Reckoning

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Abstract

This report details the development and creation of the game *Reckoning*. *Reckoning* is a 2.5D, side-scroller shooter made for people who enjoy games set in the Wild West, and people who like challenging games. This report describes the game's background research, design, development, playtesting, public appearances, and possible future iterations.

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1. Introduction

Reckoning is a 2.5D, side-scroller shooter set in the Wild West. The player is thrust into the thrilling finale of a tale of revenge, to hunt down a bandit leader who long ago kidnapped the player's son. Through cover-based combat and intense duels, the player experiences the gritty intensity of our wild frontier. *Reckoning* is a student created project with the goal of bringing the classic spaghetti western drama and aesthetic into an interactive medium. Despite being such a well-known time-period, the Wild West has often been a rarely-explored and forgotten genre for video games. Unlike world wars, high fantasy, sci-fi space, or zombie survival games, "the Western has remained one of gaming's most obscure genres." [1]

Reckoning took nine months to develop. The game was built from the ground up, beginning with proofs of concept, storyboarding, and thematic iterations. Substantial assets were created for the visual, technical, and audio components of the game. Over 4 characters were modeled, dozens of custom assets were built, and *Reckoning's* core gameplay was scripted from scratch. Voice lines and custom sound effects were also developed. *Reckoning* ultimately strives to create an engaging experience through immersive and tense gameplay. The team was able to achieve this through detailed, realistic environments and carefully-paced gameplay. Bullets do extremely high damage and reloading takes a long time, ensuring the player is deliberate with their decisions and feels a gritty reimagination of the Wild West.

This paper describes the process of creating *Reckoning*, from conceptualization through playtesting and polishing. Chapter 2 discusses the inspiration and design process we used for art, tech, and audio. Chapter 3 then discusses how all three of those components were created and implemented into the game engine. Chapter 4 discusses the various strategies we used to playtest and what feedback we got from each of those sessions. Finally, chapter 5 reflects on the development process, both the successes *Reckoning* achieved and the problems that occurred during the production.

2. Design

This section discusses all the inspiration, planning, and concepting that the team went through before the development process. It touches upon our game design document including the goals of Reckoning, target audience, and other unique features. This section also includes games, movies, concept art, and other visuals mediums the team used as inspiration for the art and gameplay of Reckoning.

2.1. Experience Goal

Reckoning's experience goal is to allow the player to experience the finale of a thrilling Wild West revenge story. This goal was achieved by creating an immersive experience that captivates players. A realistic and high resolution environment sets a believable scene of the Wild West, while a carefully written story and selected voice actors portray believable and emotional characters. Finally, the limited UI and low mobility made the gameplay slow and dangerous, creating an atmosphere where each shot and duel matters, increasing the tension and impact of the experience.

2.2. Target Audience

This game is intended for most game audiences, and is simple to learn and accessible. However, due to its use of violence and serious subjects, it is not meant for younger players. The game will be especially enjoyed by fans of the western genre, as it incorporates many of the themes and visuals of classic western media.

2.3. Story Design

2.3.1. Story Goals

The primary goal of the story is to explore a particular emotion or concept. For this game, the primary concepts were how far someone will go for vengeance and how a female protagonist would affect the plot of a 1960's western film.

2.3.2. Story Research and Themes

The story draws inspiration from several examples of Wild West media. The most significant influence is that of Sergio Leone films, particularly The Good, the Bad and the Ugly (Leone 1967). Additional sources include the films Tombstone (Cosmatos 1993), Silverado (Kasdan 1985) Butch Cassidy and the Sundance Kid (Hill 1969), and the Ballad of Buster Scruggs (Coen 2018). From these media, several common themes emerged: "Might makes right," revenge & personal redemption, overcoming adversity through wit & grit, the majesty of nature & how small man is in comparison, manifest destiny, and white/ masculine superiority. After having identified these common themes, we wanted to create a narrative that recreated all of them except for one, which would be subverted to create a more interesting narrative. For *Reckoning* we chose to subvert the theme of masculine superiority because it wouldn't affect commonly recognized themes such as pursuit of revenge and the majesty of nature, and it seemed like an attainable method of making the game more progressive. Because of this, the overall basis of the story was to recreate these Wild West themes while subverting the theme of masculine superiority.

2.3.3. Story Overview

The overall narrative of *Reckoning* is a fairly straightforward western tale of revenge. The protagonist, who is only ever referred to as "the Revenant," was aboard a train with her husband and son when their train was robbed by a gang whose boss they called "Griffin". During the robbery, her husband was killed and her son was taken by the train robbers. Vowing to retrieve her son and avenge her husband, the Revenant sets off on a two year journey to learn who robbed that train and how to kill them. After a year of learning day by day how to survive alone on the road she heard about Henry "Griffin" Moore and the bandit gang he led. For the next 10 months she pursued Griffin's gang, killing off its members anytime she caught up to them. Finally she encountered the man himself in the small town of Charity Springs, where she killed the majority of Griffin's gang and eventually shot the man himself. The game only shows the events in Charity Springs, with previous events referenced in dialogue.

2.3.4.   NPC Interactions

One of the earliest aspects of the game that we discussed was how the player would be able to experience a Wild West narrative while still keeping the game true to the time period. This resulted in a proposed "identity" system where the player could choose how to portray themselves while interacting with NPCs. This portrayal mainly focused on whether the player was blatant about being a female gunslinger or chose to obscure their gender, potentially even being able to go as far as to disguise themselves as a young man. Both courses of action have appeared in Wild West films, such as the flirtatious banditry of Kate in Tombstone (Cosmatos 1993) or a disguised Etta Place joining Butch and Sundance in the robbery of a Bolivian bank (Hill 1969). Several different methods of giving weight to the player's portrayal decision were discussed. One idea was to have purchasable items in town with different shopkeeps setting prices depending on their view of the PC, but it was decided that the difficulty of creating a balanced economic system in a short period of time was too high. Another method was to have the player track down Griffin through the game using information from the townsfolk. A given townsfolk would be more or less likely to cooperate depending on the player's dialogue and portrayal choices. While this option seemed more feasible, as the project progressed the amount of NPC interactions was repeatedly reduced to maintain scope. In the final game, the sole remaining NPC interaction is with Griffin during *Reckoning's* finale.

2.4.   Art Design
2.4.1.   Environmental Design

This section will discuss the inspiration and design for a wild-western environment. It will talk about setting research, concept art, and plans for efficient, modular workflows

2.4.1.1.   Setting Research

Making Reckoning an immersive experience required an accurate representation of a Wild West settlement. The first step was to decide upon a location the game would take place in. We wanted to avoid a purely desert aesthetic like New Mexico or Nevada, and instead were inspired by the rocky arid regions of Utah and Colorado. Especially the large hoodoo and rock formations of Utah in areas such as monument valley pictured in Figure 1.

Figure 1. Colorado Plateau

This arid rocky biome is part of the Colorado Plateau, a large region consisting of areas of Utah, Colorado, Arizona, and New Mexico.

Much of Wild West towns that appeared in this region were 17th century mining towns. Back in the 1860s, silver was discovered in the Colorado Plateau Region. After the Gold Rush of the 50s, many people also populated areas of Colorado and Utah to set up silver mining towns, hoping to find the success many prospectors did 10 years earlier. However, many towns dried up quickly, leaving the settlements abandoned or run down by the end of the century. [2] Towns such as Silver Reef and Grafton are examples of old Utah mining towns that have since been abandoned. Grafton is now "one of the most photographed ghost town[s] in the west" and has been used as the filming location of many western hollywood movies including Butch Cassidy and the sundance Kid. [3] Examples of these towns can be seen in Figures 2 and 3.

Figure 2. Grafton Utah Ghost Town [4]

Figure 3. Wild West Ghost Town [5]

Reckoning takes place in a fictional town named "Charity Springs" located in southeastern Utah during the late 1800s, A small old silver mining town that has begun falling into disrepair. Charity Springs allows the setting of our game to be historically and environmentally accurate, as the arid rocky deserts and alpine forests built in our final game are natural features of the Colorado Plateau that mining towns appeared in.

2.4.1.2. Inspiration and Concept Art

Inspiration for Reckoning came from many classic and contemporary Wild West media. We wanted a traditional Spaghetti Western feel and look such as The Good, the Bad, and the Ugly (Leone 1966) or Once Upon a Time in the West (Leone, 1968). These western films often had a muddy, gritty color palette saturated with browns, reds, and greys. These colors made the

west look dirty and worn down, fitting for a genre known as a lawless land full of wild people. We similarly wanted to primarily use this color scheme within reckoning to highlight the decay of the town and make the playing experience feel more intense and gritty rather than lighthearted and colorful. In Figure 4, a basic color scheme can be taken from The Good, the Bad, and the Ugly's iconic standoff scene.

Figure 4. The Good, the Bad, and the Ugly Color Scheme [6]

Some more modern takes on the western genre also influenced artistic development as well. The Red Dead Redemption video game series developed by Rockstar games has become the most popular Wild West gaming experience. Red Dead does a great job of creating lots of environmental variety, including both traditional Wild West town sets as well as denser forests and developed towns, seen in Figure 5. Variety in landscapes and a detailed, lived in world were important parts of making Reckoning immersive.

Figure 5. Red Dead Redemption 2 (2018)

There were also specific buildings, points of interests, or other features that were consistent between all western entertainment. The prevalence of saloons, sheriff offices, banks, and horse stables were shown again and again in films and games. Such buildings are even highlighted on the player's map as key locations in Red Dead. Since these are such iconic staples of towns in the west, special attention was made to the design and models of these buildings. The interior of a saloon was originally planned as a key location in Reckoning, and the Mariposa Saloon in Westworld is an example of inspiration when designing such a building, shown in Figure 6.

Figure 6. Mariposa Saloon, Westworld [7]

The watering hole of key characters in the west, the saloon is a location to breathe life into any western town. The Saloon interior scene ended up getting cut from Reckoning due to time constraints, but the saloon still features prominently in the game as a key landmark in the middle

of Charity Springs. Other western tropes such as sweeping vistas, bandit camps, horse stables, and a sheriff's office are all also depicted in some form within Reckoning.

Figure 7. Good Bad Ugly Town [8]

2.4.1.3. Modularity

Creating an entire town with enough variation to avoid repetition requires a lot of different models. If different buildings and houses look like exact copies of each other, it hurts immersion for the player and disrupts our experience goal. The job of environmental art in Reckoning is to distract the player as little as possible, and breathe life and believability into the existence of Charity Springs. In order to achieve diversity of buildings, a modular system was developed to save time.

In modular systems, objects in the game are built piece-by-piece and can be assembled in a large variety of ways, rather than making every model unique and separate. [9] Modularity is often used in the games industry to make large, repeatable environments such as sci-fi hallways or mineshafts. An example of a modular asset set can be seen in Figures 8 and 9.

Figure 8. Modular assets example

Figure 9. Modular level example

Modular pieces are usually built on a grid-system, with pieces all being of similar ratios such as 1x1, 2x1, 2x2, 4x4, and 8x8. These pieces are then put together like legos, combining in numerous ways to remove exact repetition.

Not all buildings in Reckoning were built modularly. Seven unique buildings were modeled on their own with extra details: The Saloon, Bank, Train Station, Post Office, Sheriff's Office, and Stables. Each of these buildings is a key landmark and important part of western towns, and extra time was given to their creation accordingly.

For the rest of the buildings, modularity in Reckoning was broken down into 3 levels of components: Building pieces, textures, and decorations. Different wall pieces for fronts and sides of buildings were modeled with no extra details on them. Each of these wall pieces was then given multiple different texture maps to add increased variation. Windows, doors, awnings, and signs were finally added after that, allowing further customizability. These three stages can be seen in the Figure 10.
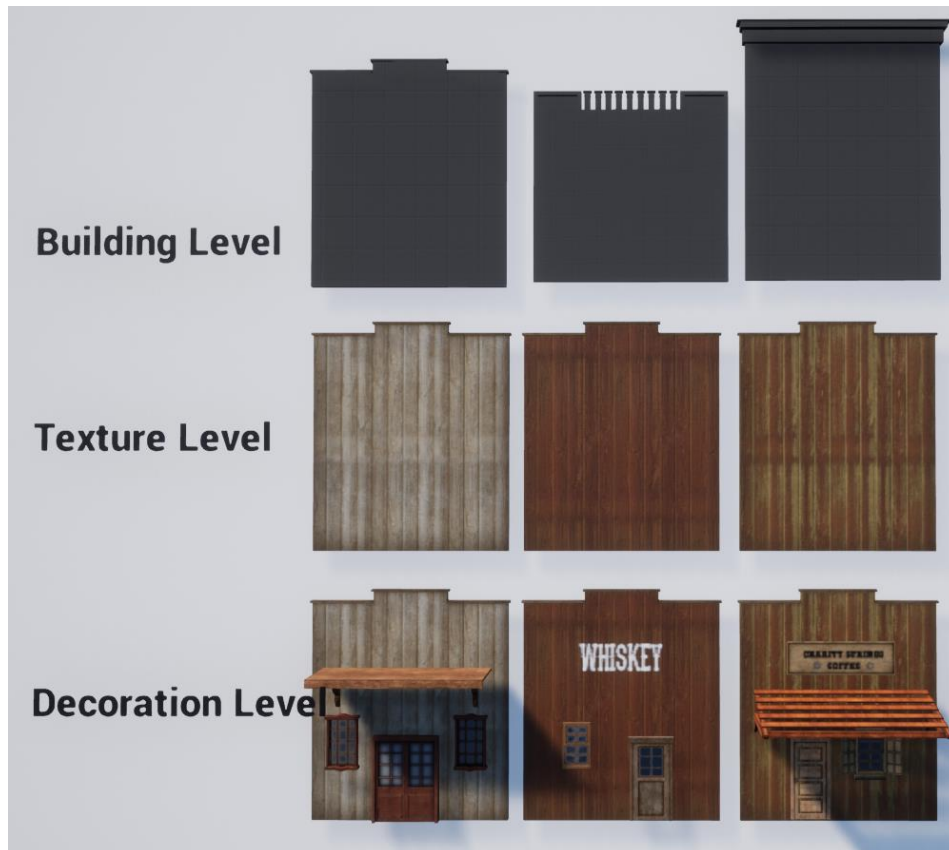
Figure 10. Reckoning Modularity Levels

2.4.2. Character Design

This section goes over the initial design for creating characters that fit into the Wild West. It will go over Inspiration and Concept , the design of the main character, and finally the design for the enemies.

2.4.2.1. Inspiration and Concept

Character designs were based on traditional western looks and attire often seen in movies such as The Good, the Bad and the Ugly (Leone, 1967) and games like Call of Juarez: Gunslinger (Techland, 2013) and Red Dead Redemption (Rockstar Games, 2010/2018). Clothing included Stetson style cowboy hats, button down shirts and denim pants [10]. Leather coats and accessories along with cloth bandanas and ties were also prevalent in both the west and in film. The overall style of the characters was to be fairly realistic in both proportions and textures. Final designs can be seen in Figure 11.

