Pandora: Purge of Pride

Interactive Media and Game Development

A Major Qualifying Project Report
Submitted to the faculty of
Worcester Polytechnic Institute
In partial fulfillment of the requirements for the
Degree of Bachelor of Science

By:

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Ryan Casey

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Michael Frankfort

_____

Jillian Sauer

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Alex Thornton-Clark

Advised By:

Professor Britton Snyder

Professor Robert W. Lindeman

Abstract

This report discusses the design, implementation, and analysis of *Pandora: Purge of Pride,* a first person puzzle game based on the myths of Pandora's Box and The Seven Deadly Sins developed in the Unity game engine for PC and Mac OSX. *Pandora* was created as a WPI MQP for the Interactive Media & Game Development (IMGD) and Computer Science (CS) majors. Players in *Pandora* play as Pandora, a Victorian woman who unknowingly unleashes the Seven Deadly Sins from the "Pandora's Box" of myth. Players must complete puzzles in Pandora's mansion to recapture the Sins. As each Sin is recaptured, Pandora gains a new power with which she can manipulate the environment and solve further puzzles. This report documents the initial design of *Pandora*, the objectives in creating *Pandora*, the development process, and the project team's retrospective thoughts on the development process.

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1. Introduction

Pandora: Purge of Pride is a first-person puzzle game in which the main character, Pandora, must use powers based on the Seven Deadly Sins to solve puzzles. These puzzles are created by said Sins escaping from "Pandora's Box" as inspired by the old Greek myth. The concept was developed over the summer of 2012, and work began that August.

Several goals were key in the design. First, the game should be thematically interesting. A story-driven, linear approach set in Victorian England was decided to be unique among other puzzle games. The story was based on classic mythology, which is also largely unused in video games.

Next, it was important that *Pandora* could be entered into independent gaming festivals and competitions. A unique art style was essential to make *Pandora* stand out in these competitions and set it apart from any other games that might be there. Visually unique games such as *Bioshock, Prince of Persia, Braid,* and *Borderlands* were used as reference in creating *Pandora*'s art style.

Finally, *Pandora* stars a female lead. Although nearly half of all gamers are female (ESA, 2012) there is a perception in the game industry that games with female leads will sell worse (Kuchera, 2012). Thus, *Pandora* was focused on Pandora, a female lead character who is fully developed, and more than a simple swap out for what could just as easily be a male character.

Keeping these primary goals in mind, Pandora was developed during the 2012-13 school year, and designed in A term of 2012 (a full version of the design document can be found in Appendix A: Game Design Document). Ultimately, adaptive difficulty, unique puzzles, and other mechanics were added to *Pandora*. *Pandora* was tested to further improve the experience for players. This provided feedback that allowed *Pandora* to be improved before gaming events, and allowed *Pandora* to grow beyond a school project and toward a commercial release.

2. Gameplay

Pandora: Purge of Pride is a first person puzzle game that gives players a set of powers based on the Seven Deadly Sins in order to solve puzzles. The player starts the game with no powers; as they solve each puzzle, they are rewarded with the corresponding power, which they can then use to solve the subsequent puzzles.

The Sins enter the mansion when Pandora opens an ancient Greek jar that her husband has discovered and brought back to England as a trophy. However, this jar is filled with the Seven Deadly Sins of legend - Greed, Wrath, Gluttony, Lust, Sloth, Envy and Pride - and they immediately escape. They corrupt Pandora's mansion, setting up the puzzles she will encounter during the game. Pandora realizes that she must counteract the Sins in order to prevent them from escaping beyond the mansion and affecting the rest of the world.

Each puzzle was designed with this progression in mind. Since the puzzles appear in a constant order for each play-through, it is always known what powers the player will have as they play through each puzzle. However, the puzzles were also designed with two elements of dynamic gameplay in mind: reactive difficulty for each puzzle, and a degree of freedom in each puzzle's solution. An example of both of these mechanics can be seen in a puzzle where the puzzle has to match colored cubes. The number and orientation of the puzzle's blocks vary depending on the player's performance in previous puzzles.

