. platforming). The artifact that did have the most changes was having immediately recognizable details. In each section, players would get easily distracted if they didn't know what their objective was. If they couldn't recognize what to do through either stage details or directly being told (i.e. information bar, voice chat) within 1 to 1.15 minutes, the players would begin to aimlessly walk around. Yet after players were able to immediately grasp what their goal was, their enjoyment had a very substantial increase.

There are two main takeaways from this project: Changeable Level Design in Video Games can be highly influential to the player's enjoyment, and that immediately recognizable details are the most important artifacts used in constructing levels. However, there were many faults in the data that would lead us to this conclusion. All of the data gathered was done qualitatively rather than quantitatively. The lack of any quantifiable data (e.g. # of player deaths & death coordinates, positions players commonly walked over, the time it took for each player to complete a section, etc.), would greatly reduce the accuracy of the results produced in this experiment. Moreover, the small pool of data recorded (only 2 sessions) meant that the data collected may be false and cannot be averaged. Finally, more player-specific details (e.g. heart rate, RITE testing) couldn't be examined due to the conditions of the experiment being "online-only".

This topic could be investigated further, as this paper only covers the impacts of different artifacts. Testing for more personal responses (e.g. individual player performance, Qualitative surveys) could be done to find new evidence of the impacts on enjoyment level design could create. Testing changes in level design in other genres would be important as well, as this paper only covers changes in the enjoyment of an adventure map. Players who play games with less of a direct focus on level design (e.g. Strategy games, racing games) may show a far less or far greater reaction to changes. In the future, we plan to do a similar experiment by analyzing quantitative data and automating the level changes to allow for more iterative feedback to the players.

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