Figure 11. Character Line-Up, featuring (left to right) Revenant (player), Griffin, Enemy Variations

To achieve the final designs, reference images were gathered for clothing and style to help inform the characters' designs. From the reference images a few concept sketches of potential characters were created to help develop their design moving forward. An example of this can be seen in Figure 12.

Figure 12. Enemy Concept Art with Reference

2.4.2.2. Main Character

The design of the main character was to that of someone who has been venturing in the wilderness for a while out for revenge. Clothing needed to look comfortable for travel as she was tracking down the gang that kidnapped her son, throughout the frontier, as well as functional in a fight so she could enact her revenge effectively and with any hindrance. Her clothing would be worn and dirty as she approaches the end of her journey, at the start of *Reckoning*. Figure 13 shows an example of a character and clothing from Red Dead Redemption II (Rockstar Games, 2018), that fits the style of the game and helped further the design of the main character.

Figure 13. Red Dead Redemption II Sadie Adler [11]

Figure 14. Initial Character Concept

Figure 14 shows an initial concept design that was partially used to create the main character of the Revenant. An article of clothing not shown in the concept art that is often in western media is a cloak or duster which was eventually added to her design. This article of

clothing is commonly worn by men and fits into the initial idea of potentially hiding the fact she was female based on player choice. Once that story decision was scrapped it stayed because she had been traveling in the wilderness for over a year and the duster was designed to keep the user dry and protect their clothes from the dust and brush of the desert [12]. Along with practical reasons the duster is an iconic western visual in film and allowed for the ability to add clothing physics into the game. Figure 15 shows a picture of a duster as seen in *Once Upon a Time in the West.*

Figure 15. Example of Western Duster from Once Upon a Time in the West [13]

2.4.2.3. Enemies

All of the enemies are part of the same gang and as such were designed to resemble that of a gang that would look like they belonged in the Wild West. Like the main character, the art style was realistic, and featured the traditional Wild West style clothing previously mentioned along with vests, gloves and various leather accessories such as chaps some of which can be seen in Figure 16.

Figure 16. Example of Enemy Clothing

Many articles of clothing like the vest, shirts, and cloaks along with heads were originally designed to be modular so multiple enemies could be created with a few assets. However the modularity was not fully explored and instead enemies used different textures to add variation. Original enemy concept can be seen in Figure 17.

Figure 17. Enemy Concept Art

2.5. UI Design

2.5.1. Main Menu

The main menu was designed to be rather simple, with only a few buttons. One to start the game, followed by one to show the controls, another to view the credits, and lastly one to quit. The menu was not intended for players to spend a lot of time on so its main purpose is to get the player ready to play the game. The original design for the main menu can be seen in Figure 18.

Figure 18. Original Main Menu

2.5.2. HUD

Initially the design for the UI was to go with no HUD shown in Figure 19. This was to maintain a realistic and more serious tone for the game as well as increase difficulty. The player would have to keep track of their own bullets, while health was represented by a red tinge on the edge of the screen that became more intense the more damage they took. This was done to avoid health meters, thus maintaining the minimal UI approach. In the dueling sections of the game it was originally meant to show the weapon spread through a cone in front of the player. This would give a clear indication of what was happening during duels, but since it was only there for duels it would not add much to the UI. However, due to player response a small ammo counter along with a list of available actions was added in the bottom right. Additionally the dueling

cone was replaced with a small bar on the bottom of the screen that got smaller as time went on showing the gun's spread.

Figure 19. Original No HUD Design

2.6. Audio Design

2.6.1. Audio Goals

The game audio of Reckoning serves two main purposes. The first is to discreetly immerse the player in the game world. This is primarily done through ambience and music. The second goal is to provide cues to gameplay elements such as the player's ammo count. By focusing on audio rather than visual cues for these elements the game can appear more cinematic.

2.6.2. Audio Research

The majority of research regarding audio focused on the music in Wild West films, particularly that done by Ennio Morricone.

2.6.3. SFX

Most sound effects in Reckoning act as gameplay cues and are therefore tied to the actions of the player or npcs. These sounds include footsteps on various surfaces, gunshots,

reloading various numbers of bullets, clicks to indicate the player's remaining ammunition, horse whinnies and hoofbeats and voice lines for both the player and non-player characters to communicate each character's state and actions. SFX also included ambience for the player's current location.

2.6.4. Music

After initially reaching out to several musicians without much success the song Dirac, which acts as the background music for the whole game, was downloaded from filmstro.com. Initially this evocative but fairly simple song was meant to be used as a base for a more ambitious audioscape. Music plays an integral role both in setting the tone and communicating narrative beats in films, especially in the films used as a reference for *Reckoning*. Given this, a plan was formed for implementing a dynamic background music system. This system would augment the practice of using in-game trigger volumes to cue music shifts by having several individual tracks correlating to different parts of the song, such as melody, harmony and percussion. Situations such as a gunfight, the start of a duel, or walking through town would tweak the volume of these tracks to convey the desired emotion with more precision. Dividing different songs into tracks would also allow for a more gradual shift in background music. Unfortunately due to time constraints and the team's inexperience with music composition this system was never developed.

2.7. Gameplay Design

2.7.1. Paper Prototype

The first step in designing the game was a paper prototype of the game. This prototype was made to help design the level, flesh out the story, and see how the pacing of the game felt. This was achieved through a hand drawn map of the game where players would navigate using small cutouts. A full layout of the paper prototype can be seen in Figure 20 and a close up of the final encounter can be seen in Figure 21.

Figure 20. Paper Prototype Level
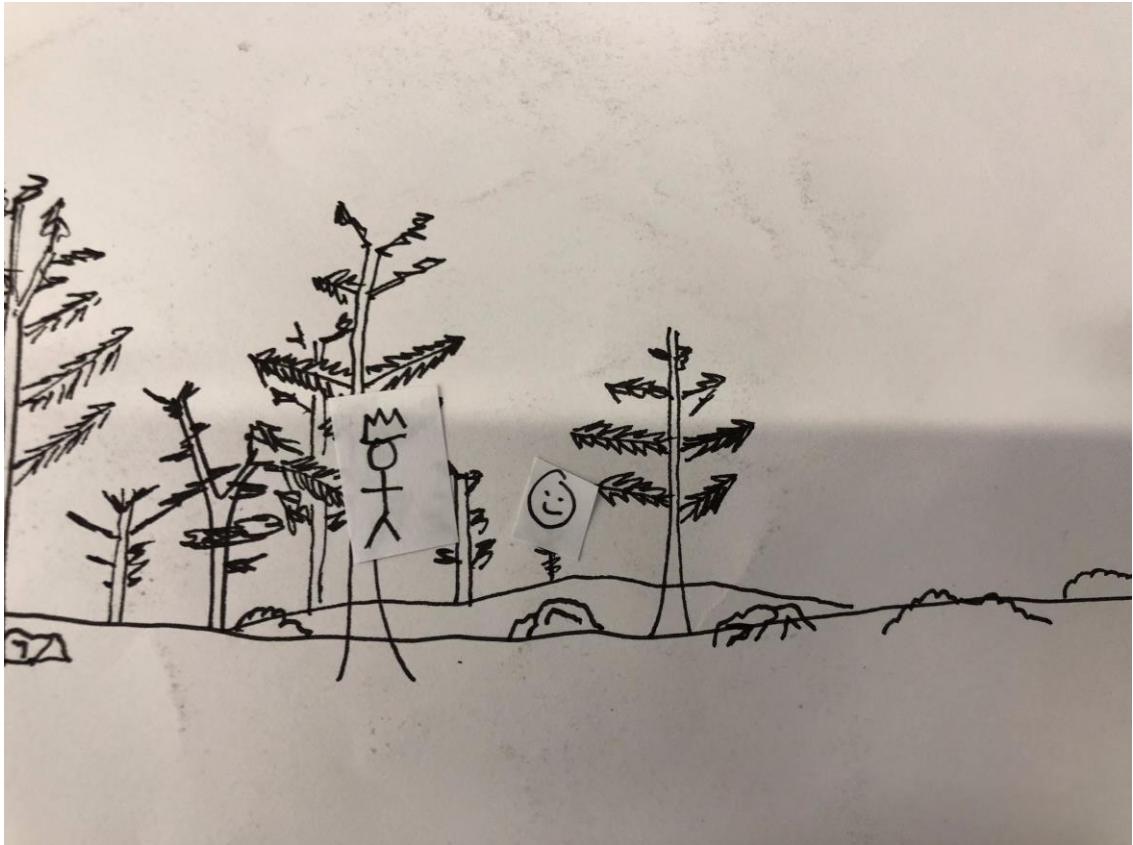
Figure 21. Final Paper Prototype Encounter

As a player progressed through the level a member of the team would read out various story beats so that the person playing would be able to understand how the story was unfolding. At two set points in the level the player would encounter a duel which would involve the player rolling a die and playing a rock paper scissors like game against another person who represented the game's AI. The duel would first have the two people choose a number from one to five to play during the rock paper scissors game instead of the usual hand gesture. The player with the higher number would go first, and the playertester would go in the result of a tie. The first player

would try to roll the die above the number that they had just played in order to win. If the player was unable to do so, the AI player would then roll the die, and if they also failed to to roll higher than their number the two players would alternate rolling until someone won. Figure 22 shows a playtester trying out the dueling mechanic in the paper prototype.

Figure 22. Paper Prototype Dueling

After the level was completed a quick run through of the levels greybox was played from a video clip. This was to help the playtester visualize the game in the engine and would allow them to provide additional feedback on how the game should look which can be seen in Figure 23.

Figure 23. Showing Greybox video

2.7.2. Movement

The movement system was designed to be simple and realistic. The player's movement would be restricted to moving left or right either by walking or running. Jumping is a common aspect in many games especially side scrollers but people do not often jump in most real life situations so the idea was not used to keep the tone of realism. In its place originally was a dodging mechanic which was replaced by the ability vault and take cover upon coming across objects in the players path

2.7.3. Shooting

Shooting was designed to be rather simple. A character would have six shots in their gun, as this is a Wild West game and everyone has "six-shooters". Shooting was meant to be difficult and punishing for the player. A slow firing speed and long reload time would mean that missing shots would be punishing for the player. However, the player would be rewarded for making good shots though as enemies would die in one to two bullets. The actual bullet was initially designed to be hitscan meaning it had not travel time but the idea was replaced, making the bullet a projectile instead so the player can see the bullet if they are quick enough. Early on a stretch

goal was to have multiple weapons the player could choose from however this was quickly abandoned due to the added complexity.

2.7.4. Dueling

Dueling was a mechanic that was designed to be in game from the start. *Call of Juarez Gunslinger* was used as the primary inspiration for how the mechanic was going to function. The camera would go to the side of the player, and there would be a circle decreasing in size representing the range. This was to make a more realistic dueling mechanic where there are benefits for shooting later, increasing tension. In early prototypes we altered the design so the player would view the duel from the side and instead of a red circle they would have a cone in front of the character that would decrease in angle as the duel progressed to show the spread of the weapon. Due to technical difficulties the cone was abandoned in favor of the red bar that would appear in the final iteration of the game. At the end of the project a prototype where the camera would go to the hip was made but it was left incomplete with only the camera angle change being implemented.

2.7.5. Health

Health is represented by a red tinge on the edges of the screen that becomes more intense as the player takes damage. Initially the player had little health, dying in only a few bullets. The player had little health in order to make the game more difficult. This was too punishing however and a health regen system was added to help counteract the punishing nature. Although the player still has very little health and can't take many hits in succession.

2.7.6. Controls

The controls were loosely set from early on. WASD keys for movement, and the mouse for aiming and shooting. The player would be able to move left and right, but to keep the game realistic the ability to jump was cut very early along with the W and S keys. Instead the player would be allowed to vault over obstacles, controlled via the space bar. Using the space bar for vaulting was picked early and stayed bound to that key for the rest of the project. The player can also take cover behind any obstacles in their path. For this we went with E initially and largely stayed there for most of the project except for a few internal tests where we bound it to F. Reload was bound to R and remained there for the whole project for the sake of consistency with other

shooters.

2.7.7. Artificial Intelligence

AI was intended to be simple as most of the team did not have much experience in programming AI. As such it was designed to act as a trimmed down player and return fire at the player when within its attack range. The AI would also make a death phrase or sound when it died. There are two types of AI in the game, a standard fighting AI and the dueling AI. The standard AI moves within range of the player and then begins shooting at them till they either kill the player or the player kills them. The dueling AI doesn't move and instead is activated when the player enters the duel. The duel AI will then wait while his spread decreases in the same manner the player's spread decreases then decide when to shoot based on his spread. The final boss of the game is a dueling AI with a different model.

3. Implementation

This chapter will discuss how each aspect of the game was implemented into the engine. It talks about the tools used as well as how the art was added for both characters and the environment. It goes over how the gameplay was added and finally how the team implemented and used audio.

3.1. Tools

3.1.1. Engine

For our engine we went with Unreal Engine 4. We decided to use it because it had ample documentation, and its blueprint system was much more user friendly for people who did not have much coding experience. Initially we decided to try and import an existing kit for our project and work off that, however it proved too difficult to modify to our needs, so it was dropped all together and we went on to fully implement our own systems for the game.

3.1.2. Source Control

For source control we decided to use Perforce. This was provided by Professor Moriarty, and unfortunately was only available towards the end of our project. The choice to use it was clear as it integrated well with the Unreal Engine. Additionally it handles Unreal Engine's unique file types well whereas other source control methods have issues with Unreal's binary file types.

3.2. Art Implementation

3.2.1. Characters

The following sections go over the character creation pipeline. It starts with the modeling and texturing process. It then goes on to rigging in Mixamo and ends with the process of creating animations.

3.2.1.1. Modeling

From the concept art that was made previously for each character, a base mesh was made in Zbrush using zspheres to outline the general shape of the character. One base mesh was made for each type of character, one for the player character and one for the enemies, so proportions and size would be fairly close across all characters so the rigs and animations would work for all the characters with minimal deformations. From the base mesh additional details such as facial features and clothes were added as subtools. Figure 24 shows the process of creating a character slowly adding detail over time.