We have also integrated storytelling elements into each level. The player should stay immersed in the game for story moments. A series of short cutscenes serves to point out in general terms what the player should be paying attention to, and ancient scrolls in each level provide the bulk of the story content. This allows the player to find the story at their own pace, and further invests the player in exploring the world.

2.1. Win Condition

Ultimately the player will progress through each of the first six areas and will have gained all of the powers. At this point, they will reach their ultimate goal: the trophy room and the final of the Sins, Pride. Pride is different than each of the previous puzzles in several ways. First, this is a confrontational puzzle. Pride has consumed Pandora's husband, Bruce, and Bruce is so corrupted by Pride that he is trying to stop Pandora by using the powers of the Sins against her. For instance, he can create Gluttony balls that will crash down on the floor of the trophy room and break open holes which Pandora can fall into.

The player must use all of the powers available to break down Pride in this final battle-puzzle, and ultimately save Pandora's husband. This is the final level of the game, and, once Bruce has been freed from Pride's influence, the Sins will have been stopped completely and the mansion will be returned to normal. The player will then view a short sequence of images that explains the conclusion of the story, thus ending the story of *Pandora*.

2.2. Setting

Pandora: Purge of Pride takes place in a mansion somewhere in London, England during the Victorian era (Figure 1). The mansion is large and generously furnished; its owner, Bruce, is a famous British explorer and brings back many artifacts and trophies from expeditions. However, Pandora has ultimate control over the house since Bruce is often away on adventures. This means the mansion is filled with Pandora's books, decorations, and furniture. The remainder of the decorations in the house consist of Bruce's trophies and finds from his adventures. He is not a subtle man and takes great pride in displaying his artifacts prominently.

Figure 1: Reference image of a Victorian mansion (http://www.screamfestla.com/images/623052-A-fancy-old-Victorian-mansion-in-Eureka-0.jpg)

When the Sins escape, they rearrange the normal decoration, using Bruce's finds. They also break down the mansion itself, tearing wallpaper, dirtying floors, and generally disorganizing everything. The Sin powers have also possessed some objects in each room, causing them to float about the room in a haunted manner.

Each Sin has taken over a different room within the mansion, with the theme of the room reflecting the Sin that has taken over that area. The levels are divided thusly:

- Greed is set in the library. The greed for knowledge in the library attracted this Sin there. The room is decorated with many bookshelves and colored a golden tint.

- Wrath is set in the wine cellar. The connection between alcohol and Wrath drew this Sin there. Furthermore, Wrath was attracted to the lowest part of the mansion: the closest point to Hell.

- Gluttony is set in the dining room. This room is tinted blue, and serves as a fitting home for the all-consuming Sin.

- Lust is set in the bedroom. Not only is the bedroom where Lust is most commonly expressed, but it is also decorated in a passionate red.

- Envy is set in the ballroom. When Pandora and Bruce host their socialite friends this room is the nexus of Envy and is decorated green.

- Sloth is set in the garden. A private garden is the most low-intensity area of any mansion, and this allows Sloth to effortlessly settle in here. All of the colors in the garden are desaturated and grey.

- Pride is set in Bruce's study and is tinted purple. Bruce's pride is his downfall, and the study where he displays his trophies and artifacts becomes the seat of Pride and the scene of the final level of the game.

2.3. Player Interaction

The player's primary mode of interaction comes through using each of the powers (Figure 2). Each power manipulates objects in the environment in its own unique way, detailed here:

- Greed pulls objects toward Pandora

- Wrath pushes objects away from Pandora

- Gluttony makes a duplicate of the selected object

- Lust attracts two selected objects toward each other and binds them together

- Envy pulls Pandora toward the selected object

- Sloth makes the selected object float and move more slowly

Figure 2: Pandora using one of her powers

The player uses all of these powers to solve the puzzles and undo the effects of the Sins on Pandora's mansion. The only Sin without a corresponding power is Pride, as it is only seen in the final boss level that Pandora must defeat.