Figure 24. Modeling Process for Giffin, (left to right) Base Mesh, Clothing Base, Final Facial Details

Some smaller miscellaneous items on characters such as belt buckles, buttons, and eyes were made inside of Maya instead of Zbrush and were later imported into Zbrush which can be seen in Figure 25. This was done to keep the polygon count as low as possible as basic shapes inside of Zbrush often have higher polygon counts than what is needed. Also during the retopology phase simple shapes often deform due to the automatic process used, so using simple low polygon Maya models allowed the model to maintain its shape.
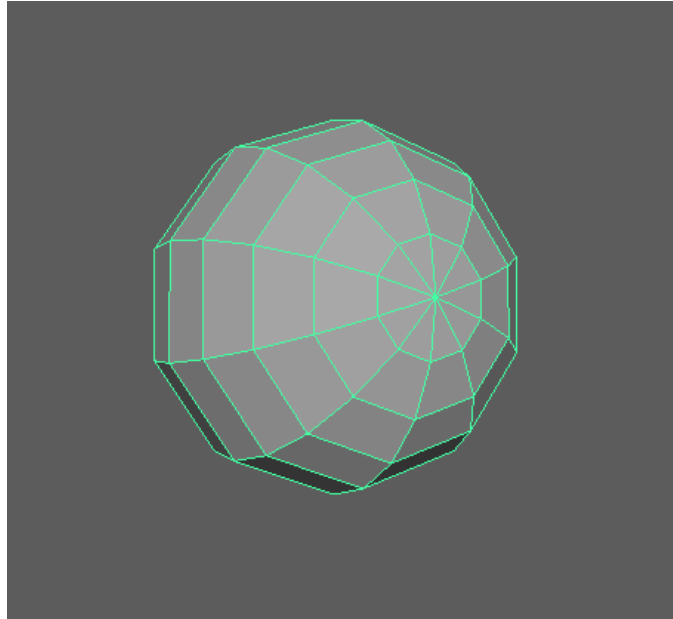
Figure 25 Low Poly Eye Made in Maya

After most of the detail was added to the character, it was retopologized using Zbrush's Decimation Master and Zremesher tools. This allowed for the high poly models of millions of polygons to be lowered down to only a few thousand polygons per subtool, which can be seen in Figure 26 displaying high poly and low poly wireframe models of the player characters clothes.
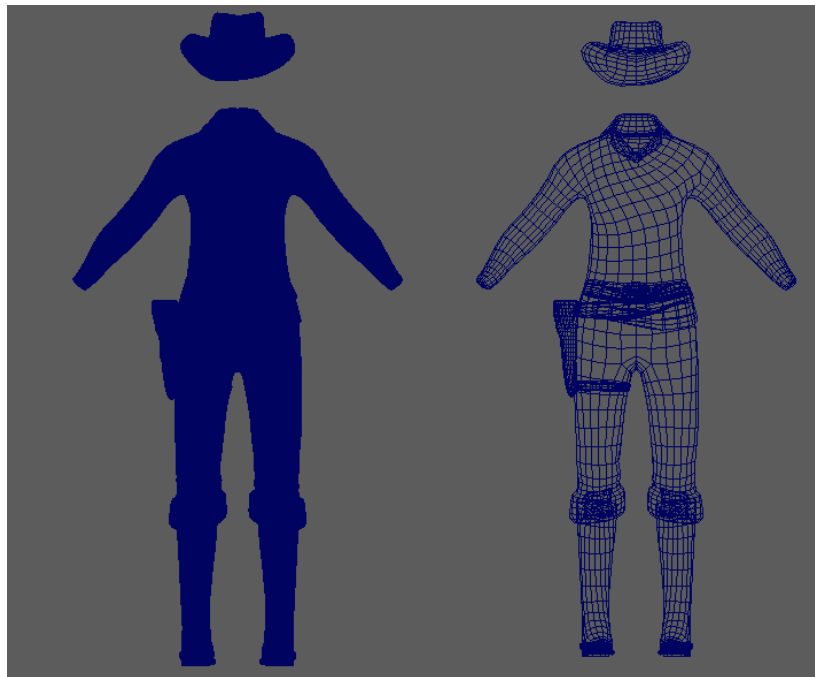
Figure 26. Wireframe High Poly Clothes(Left) vs. Wireframe Low Poly Clothes(Right)

After a subtool was Zremeshed, textures and detail from the high poly mesh were projected onto the new low poly mesh allowing for the creation of normal maps with optimized characters. In order to help with framerate and rendering in engine a mesh is made to be as low poly as possible using normal maps to give the illusion of depth when there is none. Figure 27 shows the difference and of depth and detail between a high and low poly model. In game the low poly model is used in combination with a normal map generated from the high poly model to give the appearance of a highly detailed character.

Figure 27. High Poly Player(Left) vs. Low Poly Player(Right)

3.2.1.2. Texturing

Texturing occurred in two different parts once in Zbrush and then again in Substance Painter. First the models were unwrapped inside Zbrush using its UV Master tool before they were exported which allowed the models to receive textures. Inside Zbrush the characters were given simple temporary textures to show off the general design and color palette of the character, and make sure they fit into the world. The simple textures were designed to display the main color of the object it was part of. For example leather objects were given brown colors while

objects made of canvas were given a beige color. These simple textures can be seen in Figure 28. This was done to make sure that when a character was placed in the world that it looked like they belonged there and their clothing did not make them stand out too much from the world around them.
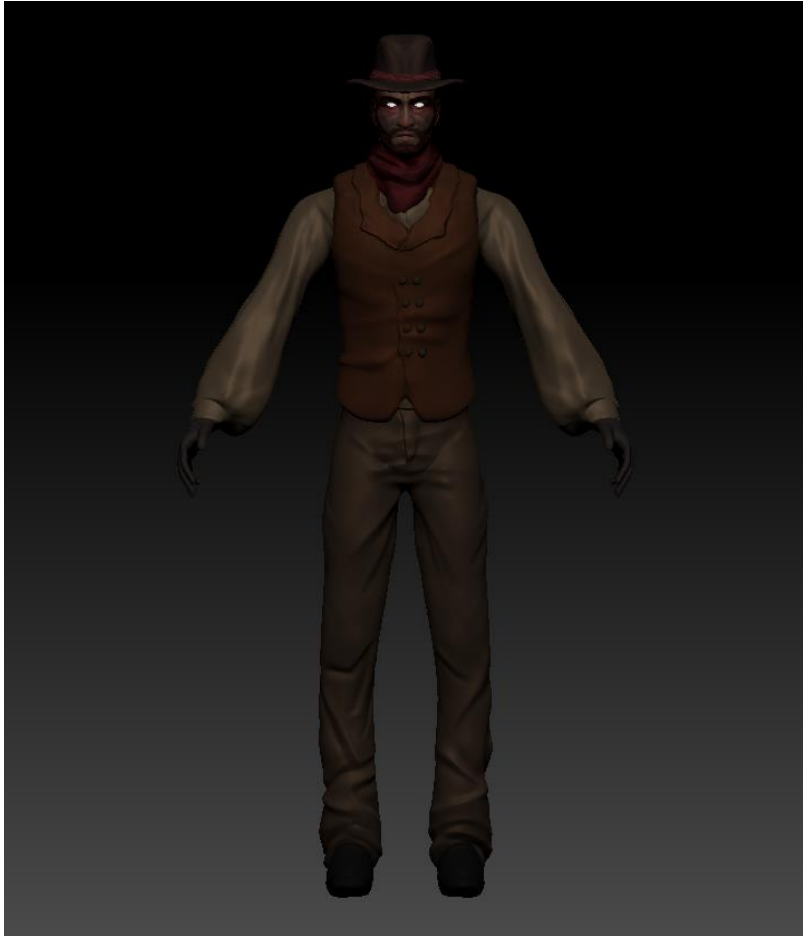
Figure 28. Temporary Textures of Enemy in Zbrush

After a model was exported from Zbrush it was taken into Substance Painter, where the character was given a different texture set using various materials inside Substance to make everything appear more realistic and of higher quality. Inside Substance the normal map from Zbrush was imported alongside the model to make sure the details from the high poly model were brought in. The simple textures were replaced with materials to make their clothing look like it was made of actual material such as leather or denim. Additionally other maps such as roughness, metallic and ambient occlusion were also generated. These maps provide additional qualities and allow for the fine tuning of a character's shininess, reflectivity, and depth of

shadows. Items like brass belt buckles or metallic buttons take on properties someone would expect to see in the real world as metal is shinier and reflects more than cloth. Adding these maps gives a character even more detail than would be possible from the previous simple textures used. Textures were also used to add some variation to enemy encounters by tweaking the appearance of a mesh to make it look like a different character. Figure 29 shows some of the final textures along with an example of the variation used in game.

Figure 29. Final Textures of Enemy Variations in Substance Painter

3.2.1.3. Rigging

All of the characters were rigged using a website called Mixamo.com. Mixamo is a website that allows a user to upload a model and have it automatically rigged. Once uploaded the user tells the program where on the model certain body parts are such as wrists, elbows, knees, and the groin. Once finished Mixamo takes some time and adds the skeleton and skin paints to produce a rig. Also on the website are a large variety of premade animations that are designed to work with the rig that the user can download. Using Mixamo allowed for the rigging process of the character pipeline to be sped up as it was all done automatically. Characters were first exported out of Zbrush and imported into 3DS Max where they were prepped for being sent to Mixamo. Once done they were uploaded to Mixamo to be rigged. Mixamo only allows for

humanoid bipedal characters to be automatically rigged, which worked out as every character was human, and allowed for all characters to have a similar skeleton and share animations. Once a character was rigged in Mixamo the t-pose mesh was downloaded and once again imported into 3DS Max to fix some issues before finally importing into Unreal. Figure 30 shows the before and after of a character being imported into Mixamo
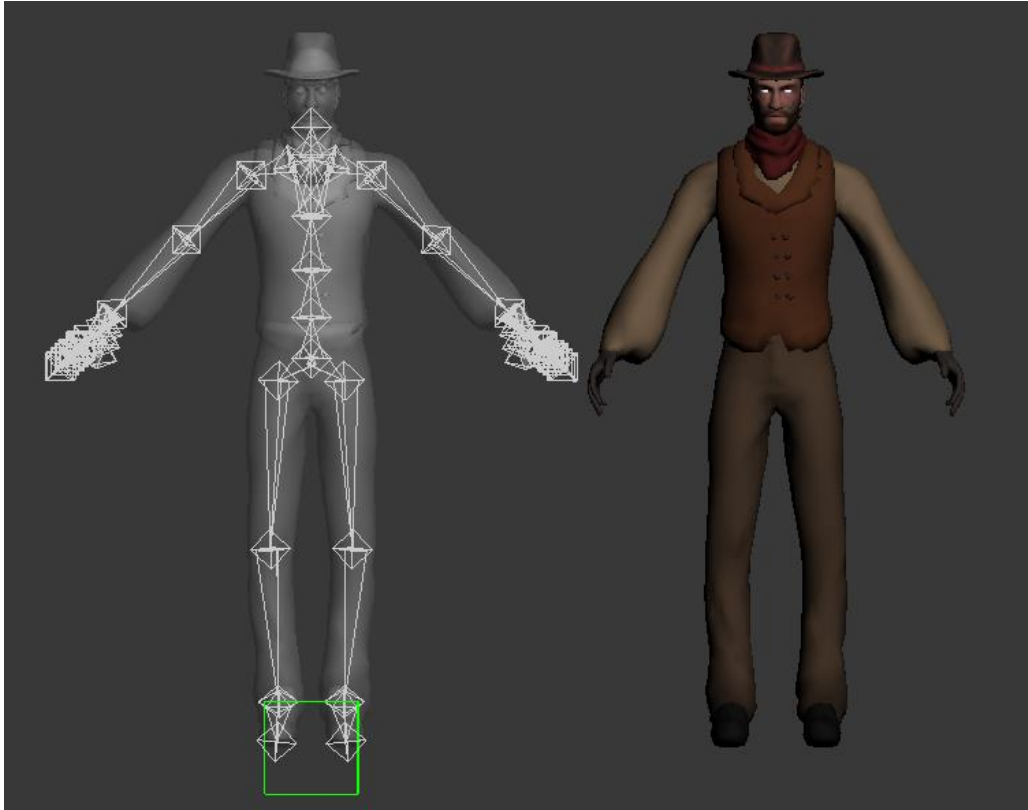
Figure 30. Character Before(Right) and After(Left) Mixamo in 3DS Max

3.2.1.4. Animation

Mixamo allowed for the use of premade animations that used the rig that Mizamo created. Most of the animations found inside of Mixamo did not fit the style of the game so only a select few were downloaded. Some of these animations were used as place holders while proper animations were made. Those that were used in the final product and came from Mixamo were modified inside of Maya so they would be a better fit into the game. The rest of the animations were animated inside of Maya, an example of which can be seen in Figure 31. Since the characters shared skeletons animations only had to be created once and it would work for all characters. Once an animation was finished it was exported as an FBX and imported into Unreal.

39

Table 1 shows all the animations that were created for the characters divided up into four sections depending on where it is used
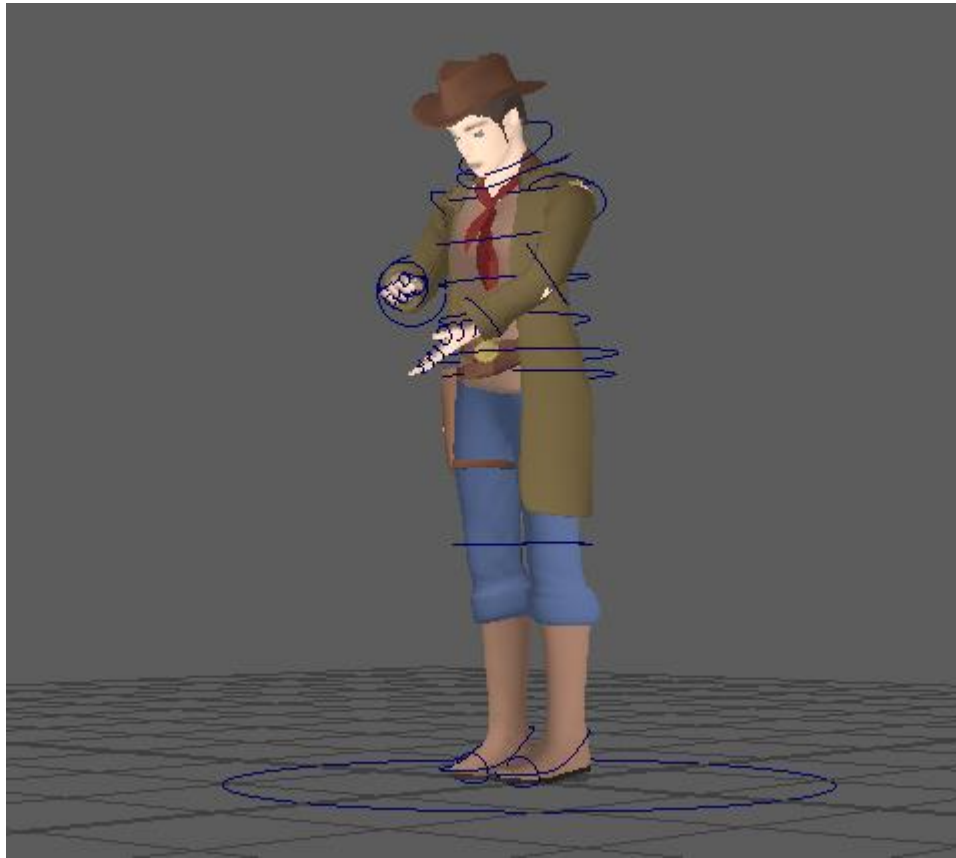
Figure 31. Reload Animation in Progress inside of Maya

Table 1. Character Animations

Movement	Gun	Horse Riding	Duel
Idle	Idle Aiming	Mount	Holster Weapon
Walk	Walk Aiming	Dismount	Duel Idle
Run	Shooting	Idle	Draw Weapon
Cover	Reload Start	Walking	
Vaulting	Reload Loop	Galloping	
Death	Reload End		

The human characters were not the only models in the game that needed to be animated. At a certain point in the game the player is able to get on and ride a horse. The horse model itself was not created by the Reckoning team but was bought instead. Figure 32 shows the

process of animating the model while Table 2 shows the animations that needed to be made.
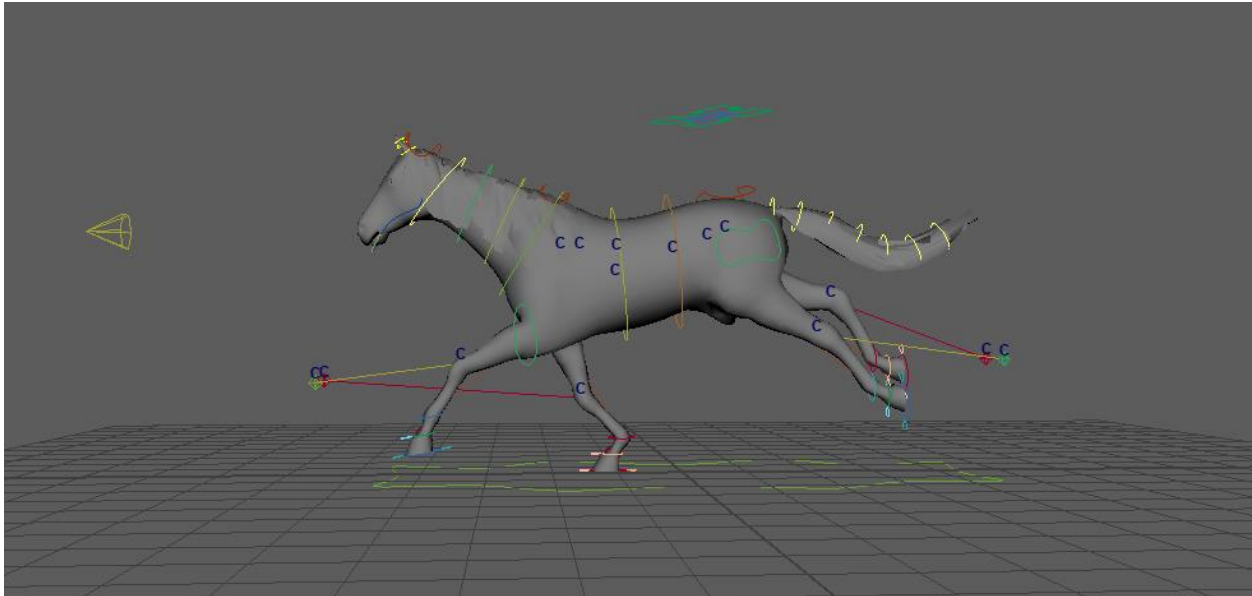
Figure 32. Horse Rig Animated inside of Maya

Table 2. Horse Animations

Idle	Walk	Gallop

3.2.2. Environment

This section covers the methods and decisions involved in creating the world of Reckoning and all the assets within it. This section will first cover the modeling and texturing of custom assets, and then discuss the implementation of assets into the game engine.

3.2.2.1. Modeling

Custom objects modeled for Reckoning were built inside Maya. To ensure proper optimization, most objects were modeled without much surface level detail, which would later be added in the texturing stage. Figure 33 shows an example of this through the sheriff's building.
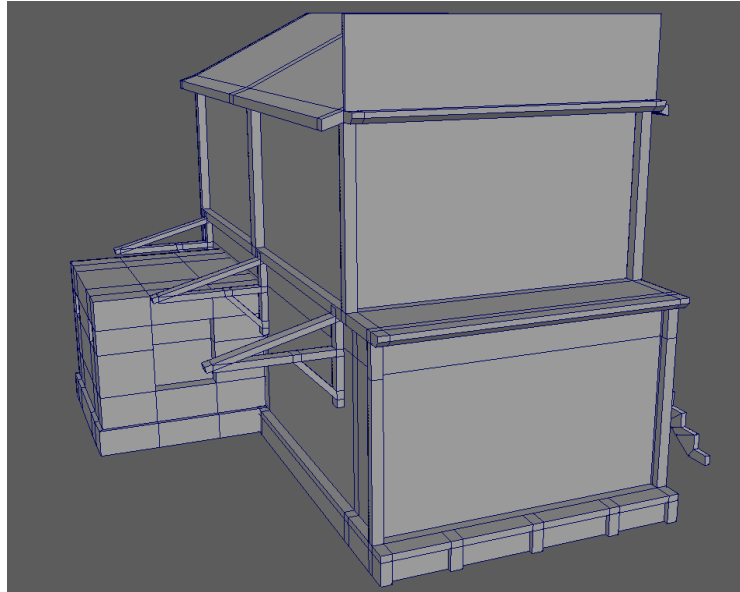
Figure 33. Sheriff Building

Windows, doors, and other decorative pieces were omitted from buildings and modeled separately. This was done because of the modular development pipeline to ensure any building could have any type of window or door attached to it, allowing for increased variety, shown in Figure 34.
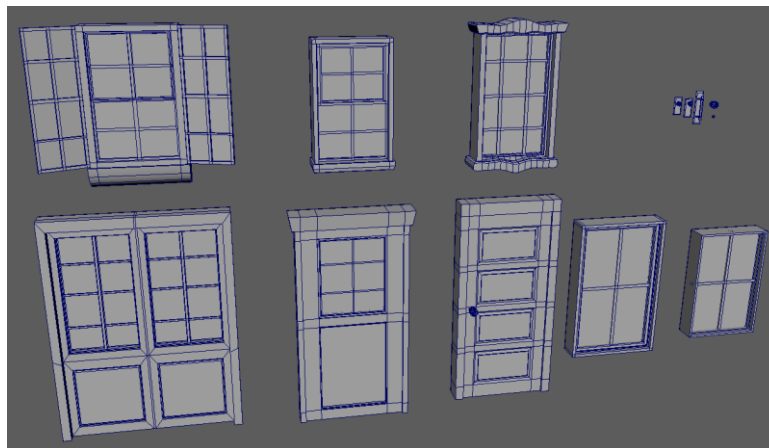
Figure 34. Modular Doors and Windows

3.2.2.2. Texturing

Objects were UV'ed inside Maya and textured inside of Substance Painter. Substance Painter was chosen instead of other texturing softwares for its ability to see the textures applied to the 3D model in real time as well as its PBR integration. PBR stands for physically-based

rendering, and works to simulate textures and how they would react with real-world lighting. In a PBR texturing workflow, objects are textured with materials such as wood or metal that have set metallic, roughness, and diffusion maps that control how light reflects the object. All these material calculations are done to recreate real-world physics, and can react in real time within game engines to dynamic lighting. [14] PBR has become the industry standard of texturing within the games industry recently, and allowed textures within *Reckoning* to be as realistic as possible. An example of what PBR looks like and how it affects objects can be seen in Figure 35.

Figure 35. Non PBR vs PBR comparison [15]

Substance Painter also has many useful functions and tools that allow generated simulations of wood wear, dust, rust, and other natural effects that would take longer to emulate in programs like Photoshop, seen in Figure 36. Substance painter uses a non-destructive, layer-based workflow similar to programs in the adobe suite. This allows users to edit materials and textures on objects quickly and procedurally, and experiment changes quickly while returning to their original textures without issue.

Each object has a color, normal, roughness, metallic, and ambient occlusion map. Surface level details such as wooden planks, built-up dirt and grime, layered bricks, and wood chips were all added at this level as normal maps, shown in Figure 37. This ensured each object would look detailed, but the detail would be calculated through a texture rather than through extra geometry, improving game optimization. Most in-game textures were 4096 x 4096 pixels for large buildings, to ensure high enough quality, while most smaller decorative models were textured at 1024 x 1024 or 2048 x 2048 pixels.

Figure 36. Textured Building
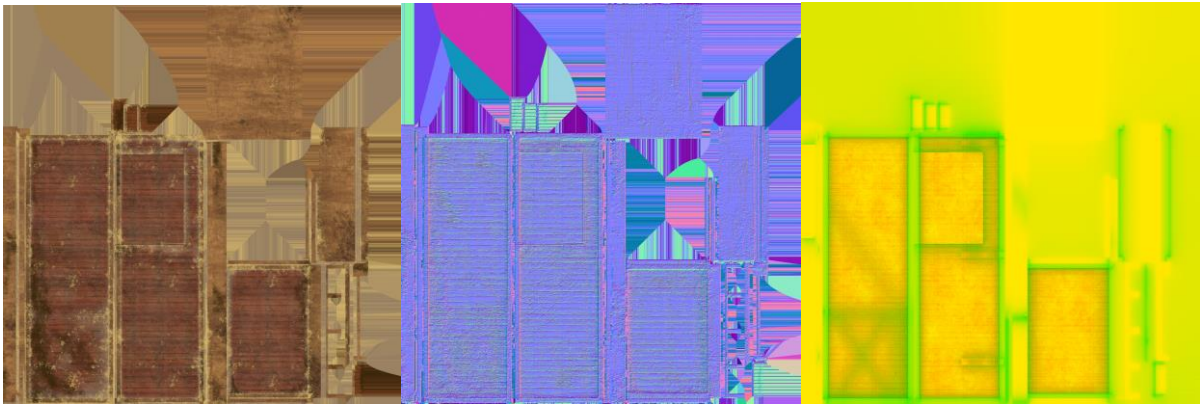
*Figure 37. Sheriff Building Texture maps (left to right) Color, Normal,
Occlusion/Metal/Roughness*

3.2.2.3. Engine Development

Once all the assets were modeled and textured, they were brought into Unreal Engine 4. Unreal Engine 4 is a game engine that uses real physics-based calculations to build the lighting and structure of the game. Here, all the assets were moved, duplicated, and placed to build up our town. A landscape was then created, using the Unreal 4 landscape tool and textures acquired from Quixel Megascans. Foliage, such as grass, trees, and rocks, were all acquired from third-party creators on the epic games marketplace. These foliage assets were then placed to build up

the desert landscape and the final forest. Foliage is the main final piece that adds immersion and detail to a scene. Below in Figure 38 you can see the foliage used to create the forest.

Figure 38. Forest Foliage

 Since Reckoning takes place outdoors, the level is only lit by the sun and has two lights, a directional light and a skylight. Lighting is dynamic and calculated in real-time so that in-game shadows will move based on the where the player is or as objects move or change perspective. The light was created for Reckoning to take place during noon. Shadows are stark and sharp, and lighting is harsh. The entire scene is also tinted with a slight reddish-brown color, and saturation is reduced. These lighting effects are all made to make the environment appear grittier and worn down. Additionally, when researching the western genre, many faceoff or duels seemed to often occur during high noon. Since in Reckoning, the player has multiple duels and fights through a town street, the lighting has also been set to noon to reenact the lighting from famous western movies. Figure 39 shows an overview shot of the game and its lighting.

Figure 39. Town Overview

3.3. Gameplay Implementation

3.3.1. Movement

Player movement was based off of the default Unreal 2.5D side scroller blueprint which allowed for a player to move left and right as well as jump, given the correct input. The blueprint was modified to get rid of the jumpring mechanic adding a valuting mechanic in its stead. This allowed the player to vault over obstacles in front of them when they collided with a corresponding collision box. The collision box also let the player crouch allowing them to avoid being shot from the enemies.

3.3.2. Shooting

For shooting a simple projectile base system was used. When the player clicked the fire button or the AI decides to shoot a bullet projectile spawns at the end of the revolver's barrel. The bullet travels in the direction the player is aiming at a high velocity. While aiming the player is able to adjust angle of the gun by moving the mouse or right stick to move their arm shown in Figure 40. The same logic is used for the AI which is set to aim at an angle towards the player.
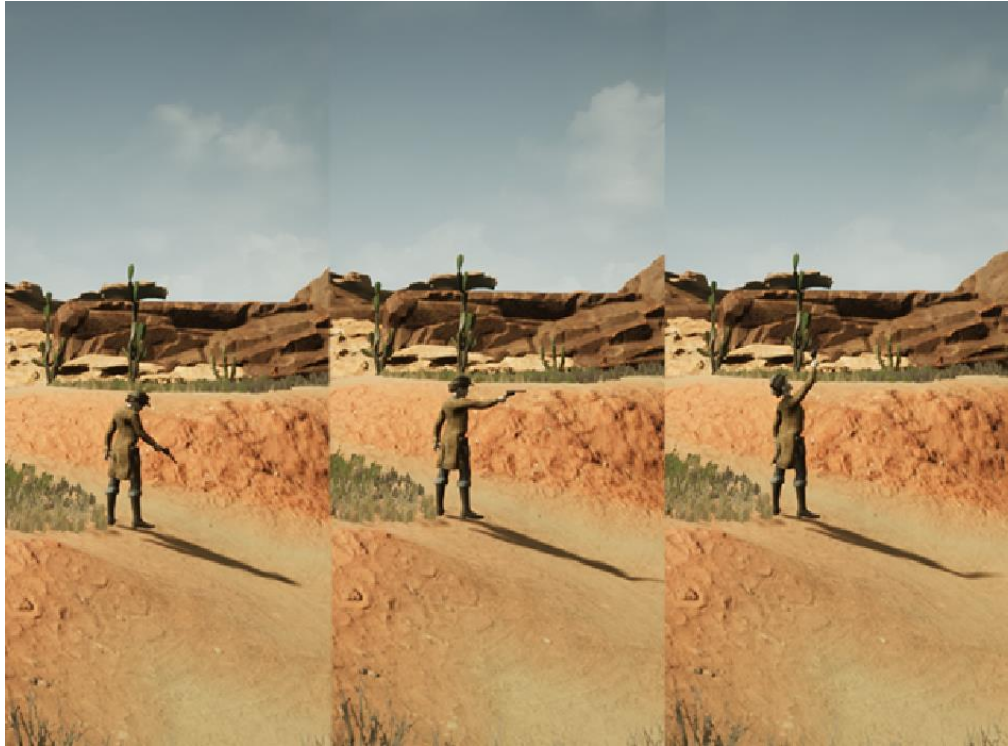
Figure 40. Range of Player Aiming

3.3.3. Dueling

Our dueling mechanic worked by stopping player movement when they collide with a collision box, and adding a great deal of spread to the bullet. This spread was added by slightly rotating the bullet before it was fired from the gun. The spread of the bullet is based on the amount of time the player has been in the duel, decreasing as time goes on. When the player first triggers the duel the camera shifts to center both the player and dueling enemy. This separates the duel from other sections of gameplay and lets the player know something else is happening. Once the camera is set the duel begins and the spread begins to decrease marked by the red bar on the bottom of the screen in Figure 41. Once a duel is over the camera resets back to its normal position and the player is once again able to move normally.