The player also interacts with Pandora through finding the scrolls that contain story points in each level. This rewards the more explorative player, and serves as a secondary objective at all times. Pandora also reacts to player actions through her own inner narration in which she comments on things she sees in the levels, gives hints to puzzles, and makes the occasional joke.

2.4. Player Experience

One of the team's overall design goals with *Pandora* was to create an original experience for the player. In order to do so, *Pandora* was designed in a way which allowed the player to learn new strategies and controls while telling a unique story in the process.

2.4.1. Narrative in *Pandora*

Many people have heard of the myth of Pandora's Box; a curious young woman opens a vessel unleashing all the world's evils onto the unsuspecting people of earth. In order to use such a well-known myth as a story arc, it was important that the team not only alter the story to fit the game's needs, but also to introduce new characters and their weaknesses to provide an original experience. Several methods of storytelling were implemented in the game that contributed to create a strong backbone for the story that the player would want to continue to reveal and see more of.

2.4.2. Puzzle strategy

With each Sin that Pandora successfully defeats, she gains a new power which allows her to manipulate objects in a specific way. Each puzzle was designed so that the player uses previously learned powers in order to successfully complete the current level. For players to do this successfully, the design goal was to teach the player how to use each new power before presenting them with an unfamiliar puzzle which required the newly found ability.

To do so, "intermediate" puzzles were created and placed before the "main" puzzles in each level, as shown in Figure 3. Intermediate puzzles were set up so that a player has to complete one specific task to enter into the main puzzle room. This task involves using the most recently learned power to manipulate one or more objects in a puzzle to advance in the game. Once the player completes the intermediate puzzle they advance to the main puzzle room, and are expected to be able to use all previously learned powers to complete the main puzzle.

Figure 3: The intermediate puzzle before the main level of Lust

To add variety to *Pandora*, the team designed three types of puzzles which can be defined as action puzzles, logic puzzles and object manipulation puzzles. Action puzzles require the player to use the powers at specific times to accomplish the puzzle's goal, whether it is climbing to a given location or avoiding a falling object. Logic puzzles challenge the player to think strategically in placing or moving objects to accomplish the current task. Finally, object manipulation puzzles combine both logic and action elements to complete the puzzle and advance further in the game. For example, a player may have to use logic to combine objects to build a ramp, but then must use the powers quickly to launch

objects off the created contraption. These three puzzle types help create variety for the player, while honing the player's skills by challenging them to use a specific power in more than one way.

2.4.3. Dynamic Puzzle Difficulty

To build replayability and cater to all potential players, the team created a dynamic difficulty system that allows players of all skill levels to enjoy *Pandora*. To implement such a feature, some research had to be done to correctly gauge how a player can be considered "good" at a specific game (Hunicke & Chapman, 2004). The consensus was that each game is different, and that ample player testing is needed to get a good set of data.

All of the puzzles in *Pandora* are set up to increase in difficulty based on the ability of players to complete the previous puzzles. For example, if one player had difficulty and played poorly through the entire game, the next incoming puzzle is adjusted so that it is easier to complete. Figure 4 shows an easier version of the "Lust" puzzle.
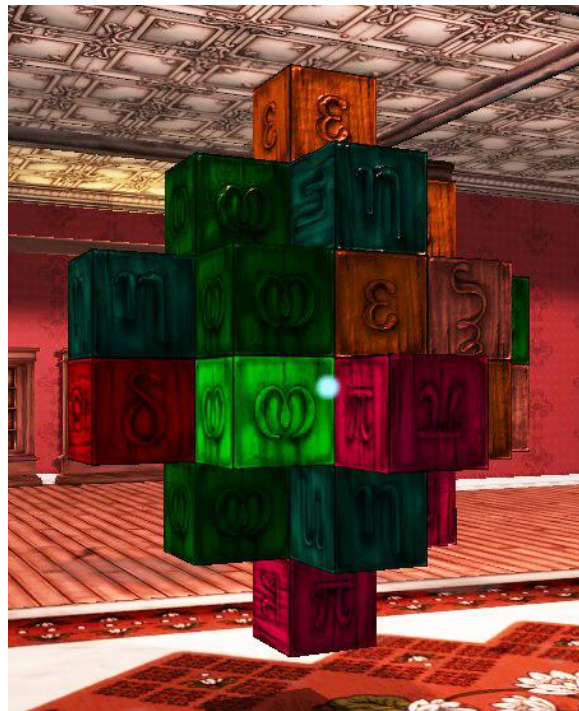
Figure 4: The Lust puzzle on the "easy" dynamic difficulty setting

The difficulty system in *Pandora* keeps a running score from one to ten which fluctuates based on the average of all the currently completed puzzles. This score only fluctuates a certain amount per level. The design reason for this restriction is twofold. First, it doesn't make sense for players who do extraordinarily well on a specific puzzle to then automatically get extremely difficult puzzles for the rest

of the game, just because they may have done well on a specific puzzle that suits them. Second, the game should not punish a player who may have a rough time with one particular puzzle but is otherwise adept to solving *Pandora*'s puzzles. This restriction is necessary due to the fact that, as mentioned in the previous section, there are multiple types of puzzles and each player may have different strengths and weaknesses when it comes to a specific genre of puzzle. The difficulty manager takes game heuristics into account when determining a puzzle score for a specific level; it keeps track of the number of moves (if applicable), number of resets, and game time. These three attributes are weighted differently depending on the type of puzzle. For example, logic puzzles require thinking about the correct moves needed to solve the puzzle; therefore, time is not as important of a factor, because the player should not be set back for thinking deeply and taking a longer time to figure out how to solve the puzzles. The adaptive difficulty for *Pandora* was designed not only to help the player experience the full game on any skill level, but to also add a unique feature, as many puzzle games do not have any sort of adaptive difficulty element.

3. Development Environment and Project Management

At the beginning of the project, all four teammates agreed on a set of goals that to accomplish with *Pandora* by the end of the development cycle. These goals were then thoroughly analyzed through player testing for evaluation purposes.

The main goals included:

- A strong, non-clichéd female lead character
- An embedded storyline which guides the player throughout the game
- A unique visual style that stands out from other 3D games

3.1. Workflow

In order to create a finished and bug-free experience for the players, the team adhered to a strict, deadline-based schedule which allowed work to be evaluated from week to week. Weekly meetings were held with two advisors to gain feedback and direction in regards to gameplay elements, art quality, implementation of technical features, and design decisions. These meetings were helpful in managing the scope of the project and keeping the project on course with the goals identified at the beginning. The advisors helped the team meet weekly goals and keep control of the project in terms of scope.

After each meeting with the advisors, the team met separately to not only talk about what the professors advised, but also to manage who was working on each feature until the next meeting. The team met an additional two times each week, once to plan and write an agenda for the next advisor meeting, and once to compile individual work into the main body of the game. Although team meetings were frequent, a majority of the modeling and scripting was done on a per-person basis. During the team meetings, art or technical features were assigned to each person to work on based on their talents and what needed to be done each week. This allowed each team member to focus on a specific task and accomplish the items needed for each deadline. The development timeline and deadline goals are shown in the spreadsheet in Figure 5.