Figure 41. Duel in Town Center Showing Centered Camera and UI

3.3.4. Health

Player and enemy health work by decreasing the character's health whenever they are hit by a bullet projectile. While the health number is never explicitly shown, the player has a maximum of 150 health and the enemies only have a maximum of 50. This is done so that the power of the gun can be felt from killing enemies in one shot, while giving some leeway for the player. Health slowly regenerates over time and is decreased by 50 every time someone gets hit by a bullet which gives the player the ability to take roughly 4 shots before they die. During a duel damage is increased to 150 making it so anyone hit by a bullet will die. Figure 42 shows the UI element when the player is on very low health.

Figure 42. Example of UI Showing Player on Low Health

3.3.5. Controls

Controls originated as being rather simple and gave the player the choice between mouse and keyboard or controller. For mouse and keyboard A and D were used for movement, shift for sprinting, space for vaulting, R for reloading and E to take cover when the player was near an object they could duck behind. The mouse was used to aim with the right click held and shoot with the left mouse button. For the controller the left stick was used for movement, holding the bottom face button was for sprinting and tapping it would allow the player to vault. The left face button was for reloading, while the right was for taking cover. Aiming was done by holding the left trigger and moving the right stick and shooting was done by the right trigger. Figure 43 shows the controls menu inside the game
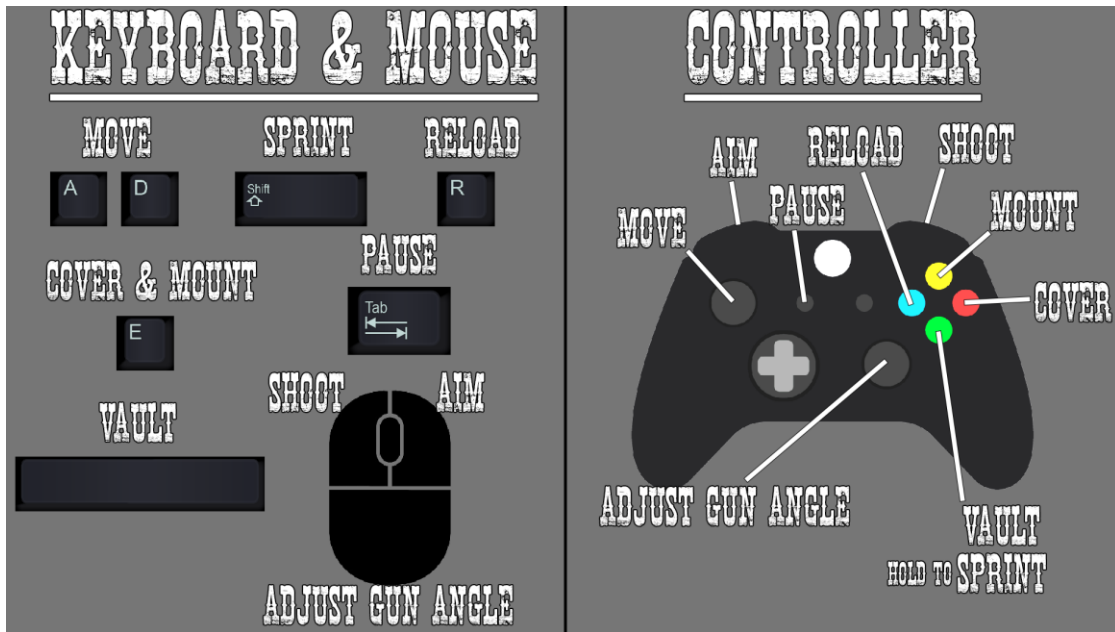
Figure 43. In Game Controls Menu

3.3.6. Artificial Intelligence

For our AI we used Unreal Engine's built in behavior trees. They provided a simple way to quickly make an AI. Initially we just had one AI, the standard one that moves to the players position and shoots towards the player. He does this by checking if you are within range, checking line of sight, then moving. When he is in shooting range he begins to shoot at the player and will do so until he is killed. The AI mesh is chosen randomly on creation from the three possible enemy varieties along with the texture, to provide variety among the enemies. And example of the AI aiming at the player can be seen in Figure 44.

Figure 44. Enemy AI (left) aiming at Player (right)

For our dueling AI we started with a clone of the basic AI, removed the movement and set his attack status to be dependent on a variable that is altered when the player enters a trigger box. The dueling AI also differs from the standard AI in that his shooting has a considerable amount of spread to it while the standard AI has none.

3.3.7. Horse

Due to time, the horse model and rig was purchased from turbosquid.com. The horse functioned as an interactable object that the player or AI would be able to interact with. Upon overlapping its collision box a player or AI would be able to mount the horse. Upon mounting, the controls would no longer move the character but instead move the horse until the character dismounted. Due to the nature of the horse's use its movement was constricted to push the player forward in its intended scene. A picture of the horse and its collision box can be seen in Figure

Figure 45. Image of Horse Rendered in Engine

3.3.8. UI

While the initial idea was to have almost no UI, with the only planned UI elements being for dueling and indicating health, after testing we decided we needed to add some way for players to keep track of bullets. It was made using Unreal's widget system. This built in system is quick and easy to make user interfaces in with. The UI itself consists of 6 bullet icons in the bottom right that turn invisible one by one when the player shoots. Initial images for these icons were simple stock images found online of a bullet, and an existing image that came with Unreal for when there is none. The blueprint uses a switch statement to determine the amount of bullets and hides the rest to show the amount of ammo currently in the gun. It checks and updates itself every tick.

Additionally due to feedback from playtesters, text appears above the bullet counter whenever the player is in range to do an action. These actions include vaulting, taking cover, and mounting. The UI for the game can be seen in Figure 46.

Figure 46. Bullet Counter and Action Text UI (Seen in Bottom Right)

The dueling UI consists of a red progress bar with an offwhite background. This is located at the bottom of the screen and only appears when the player enters a duel. It is activated by the same trigger box that starts the duel. The progress represents the maximum spread of the weapon. This is gotten from the player character blueprint and is always decreasing, making the player's gun more accurate. The main Menu also received changes to fit more into the Wild West style shown in Figure 47.

Figure 47. Updated Main Menu Screen

3.4. Audio Implementation

Figure 48. Audio Asset List

3.4.1. Sound Effects

All of the raw sound effects were downloaded from freesounds.org, then mastered in Reaper. Both are excellent resources that can be used for free, although free access of Reaper is only available through the trial version. After each sound was isolated and mastered for volume, it was exported as a .wav file for implementation into Unreal. Brief sounds that required random variations, such as footsteps and wounded sounds, were combined using Unreal's audio blueprints. This allowed for the greatest level of flexibility when it came to adjusting randomly varied sounds.

3.4.2. Voice Lines

Voice lines were recorded using a Zoom H2 digital recording device in a sound-proofed room. This was the first time we had attempted to use voice lines, so several weeks were spent consulting Keith Zizza and Allison Darling regarding how and when to record the lines. Next we sent a recruitment email to all WPI IMGD students. Students who responded to this email were then corresponded with on an individual basis to schedule auditions. After every applicant auditioned they were either assigned a fitting role, or if no roles fit were notified as such and thanked for their participation. Since the majority of voice lines are brief and reactionary, multiple takes of a desired sound were recorded in a single chunk then refined afterwards in editing. The only exception to this is Griffin's final monologue, which was recorded first line by line for more detailed directing before several full monologue takes were recorded.

3.4.3. Music

Throughout the MQP several sources for the background music were explored including a proposed commision from an independent musician. Ultimately due to time constraints and the lack of an experienced musician on the team the current background music was downloaded from filmstro.com and mastered for smooth looping.

4.   Playtesting and Iterations

Over the course of development the Reckoning team was able to gather feedback and playtest the game at various events or milestones. The following sections go over what each event or milestone was and the information gathered at each, along with how the team implemented that feedback. The first was a paper prototype of the game, followed by Alphafest, a WPI IMGD run event that allowed students to show their alpha's, and finally the WPI booth at a Pax East event called Made in MA.

4.1. Paper Prototype

The paper prototype was the first build of the game and was used to help design the basics of the game and make sure players could understand what was going on. It tested the design of the level, through the full layout and greybox video. The story through the various story beats read aloud to the player, as well as the pacing through how the player moved through the level.

4.1.1. Data collection method

Data was gathered after the entire level was played and the video was shown through the use of a survey. The survey consisted of eight questions seven of which required Likert scale answers from one to four. The final question was an optional response question to provide any additional feedback on the prototype.

The main goal was to find out whether players found any potential problems or had any issues with the direction of the game or story, before the game became more fleshed out and harder to change. This was done early in development when things were still able to be changed with relative ease.

4.1.2. Feedback

A total of six people playtested the paper prototype and provided their feedback. Overall the feedback was positive allowing the team to move forward. The two major questions revolved around the narrative and the pacing of the level.
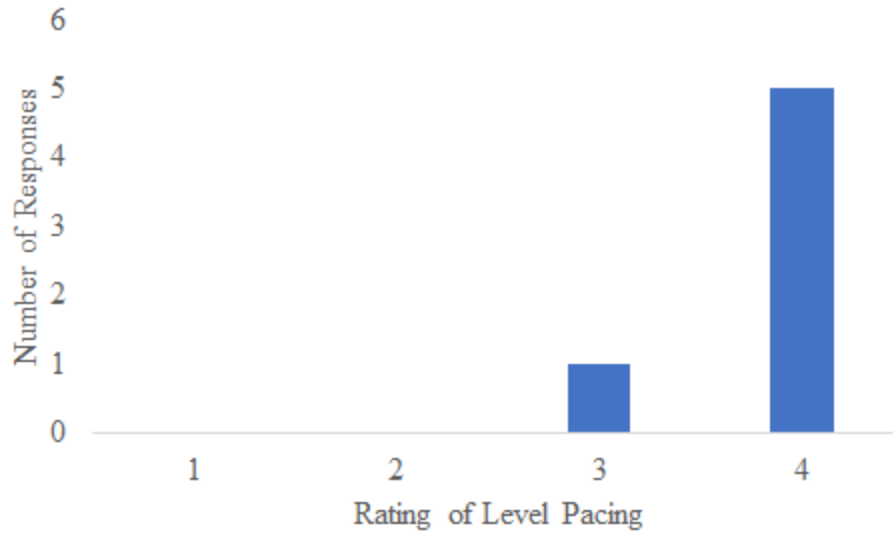
Figure 49. How was the Pacing of the Level, 1=Bad and 4=good
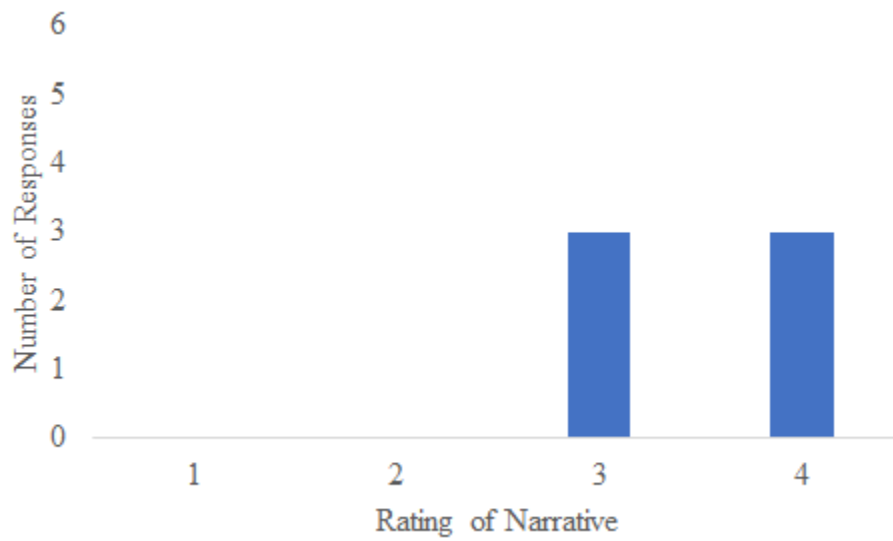
Figure 50. What do you think of the Narrative, 1=Bad and 4=good
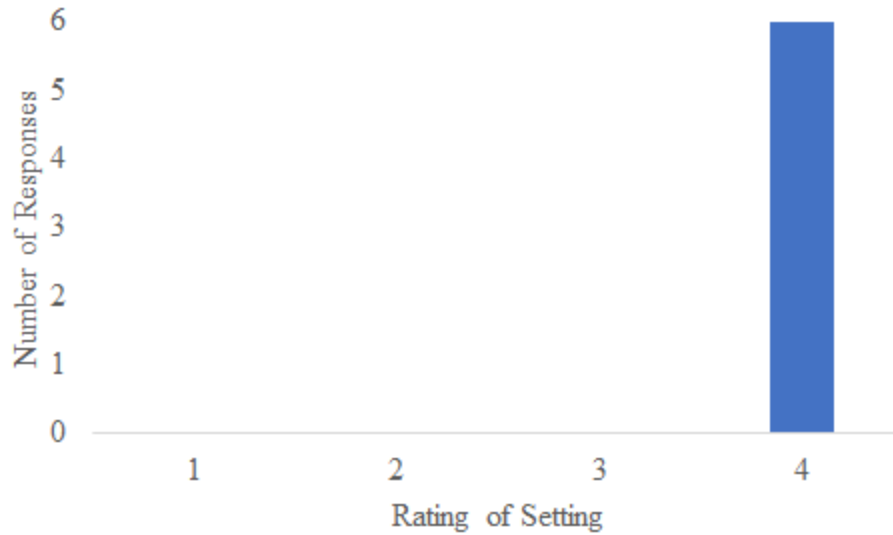
Figure 51. How did the Setting Feel/Look, 1=Bad and 4=good

Figures 49 and 50 show responses to those main questions with both receiving all positive responses. No tester had any problems with the narrative and the pacing and design of the level worked well. The setting was highly rated shown in Figure 51 and the idea of dueling fit well into the game which is seen in Figure 52.

Figure 52. How well do you thin the narrative fits into the Game, 1=Bad and 4=good
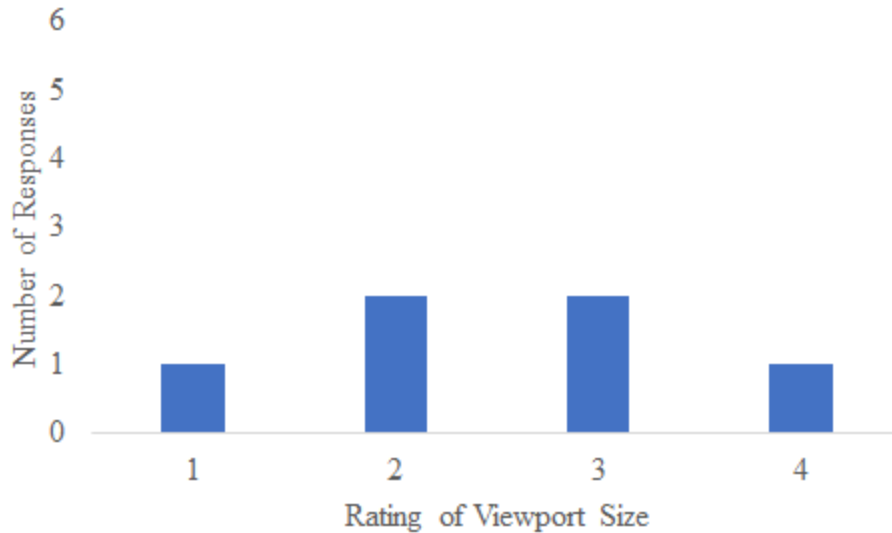
Figure 53. Did the Viewport Feel like it was the right size , 1=Too Small and 4=Too Big

The viewport was one of the few things that divided people playtesting the paper prototype, with half of the responses on either side shown in Figure 53.

4.1.3. Changes made

With most of the feedback being positive for what the team had in place for the paper prototype, only minimal changes were made moving forward with the actual game level. The viewport was pulled out as the team decided to show more of the environment and help the player see more of what they were doing. Some of the level was ultimately cut as time went on so where enemies were placed around the map changed a lot from the paper prototype. Dueling inside the paper prototype was always an approximation of how it would work inside the actual game and as development continued so did the mechanics behind dueling.

4.2. AlphaFest

Alphafest is an event designed to help students show off and test their games hosted by the WPI IMGD department. This was the first major test of the actual game that the team was able to do. It showed off an alpha version of the game designed to help provide feedback on the basic controls and feel of the game. Major aspects such as dueling and the narrative were left out and many temporary assets were used for textures and animations. Playtesters would come and

sit down at the teams table and play the game using a controller

4.2.1. Data collection method

Data was collected through the use of a survey once the player finished playtesting. The survey asked nine questions, three were on the likert scale from one to six. A single question was true or false, while the remaining five were all open responses. The likert questions revolved around the gameplay and controls of the game so the team could more easily determine areas to change technically. The true or false was used to judge the entertainment of the player, while the open responses were for the feeling of the game as well as any issue the player had.

4.2.2. Feedback

29 people playtested Reckoning at Alphafest and filled out the survey. Responses showed what controls the players had trouble with and identified areas that could use additional time.
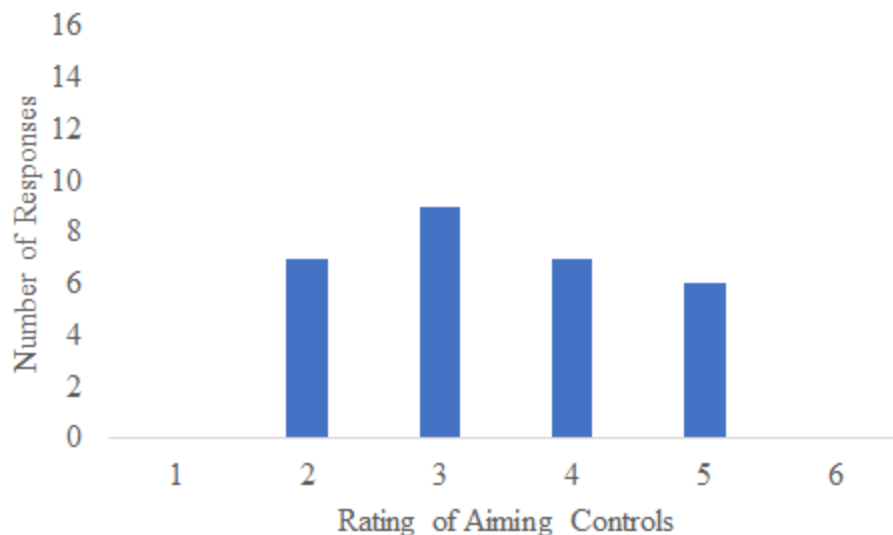
Figure 54. How were the Aiming controls, 1=Bad 6=Good

The most divisive question regarding the controls was about the aiming shown in Figure 54. Most players who did not use the right stick to aim often gave a higher rating while those that did rated the controls lower. Aiming was also found numerous times inside the open responses about places where the player was frustrated or found difficult. The system in place was not well

received by players and was mentioned the most out of anything in both verbal communication and inside the survey.
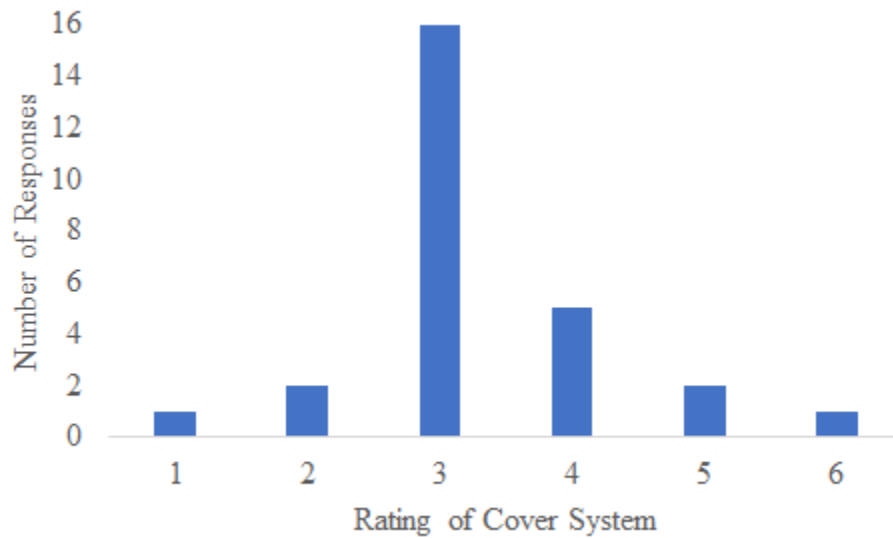
Figure 55. How were the Cover Mechanics, 1=Bad 6=Good

Unlike Figure 54, Figure 55 showed that most people rated the cover system on the low side. From observations it seemed like many players struggled to understand where and when they could take cover with some never using it all. With the ability for players to navigate through the level without using a major mechanic showed that the team needed to look into changing some enemy placement. The final Likert question asked playtesters to rate the general movement of the character, shown in Figure 56.
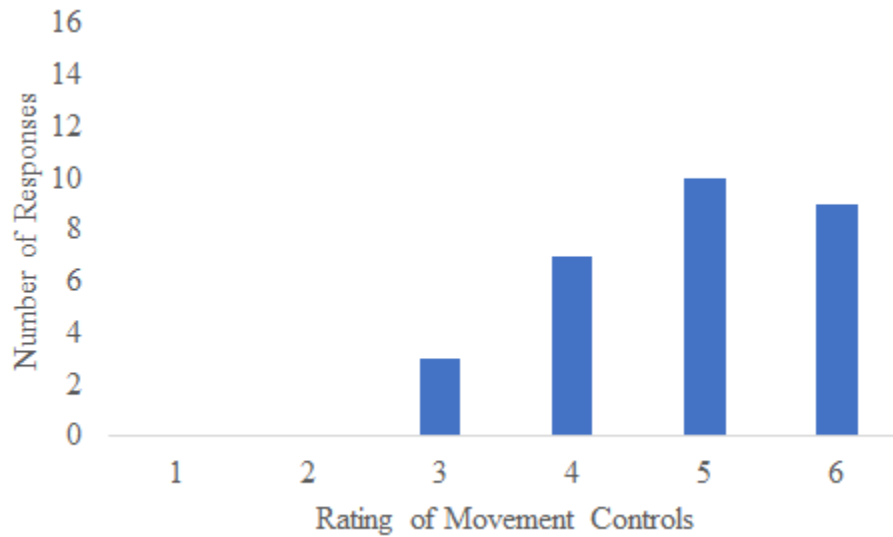
Figure 56. How were the Movement Controls, 1=Bad 6=Good

The majority of playtesters found the movement to be pretty good, and it was only in the beginning where people struggled with the controls as many were still learning them. Most people understood the basic movement in the game but struggled to understand the more complex mechanics of aiming and covering.

The survey also asked participants to provide examples of media that the game reminded them of along with a few quick descriptor words. Most of the answers aligned with what the team was going for in the aesthetic with examples like Red Dead Redemption and The Good, the Bad, and the Ugly as common answers along with words like Western, Challenging, Simple, and Beautiful appearing frequently.

Most people described aiming as a major issue along with various enemy behavior and placement. As the enemies could often see the player well before they saw the enemies resulting in getting hit from off screen and with temporary animations not aligning perfectly the bullet often shot slightly off to the side barely missing the enemy when players expected it to hit. A few areas inside the level also had some awkward collisions that often meant the player was unable to move forward if they were not going fast enough. The last major aspect observed by the team was not recorded in any surveys but a major bug allowed players to vault outside the set path, and be unable to properly progress as they could no longer shoot enemies or vault over any

object they came across. The lack of a UI or HUD was also mentioned frequently as players often lost count of bullets and never knew when they could perform certain actions.

4.2.3. Changes made

The biggest change made to the game after Alphafest was how aiming worked. Many people expressed the idea that the player should aim at the angle of the joystick itself rather than at an invisible point on screen. With many people mentioning that idea it was what the team decided to go with when making changes. Enemy AI was also tuned so players would not get shot from off screen. Many people struggled with two enemies in close proximity to each other however it acted as a challenge to end the town section of the map. With changes made to the AI behavior itself those two enemies did not need to move as they behaved more reasonably. Many bugs were fixed such as the collision blocker and the ability to vault outside the path. While the UI was often mentioned the team decided to keep it out for further testing and see if players would understand audio queues to keep the screen UI free.

While not directly related to responses from the survey many of the animations were adjusted and changed as those present in the Alphafest build were temporary, extra consideration went into making new animations to help solve some of the issues with bullet trajectory.

4.3. Made in MA

Made in MA was an event hosted in Boston that showed off many different games made inside of Massachusetts. It was held the same weekend as PAX East in a nearby location. The major improvements made to the game came from the addition of the dueling mechanic as well as the horse. Updated and new animations were added replacing many of the old ones as well more environmental objects and textures and all the changes from Alphafest were implemented.

4.3.1. Data collection method

Unlike previous playtesting sessions no survey was given out for people to fill out. Instead feedback was delivered through communication with the tester as they played through the game. Playtesters often made remarks and asked questions which helped us know what they

found confusing.

4.3.2. Feedback

Like previous sessions, the feedback was very positive. Players understood how aiming worked much more intuitively which was one of the biggest changes from Alphafest. The setting and graphics were mentioned frequently as looking great by many including those who were unable to sit down and play.

The new additions like the dueling and horse riding went over well however, they had a few issues such as the dueling AI which still needed some adjustments. The horse had a few bugs regarding what happens when a player mounted during a certain action causing the player to get stuck. A few additional bugs such as being able to vault backwards and get stuck aiming also appeared from time to time.

The biggest addition people wanted was a UI or HUD, many people even with additional Audio queues wanted something to visualize the ammo, and see what actions they could perform. Some players were unaware of the ability to ride the horse as it was a different action the player had not previously performed.

4.3.3. Changes made

The biggest change was the addition of a HUD to the game in the bottom right. It showed players what actions they were able to perform as well as how much ammo they had in the revolver. Additionally a pause menu was added to allow players to more easily view the controls once they entered the game. Bug fixes and various tweaks to AI based on feedback were also added to make the gameplay more smooth.

5.   Post-mortem

Throughout the development of Reckoning we encountered both obstacles and successes. By examining both of these aspects of the project, we can better move forward in the future.

5.1.   What went wrong

While the final version of Reckoning is a good representation of what we wished to accomplish, there are several things that given the choice we would have done differently.

One example of something we would change is the early attempts to use the premade technical kit. The 'Side-Scroller Shooter Kit' was initially chosen as a way to avoid building a shooting and cover system from scratch, allowing for a larger focus on level design and a cinematic UI. However, this kit proved to be a poor fit for Reckoning since it had a large amount of features we were uninterested in and was very difficult to modify. Struggling with this kit consumed a significant amount of time and effort that would have been better spent developing the custom system we ultimately used.

Another early road-block was a lack of source control. While we were eventually successful in implementing Perforce, this did not happen until the final term of the project. Having access to Perforce from the beginning would have significantly sped up development time and prevented difficult merge conflicts.

To speed up production a website called Mixamo.com was used, which was very helpful in automatically rigging the characters especially since there was no one on the team that could rig a human well enough for our project. However much of Mixamo is designed to be used with the animations provided on the site. Most of the animations on the site did not work well inside the game so they had to be made from scratch or heavily edited to look right. This caused animations to take much longer to make as the rig from Mixamo was unable to accept IK movement which is a common feature in animation.

If the project was completed more efficiently there are several cut features that could have potentially been implemented into the final game. One of these features is the RPG system that was designed to give weight to playing a female protagonist in a Wild West setting. In this system the player could choose whether to try to disguise themselves as a young male or flaunt the fact that they were a female gunslinger. This choice would affect how each NPC regarded the

player, making it more or less likely for them to aid the player in their search. These NPCs and their dialogue are another feature that unfortunately had to be cut. Lastly, there were two areas that we wish could have been included in the final game. These were an abandoned mine and a saloon, interior spaces that were designed for more narrative focused encounters.

5.2. What went right

Reckoning successfully allows the player to experience the finale of a thrilling Wild West revenge story. Throughout the game's development those who played the game invariably felt that it captured the Wild West aesthetic. The 2.5D perspective allows the environment to shine while the character models, animations and audio sell the Revenant's pursuit in the foreground. However where Reckoning channels the Wild West the strongest is with its duels. The mechanics that increase accuracy the longer the player waits create a tense, weighty scene straight out of a Sergio Leone film.

While voice lines do not have a huge presence in Reckoning, we still consider them to be one of our successes. Previous to this project no one on the team had prior experience with recording voice lines, and their recording and implementation was scheduled for the later stages of development, giving little time to learn about how to do so. Despite this voice actors were recruited and auditioned in a professional manner, and the team was able to produce high quality voice lines. The best example of this is Griffin's monologue at the finale of the game. This is the only set of voice lines that had a pre-written script, and with only minor directing Nick Parker produced the impressive monologue featured in the game.

Artistically, the Wild West gave us the necessary challenge to improve our world-building skills. Practicing an entire game development pipeline from concepting to modeling, texturing, and implementing improved the speed and quality of our workflow. Practicing rigging and animation also helped improve our technical art skills. We also felt we did an effective job at creating a consistent visual theme and style through all the textures and models in the world, whether environmental or characters. All the assets in the game seemed to belong together rather than having inconsistent style or quality.