	A	B	C	D
1	Topic	Alpha, Beta, or Gold	Complete By	Art, Code, or Design?
2	Wrath Level	A+	11/30/2012	A,C,D
3	Beta Testing Round I	N/A	12/13/2012	D
4	Sloth Level	A	12/13/2012	A,C,D
5	Envy Level	A	12/13/2012	A,C,D
6	Greed Level	A	12/13/2012	A,C,D
7	Pride Level	A	12/13/2012	A,C,D
8	Lust Level	A	12/13/2012	A,C,D
9	END OF B TERM			
10	First 3 Intermediate Puzzles	A	1/17/2013	C
11	Pop-ups, screen information	B	1/17/2013	C
12	Sloth Level	A+	1/17/2013	A,C,D
13	Story/gameplay programming	B	1/24/2013	C
14	Last 3 Intermediate Puzzles	A	1/24/2013	C
15	Envy Level/Greed Level	A+	1/24/2013	A,C,D
16	Beta Testing Round II	N/A	2/1/2013	D
17	Pride Level/Lust Level	A+	2/1/2013	A,C,D
18	GUI/Controls	N/A	2/1/2013	C
19	7 Intermediate Puzzles	A+	2/8/2013	A,C,D
20	Sound Design/Implementation	B	2/8/2013	C,D
21	Camera Control/Cutscene	A	2/8/2013	C
22	Gluttony Level/Wrath Level	B	2/15/2013	A,C,D
23	Polish Round I (Wrath,Gluttony, Accompanied tutorial lev	N/A	2/15/2013	C
24	Menu Art/Sloth Level	B	2/22/2013	A,C,D
25	Envy Level/Greed Level	B	3/1/2013	A,C,D
26	Polish Round 2 (Sloth,Envy,Greed, Accompanied tutorial l	N/A	3/1/2013	C
27	Beta Testing Round III	N/A	3/1/2013	D
28	END OF C TERM			
29	Pride Level/Lust Level	B	3/15/2013	A,C,D
30	Polish Round 3 (Pride,Lust, Accompanied tutorial levels)	N/A	3/15/2013	C
31	Sound Design/Implementation	G	3/22/2013	C,D
32	Cutscene/Gameplay/Story	G	4/5/2013	A,C,D
33	All Levels	G	4/12/2013	A,C,D
34	Beta Testing Round IV	N/A	4/12/2013	D
35	Final Paper	G	4/18/2013	D

Figure 5: Tracking spreadsheet with milestones and deadlines

The team kept track of what needed to be done each week with detailed spreadsheets and deadline outlines. The progress on completed art assets also needed a detailed spreadsheet for project management purposes which can be found in Appendix B: Art Asset List. What needed to be done, when each item on the spreadsheet was due, and each item's progress towards completion were listed, as shown in Figure 5. This allowed the team to keep track of the progress of the game's assets as a whole, in terms of what had been completed and what was slated to be worked on in the coming weeks and months.

The direction of the game was defined early on through discussion and input with the whole team. Concept art and basic puzzle ideas were created in the very early designs, and reference material and inspiration from existing games and Victorian resources were gathered and reviewed. From there, each level was built with placeholder assets and the team worked through each of the individual artistic and technical elements that needed to be completed to flesh out each level. As weekly goals were completed, assets were added and the levels were iterated upon. When the levels were mostly complete, the game was opened for testing and items to fix and polish were identified based on the detailed feedback the team received. As issues were found, the team went back and iterated again for polish adding finishing touches on art assets and gameplay.

The work on the game was tracked using Tortoise SVN, which allowed the team to store all of the assets in one place and manage revisions and updates. From art assets to game builds and management documents, everything was kept in one place and it was easy to keep track of the changes made over the course of the development process.

3.2. Engine

The team used the Unity engine (ver. 3.5.4) to manage, build, and implement the work created into a fully functioning game. Unity was chosen as the game engine for multiple reasons, stemming from ease of use, general familiarity, and a simplified art pipeline. Unity was created to support many different genres of games which facilitated adding common functionality. For example, Unity comes prepackaged with default third and first person characters, which allow developers to simply change specific attributes (e.g., jump height and movement speed) in order to quickly create a character. This character can already move and look around, all with minimal effort. Many competing game engines were designed for specific game genres in mind, therefore limiting the usefulness of the engine for other purposes. Finally, Unity's art pipeline allowed simple importing of Autodesk Maya models and animations, as well as UVs created in Adobe Photoshop, which made even the technical members of the team able to edit and manipulate art assets.

All four members of the team had used the Unity engine for previous projects, so the daunting task of making a complete game in less than one year became more feasible as no one had to relearn how to implement simple features. This made it the ideal engine to use in the creation of *Pandora*.