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7. Appendices
7.1. Appendix A. Dialogue Scripts

Griffin's Finale Monologue

Griffin scrambles desperately away from the Revenant

Griffin: P-please, don't kill me. I can give you anything you want! Money, influence, power, a-anything please just please spare me oh god I don't want to d-die, n-not like this. Please just let me live a little longer I don't even know w-why you're doing this-

Griffin's back hits a tree trunk and he freezes, petrified. He takes a deep breath, then continues

G: Why? Why are you doing this? Nearly a year you've hounded me, killed my men, and for no reason. No demands, no requests, just murder. What on earth drove you to this?

A long pause, then the Revenant draws a brooch out of her pocket with her free hand

G: A- A necklace? What's that got to do… wait. I- I've seen that necklace before. One of my boys had one just like it, one of the new recruits. Evan… Eli… Elijah! Yeah, Elijah had a brooch just like that one. Gave it up, being a train raid recruit and all but I still remember it.

Griffin suddenly looks up, realization dawning on his face

G: Don't tell me- you're not Elijah's mother are you? Ha, hahaha! MGoddamn, who would've thought! That Elijah's always been tough, now I know where he got it from.

Griffin slowly stands up, gaining confidence

G: Imagine! Chasing us all this time, staining your hands red and when you've finally caught up, after all that, here you are. You must be dyin' to kill me, but the mere possibility I could bring you to your son stays your hand. Now that I understand-

Griffin whips out the pistol he has been slowly drawing behind his back and shoots the Revenant two times in the chest

G: You're just plain dyin'.

7.2. Appendix B. Informed Consent Form

Reckoning: Informed Consent:

Introduction: Hello. You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation. I will briefly explain these so that you may make a fully informed decision regarding your participation.

Purpose of the study: The Purpose of this study is to gather feedback on the current state of our work in progress video game. We will primarily be looking at your understanding and use of the game's controls, as well as asking questions about the gameplay and look of the game. We would like you to be as honest in your answers and experiences as possible.

Procedures to be followed: For this procedure you will be given a controller and be loaded directly into the video game. We will give you 5-10 minutes to play the game, then ask that you fill out a post-test survey with a set of multiple-choice questions as well as an optional area for comments or suggestions.

Risks to study participants: We expect the risks in this test to be minimal, but there are a few things we would like to share anyways. This game is a shooter based on the Wild West, and as such has themes of violence. If you are uncomfortable with this topic, feel free to opt out of participating in the survery. We will also be recording observations and survey results during your playtest. We will not be recording names or any other personal confidential information, so all published results will be anonymous. If you will allow us to use any photos of videos of you interacting with our game, we have a signature sheet you may sign. If not, you can choose to not sign the sheet and we will not use any material that depicts you. Thank you for playtesting with us today.

Benefits to research participants and others: Help give feedback and have your opinions heard in an ongoing developing video game MQP!

Record keeping and confidentiality: We will not keep any records or information that can be attributed to your personal name at any time during this process.

Compensation or treatment in the event of injury: We do not expect any serious risk from this playtest and as such do not have any compensations or treatment covered for injury. Please note: You do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact:

Reckoning MQP team, Email: gr-westernmqp@wpi.edu

IRB Manager (Ruth McKeogh, Tel. 508 831- 6699, Email: irb@wpi.edu)

Human Protection Administrator (Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu).

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit. By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

Signature of Informer_____

7.3. Appendix C. Paper Prototype Survey

1) How was the pacing of the level? 1(Bad)- 4(Good)
2) How did the setting feel/look? 1(Bad)- 4(Good)
3) Did the viewport feel like it was the correct size? 1(Too Small)- 4(Too Big)
4) How did the duel mechanic feel? 1(Bad)- 4(Good)
5) How well do you think the duels fit into the game? 1(Poorly)- 4(Very Well)
6) Do you think there are sufficient enemies to fight/ things to do? 1(Disagree)- 4(Agree)
7) What do you think of the narrative? 1(Bad)- 4(Good)
8) Please provide any additional feedback. (Open Response)
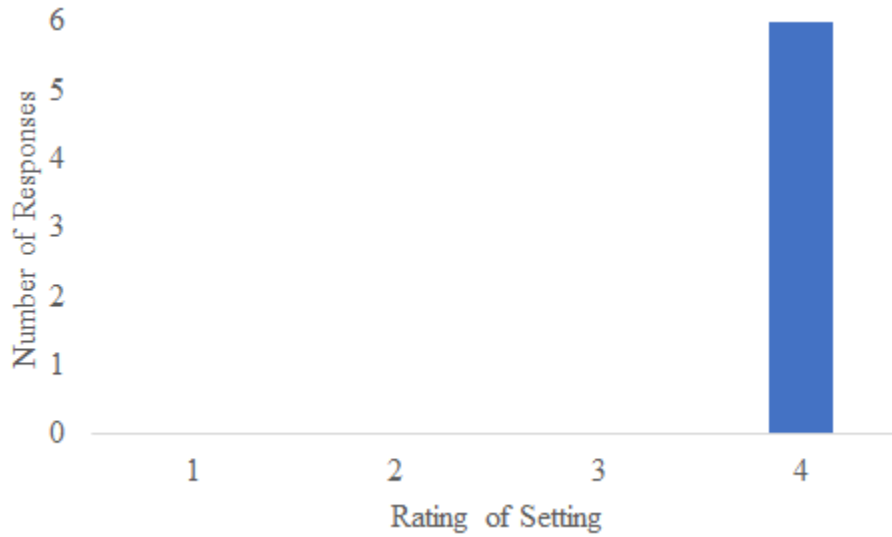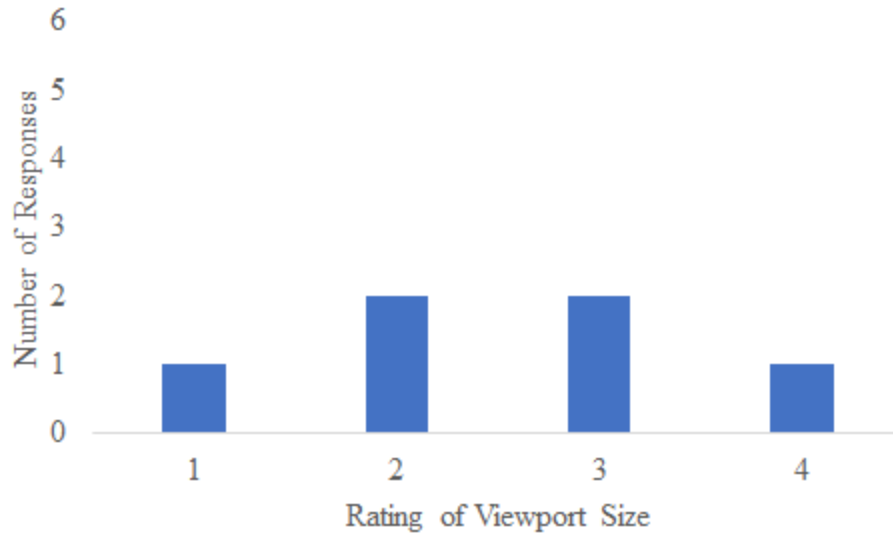
7.4. Appendix D. Paper Prototype Results

1) How was the pacing of the level? 1(Bad)- 4(Good)
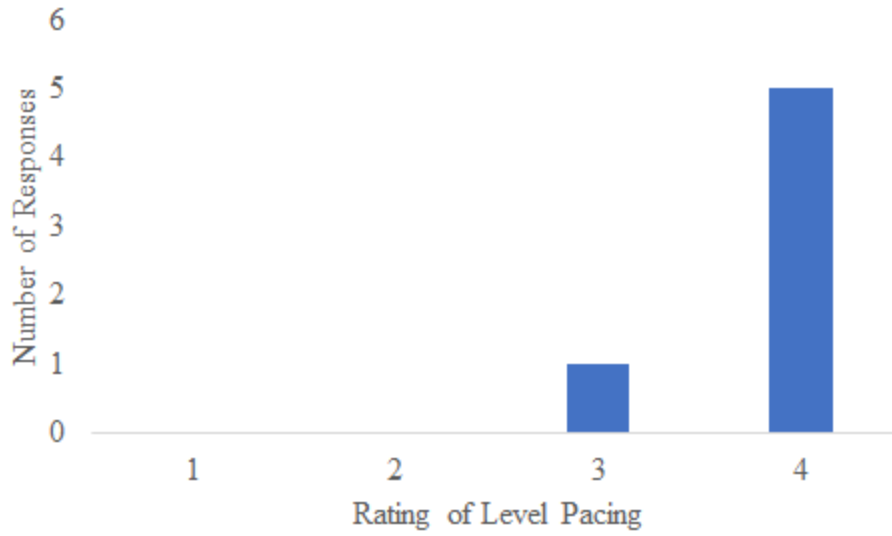
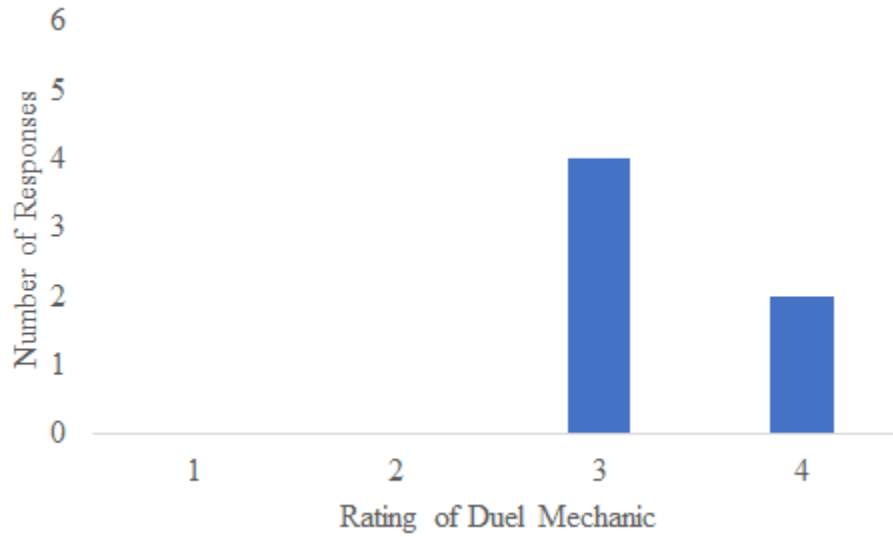2) How did the setting feel/look? 1(Bad)- 4(Good)

3) Did the viewport feel like it was the correct size? 1(Too Small)- 4(Too Big)

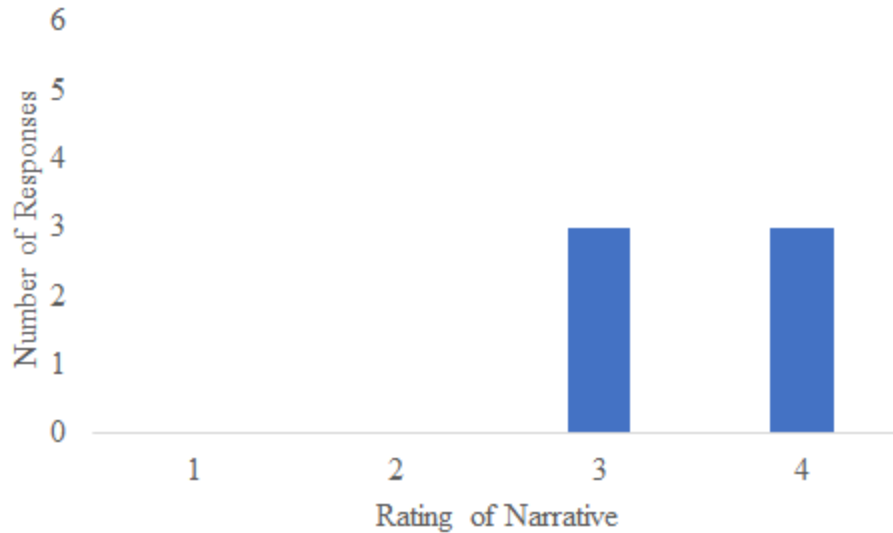4) How did the duel mechanic feel? 1(Bad)- 4(Good)

5) How well do you think the duels fit into the game? 1(Poorly)- 4(Very Well)

6) Do you think there are sufficient enemies to fight/ things to do? 1(Disagree)- 4(Agree)

7) What do you think of the narrative? 1(Bad)- 4(Good)

8) Please provide any additional feedback. (Open Response)
   - More enemies to fight would be good

7.5. Appendix E. Alphafest Survey

1) How were the aiming controls? 1(Bad)- 6(Good)
2) How were the movement controls? 1(Bad)- 6(Good)
3) How was the cover system? 1(Bad)- 6(Good)
4) Does the demo want you to play more of the game? (Yes or No)
5) What movies, comic books or other media does this demo remind you of? (Open Response)
6) What are 3 words you would use to describe the gameplay? (Open Response)
7) Where did the demo feel challenging? (Open Response)
8) Where did you get frustrated? (Open Response)
9) Do you have any additional comments/feedback? (Open Response)

7.6. Appendix F. Alphafest Results

1) How were the aiming controls? 1(Bad)- 6(Good)
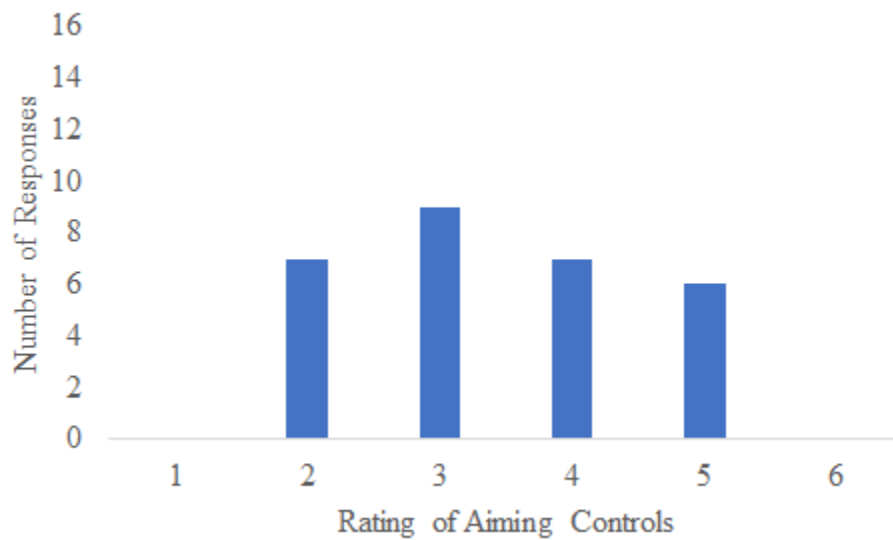
2) How were the movement controls? 1(Bad)- 6(Good)