3.3. Tools

Unity was used as the main game engine, but many other tools were used in the production of *Pandora*. On the art side, Pixologic ZBrush and Autodesk Maya were used for modeling and sculpting assets found throughout *Pandora*'s environments. Low-polygon models were created in Maya, and then textured using Adobe Photoshop to get the hand-drawn art style. CrazyBump was used to generate normal maps and specular maps for some of the models. High-polygon models were sculpted in ZBrush and then retopologized into lower-polygon versions with normal and diffuse maps for use in-game. The model for Pandora herself was modeled and textured in ZBrush, and then animated in Maya.

The technical program that was used to create and manage the production code in *Pandora* was Monodevelop, which came packaged with Unity. Monodevelop's seamless integration with all Unity components made it an easy choice to develop in.

4. Life in Pandora's Era

Developing the world and characters in *Pandora* began at the inception of the project, along with the project goals of a unique art style and a strong female character. To achieve these goals, research was undertaken to define the art style and give a basis in reality for the world of *Pandora*. From the research conducted and concept art created, the artistic style of *Pandora* emerged and her world was built.

4.1. Overall Artistic Vision

As a part of the overall project goals, the artistic vision was based around the idea that the art style in *Pandora* should be recognizable outside the context of the game. Even before a specific style was formed, the overarching goal was incorporate something unique and approach the art in a way other than the 3D realistic style that has been adapted in most current games.

When approaching this idea, games that accomplished a unique and recognizable art style were examined. Irrational Games' *Bioshock* and 2K's *Borderlands* were played and reviewed. The team looked at what these games did well and the effect certain artistic elements had on the overall artistic style, and how those elements benefited the games overall. The finalists from the past years of the Independent Games Festival, a small-studio game competition held annually, were also examined, including *Dear Esther*, *Machinarium*, and *Way*. It was useful to see what successful games had done to create visual appeal in a unique way in the development of *Pandora*'s visual style. Ultimately, the key elements identified that the team aimed to incorporate into *Pandora*'s art style were the balance of semi-realism and style, strong use of lighting and color, and a variety of different environments.

Over the course of creating concept art, it was found that the style used in the hand-drawn concepts fit well with the vision of the project and the goal of a unique style. The pen-and-ink style in many of the early concepts, including the varying line weight, cross-hatching and sketch marks, were elements that were included in the final art style. Pandora as she appears in paintings, with this style, is shown in Figure 6.
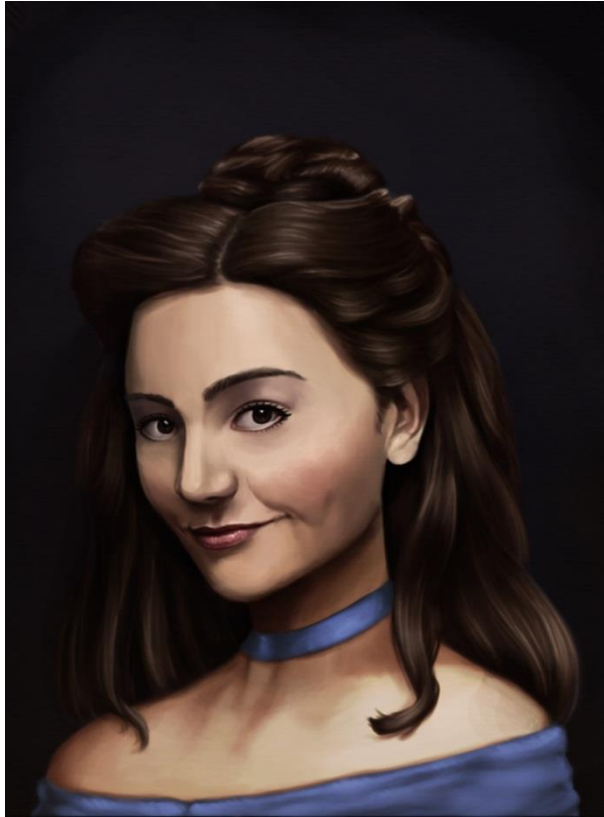
Figure 6: Pandora in portrait form as seen in-game

4.1.1. Inspiration

When forming the art style of *Pandora*, the goal was to create a unique visual style that would be recognized outside of the context of the game, and that was different from the "AAA" realistic art styles that are very common in 3D games today. The team aimed to challenge themselves artistically and create something visually interesting and unique.

The team played and examined games that had strong visuals and had accomplished an interesting art style. The components that made the art interesting in these games and how these pieces contributed to the overall visual style were reviewed. By identifying what worked well for these games artistically, *Pandora*'s art style was created.

Irrational Games' first person classic, *Bioshock*, has many strong artistic elements that add to the game's overall aesthetic. *Bioshock* has strong level design, and the artistic style incorporates semi-realism and good visual design in its lighting and color, as shown in Figure 7.

Figure 7: Screenshot of Irrational Games' 2007 classic *Bioshock* (http://www.bioshockgame.com/site/us/)

The designs of the environments in *Bioshock* show some realism so that the world of a city underwater is believable, and that the setting is clear in that it is from the 1960s with art nouveau style influences. In addition to striking a balance between realism and style, *Bioshock*'s environments were well-lit and included an abundance of colors. These elements of *Bioshock*'s visuals play an instrumental role in the mood and environment of the levels, and provide great visual interest as the players move through the different areas of the game. Even with the same assets seen in many places throughout the game, the lighting and color help to break up the repetitive feel and give each level of the game a unique, lifelike feel. The balance of style and realism, strong lighting, and the use of color were the elements the team aimed to include in the artistic vision of *Pandora*.

The art style in *Borderlands*, found in Figure 8, incorporated semi-realism and a painted, sketchy style that is very recognizable and visually interesting as well. The look and feel of *Borderlands* is recognizable as belonging to that specific game, and the use of edge detection and sketched texture details give it a semi-realistic, hand drawn feel. The art style finds a good meeting point of realism and visual style.

Figure 8: Screenshot of an environment in 2K's *Borderlands*
(http://www.borderlandsthegame.com/borderlands.html)

The artistic vision for *Pandora* fully solidified as concept art was created, as shown in Figure 9. The traditional pen and ink sketches allowed the team to start getting a feel for what the environment as well as Pandora herself looked like. The hand-drawn, sketched ink style worked very well for visual appeal. All of the objects in the game have 'inked' lines and cross-hatching that give them the hand-drawn style. The art style incorporated this, with bold colors and some digital painting, as the final artistic style in *Pandora*.

Figure 9: Ink concept sketches of Pandora

4.1.2. Characters

The two main characters in the game are Pandora, the main character and player character, and her husband Bruce.

4.1.2.1. Pandora

Pandora is a woman living in Victorian England, and is the player character in our game. She is married to Bruce, an English explorer who leaves her alone at home when he goes on his worldly adventures. Pandora is intelligent, curious, and inventive; prior to story in the course of the game, she wishes to go on an adventure herself rather than staying at home as a proper English woman, only hearing about Bruce's adventures when he returns home.

 At the start of the game, Pandora comes across a Greek jar that Bruce acquired on his most recent archaeological trip. Unbeknownst to her, this jar is the actual Pandora's jar from the famous myth. Pandora accidentally opens the jar, and unleashes the evils onto the world, in the form of the Seven Deadly Sins. Pandora, knowing that it was her mistake and not wanting anyone to get hurt, takes it upon herself to capture the sins back in the jar again and prevent them from escaping into the world beyond her home. Pandora is brave and determined in this sense, facing the consequences for her actions head-on and solving the problems presented to her.

Pandora's concepts were some of the first concept art that was created. The preliminary 3D concepts created for Pandora worked very well with the sketched art style, but the final model of Pandora has a more painted, semi-realistic style, as shown in (Figure 10) Pandora's hair and clothes were referenced from photos of Victorian women and Victorian fashion, though Pandora's skirt was shortened for ease of movement when animating. Pandora was high-polygon sculpted and painted in ZBrush, and retopologized to a lower-polygon version to use in game with normal and diffuse maps. She was then rigged and animated in Maya.