3) How was the cover system? 1(Bad)- 6(Good)
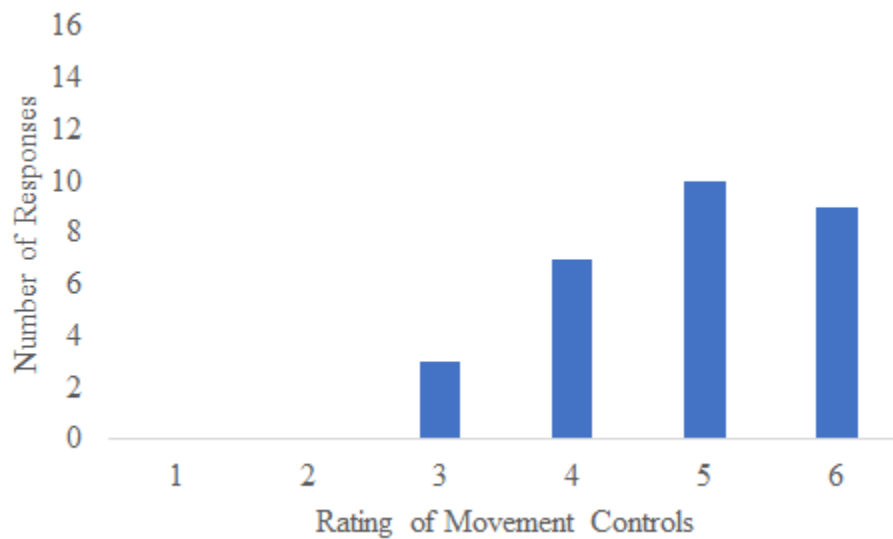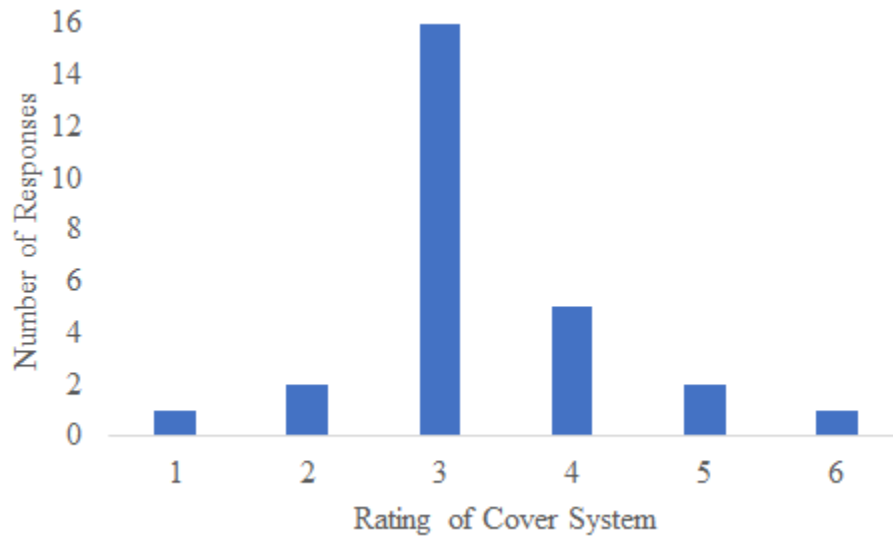

4) Does the demo want you to play more of the game? (Yes or No)
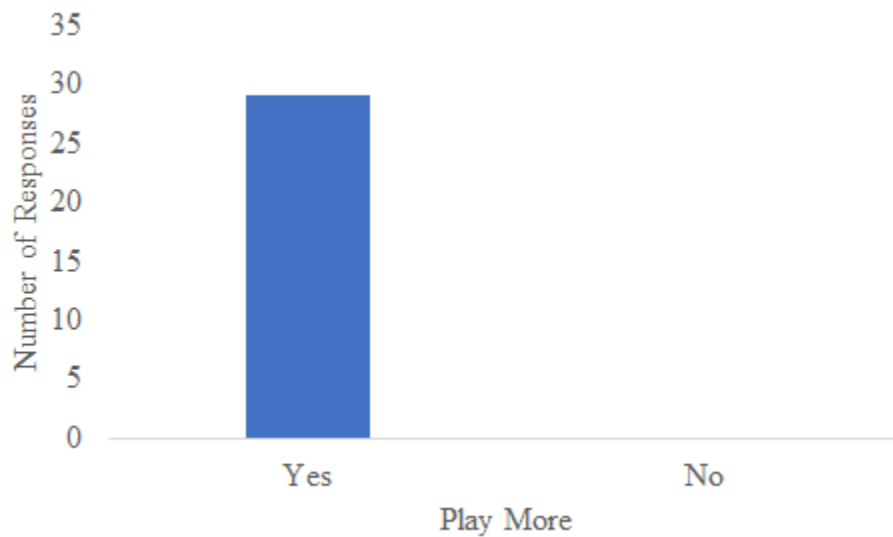
5) What movies, comic, books or other media does this demo remind you of? (Open Response)
   - The part in the Lego Movie with the cowboys
   - I don't really watch movies or read comics but really any of the Wild West cowboy ones
   - Fallout New Vegas, Red Dead Redemption
   - Westerns Generally
   - Reminds me of McCree form Overwatch
   - Western Movies
   - Gunman Clive?
   - Judge Dredd, Metroid, The Shootist

- Straight to Hell
- Borderlands 2
- Red Dead - Clint Eastwood
- Any western/ cowboy movies
- Spaghetti Western movies (the Good, the Bad, and the Ugly, etc.)
- The Good, the Bad, and the Ugly
- Westerns
- Sheriff Woody from Toy Story? Idk
- Basically every cowboy movie ever
- Wild West, RDR2
- Red Dead Redemption, Django Unchained, Deadlands
- Indiana Jones, that meme where a guy could kill you with one thumb
- Back to the Future III, Rango, Wild Wild West by Will Smith
- Back to the Future + any cowboy movie
- Milo's Odyssey (aesthetic)
- Cowboy
- Fistful of Frags
- Red Dead Redemption
- Rolling Thunder 2, Sega Genesis
- Yeehaw
- Red Dead Redemption, the Lone Ranger, Mass Effect

6) What are 3 words you would use to describe the gameplay? (Open Response)
- Strategic, Patient, Puzzle
- Wild, Wild, West
- Responsive, Progressive, fun
- Slow, Aimless, Satisfying
- Straightforward, Engaging, Simple
- Slow, Tactical, Patient
- Bulldozing through ruffians
- Dry, Shooty, Pew Pew
- Shoot, Slow, West
- Exciting, Yee, Haw
- Clunky, Intuitive
- Action, Challenge, Exciting
- Serene, Cumbersome, Simplistic
- Western, Warm, Relaxed
- Run and Gun
- Interesting, Detailed, Fun
- Quick, Cathartic, Well-lit
- Beautiful, Western, Shooter

- Active, Compelling, Simple
- Aesthetic, Smooth, Western
- Yeehaw! Running, Gunning, Reaction-matters
- Pretty, Simple, Smooth controls
- Simple, Concise, Clear
- Good, Hard, Fun
- Yee Haw Cowboy
- Scenic
- Strategy, Side Scroll, Action
- Back-and-Forth, Unavoidable, Shoot
- Shooter, 2D, Lo-fi

7) Where did the demo feel challenging? (Open Response)
- Confronting fighters with no cover
- Generally controlling the character (aiming and shooting) was a bit of a challenge, the controls involving the gun specifically aren't exactly intuitive
- Learning the cover mechanism
- Aiming was my enemy
- When I had to aim at faraway targets
- When the enemies positions started changing
- The shootout at the end probably shouldn't have a second guy show up a screen later after you shoot the first guy
- Upstair, 2 guys in a row
- Aiming the gun is very slow
- Aiming while in cover
- Aiming Up
- Aiming at the guy on the second floor
- The biggest challenge was trying to manage walking, aiming and taking cover
- When there were two enemies or when I forgot to reload
- Initially as i was figuring out controls
- Getting used to the controls. I felt they could be a little more intuitive
- Remembering to reload lol
- Dodging the guy above
- Mostly at the beginning when getting used to controls
- Cannot duck unless under cover. Can't shoot quickly, no jump or dodge, can't shoot while running.
- Trying to hit before getting hit, be quick
- It was hard to take cover and shoot
- Learning controls - however not used to game type
- While meet multiple enemies
- Guy on railing

- Felt a bit challenging to aim at people above me
- The first section
- It didn't feel Challenging
- Second shootout in town

8) Where did you get frustrated? (Open Response)
- When a gunfighters bullet can hit from off screen
- I got frustrated when I tried to aim or something and i just ended up spamming all of the wrong buttons
- Just a bit in figuring out how to aim
- Aiming
- When I had to aim at faraway targets
- An enemy could shoot me but I couldn't see him
- Cover systems sometimes activates when I'm trying to aim and vice-versa
- 2 guys very close
- Aiming the gun is very slow
- Unable to cover while reloading (or maybe it's just the animation)
- Aiming up, getting stuck on stairs
- Sometimes I would aim the gun straight and then when i took it out again i felt like i was aiming up, so i had to re-aim straight
- Movement didn't feel very fluid, especially if the goal of the game is to replicate the fighting style of old western film heroes. Transitioning between three systems mentioned before should be relatively easy to do, and quickly
- I didn't know you could hold A and vault while running
- Didn't realize how cover worked (ad to be right next it) first tried too far away and then didn't try again
- Using the right stick for aiming
- The one spot I got stuck and couldn't move and the crane controlled aiming
- Cannot loot dead bodies
- Never
- Reshoot times between bullets is slow, can only shoot while still? Changing shooting range while aiming is slower than just aiming & shooting at initial direction. Reload is slow
- Trying to aim at the guy directly up.
- Shooting and finding a place to cover while reloading
- Not being able to move other way
- After I died cuz I couldn't see the second one (he was off screen)
- Trying to aim at the second guy
- At first I didn't know how to jump but then I understood vaulting
- The first section
- Many enemies were impossible to dodge, as soon as you saw them you got shot

- General player feedback
9) Do you have any additional comments/feedback? (Open Response)
    - Overall the visuals and environment are a huge strong point! The game looks great and I really love the scene in the background. The biggest thing I have is aiming but I feel like it's going to be too hard to fix, rather than have the gun track an invisible point on the screen, have the character aim in the direction of the right stick directly. Maybe add a max rotation speed and they target along the sticks direction. Overall I'm very excited to see this game progress!
    - Great-looking environment! Maybe add an ammo count HUD indicator
    - The light doesn't quite line up with the sun, but otherwise the visual polish is remarkable
    - It would be nice if there was some sort of line coming out of the gun while aiming so I can be certain where the bullet will go (kind of like Metroid: Sammus Returns if you've played that)
    - Aiming felt sluggish
    - I don't know if I'm used to RT & R stick controls on this kind of controller (this is a me thing, so don't worry) The stairs threw me off because I thought she could walk up them
    - Not sure if getting hit made me shoot. Sometimes I'd draw & kill, sometimes miss, not sure why. Not always sure if i was shooting or a guy
    - I wish it auto targeted. Also melee would be nice
    - Ray tracing for shooting (if I'm aiming right i should hit them). No UI (ammo? health?) Controls a bit unintuitive, aiming feels clunky and can't avoid bullets. Aesthetic & feel is amazing!
    - Add a taunt, Cover sideways behind buildings
    - I love the way the game looks! The shaders are really nice an I think you were able to the vibe you were going for
    - I really enjoyed the props that are in game now, especially with the sunset backdrop. I would suggest adding in animation transitions between the moving and reloading states
    - Maybe aiming tied to the actual angle of the joystick
    - Enemies at different levels were cool, more of that could be fun.
    - Change aiming to match joystick direction.
    - Holding of gun animation seems off. The hand sometimes glitches. It would be nice to know the controls by using them even if not needed. For example you can only jump if there is a barrel and can only cover when there is an object. It would be nice to duck
    - Shows a lot of promise. Aiming could be a bit more responsive
    - Beautiful Graphics & smooth gameplay. Clear track objective, one way path

- Wasn't sure how much health I had or how many hits I could take. Wasn't sure how many bullets, probably 6 right?
- You might already have this but add an option to reload while taking cover
- Impressed for an alpha, possibly make away more intuitive
- Cool game but there's also some bugs, for example I cannot get to cover while changing mag (but it seemed like I was in cover because the enemy was not shooting me)
- Looks Great!
- I really Liked how the light worked and the characters movement looked great
- Nah
- Yee and I cannot stress this enough HAW! Hitbox for enemy felt off. 10/10 ending fell in a ditch
- Indicate enemies off screen, Ammo meter, Hip shooting/shooting over cover

7.7. Appendix G. Additional Assets

Audio

Music- Dirac from https://filmstro.com/music/western
https://freesound.org/people/lzmraul/sounds/389454/ "Footsteps_On_Dirt.wav" by Izmraul on freesound.org
https://freesound.org/people/pan14/sounds/388289/ "Foley_footsteps_desert_boots_sand.wav" by pan14 on freesound.org
https://freesound.org/people/bmcken/sounds/118187/ "Key Jingling.wav" by bmcken on freesound.org
https://freesound.org/people/kyles/sounds/454361/ "Wind light desert day steady eerie with crickets.flac" by kyles on freesound.org
https://freesound.org/people/Glaneur%20de%20sons/sounds/104952/ "Vent- wind (1).wav" by Glaneur de sons on freesound.org
https://freesound.org/people/fastson/sounds/50618/ "RemingtonGunshot.wav" by fastson on freesound.org
https://freesound.org/people/YleArkisto/sounds/320134/ "Revolveri, (pistooli), laukaus sisalla/ A revolver (pistol), Smith & Wesson 38, load, cock, single various shots, interior" by YleArkisto on freesound.org
https://freesound.org/people/kMoon/sounds/90782/ "Bullet_Flyby_2.wav" by kMoon on freesound.org
https://freesound.org/people/kMoon/sounds/90783/ "Bullet_Flyby_3.wav" by kMoon on freesound.org
https://freesound.org/people/kMoon/sounds/90784/ "Bullet_Flyby_4.wav" by kMoon on freesound.org
https://freesound.org/people/aglinder/sounds/265580/ "Impacts01" by aglinder on freesound.org

https://freesound.org/people/sketchygio/sounds/144907/ "Male_Grunts.aiff" by sketchygio on freesound.org

https://freesound.org/people/snaginneb/sounds/129346/ "Male_grunt.aif" by snaginneb on freesound.org

https://freesound.org/people/Reitanna/sounds/242623/ "Grunt.wav" by Reitanna on freesound.org

https://freesound.org/people/Reitanna/sounds/242622/ "Grunt2.wav" by Reitanna on freesound.org

https://freesound.org/people/Ornery/sounds/233345/ "Horses.WAV" by Ornery on freesound.org

https://freesound.org/people/InspectorJ/sounds/419231/ "Horse Whinny, Close, A.wav" by InspectorJ on freesound.org

https://freesound.org/people/Kubuzz/sounds/347036/ "horse's whinny" by Kubuzz on freesound.org

https://freesound.org/people/GoodListener/sounds/322454/ "Horse Snort 2.wav" by GoodListener on freesound.org

https://freesound.org/people/soundslikewillem/sounds/418427/ "snorting horse.wav" by soundslikewillem on freesound.org

Horse Model
https://www.turbosquid.com/3d-models/horse-rigged-animations-obj/1025548 by olta