Figure 10: Pandora's 3D model as seen in-game

4.1.2.2.   Bruce

Bruce is an English explorer during the height of British archaeology in the Victorian era. He goes on trips around the world, achieving fame and fortune with his discoveries and bringing back artifacts from wherever he goes. He is adventurous but prideful and arrogant, always chasing after the next big discovery to leave his mark on history and be the most famous explorer.

Over the course of the game, it becomes apparent that Bruce is missing after Pandora has opened the Greek jar and released the Seven Deadly Sins. He is in none of the rooms that Pandora explores to recapture the Sins, and the paintings of Bruce in each room have been clawed and destroyed by the evils. The sketch of Bruce found in the opening sequence is shown in Figure 11.
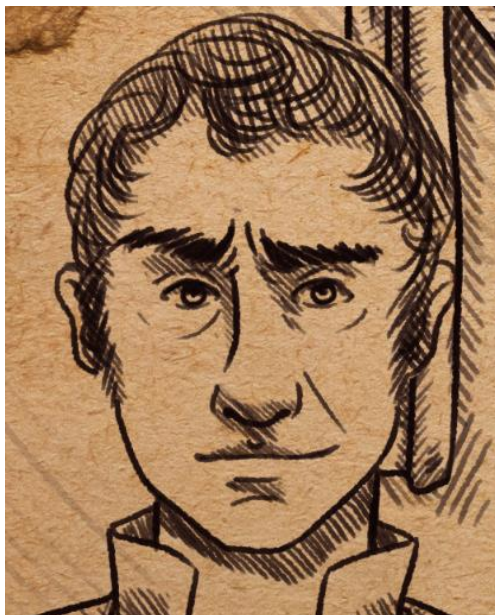
Bruce finally appears in the final boss level, where it is revealed that pride is the root of all evils and Bruce's pride became so great that it engulfed him and turned him into a golden statue of himself. Pandora must defeat the pride-infected Bruce to recapture the final sin and restore order to the world.

4.1.3. Environmental and Puzzle Objects

All of the environment and puzzle objects for *Pandora* were created by the team over the course of the game's development in Maya and ZBrush, and textured with Photoshop. Historical references were reviewed for the interior design and decoration in Victorian England to inform the design of the models and the layouts of the different rooms and levels overall. Following the style of the time as well as the art style of the game, the environment objects in *Pandora* are historically accurate and are unified artistically.

There is a wide range of environmental objects in *Pandora* because the game's setting takes place in a variety of rooms in Pandora and Bruce's Victorian-era mansion. All of the objects have the sketched and painted style, as well as each level or room has a color theme that corresponds with the Sin that has infected that room. The wallpaper reflects the overall color theme of the room, and the textures on all of the objects have been color unified - they have a low-opacity color layer with the main color of that room to set the tone of the room with that color. The library level, Greed, is gold or yellow; the basement level, Wrath, is orange; the dining room level, Gluttony, is blue; the bedroom, Lust, is red; the

ballroom level, Envy, is green; the outdoor garden level, Sloth, is grey; and finally, the boss level Pride is purple.

There are some objects that are present in multiple rooms, such as the bookcases, rugs and pillars, but art assets were also created that are unique to certain rooms because of their settings. The basement level includes casks and wine barrels, for example, and the bedroom contains a large bed and curtained windows. This allowed for variety with the environment objects in-game while also being economical with the models created. Additionally, single models were used economically by assigning different textures; for example, many of the paintings in *Pandora* use the same frame based model, with the painting in the frame different depending on the texture attached to the model. This method of texturing saved time as well as added consistency to the art assets between levels.

The puzzle objects created for *Pandora* are the objects specifically used in the game's puzzles. These had to follow the theme of the setting and the art style, but needed to still function as objects that clearly belonged to a part of the puzzle. These included the puzzle cubes, which are wooden cubes with Greek letters written on each side, as well as Greek obelisks, floating stone tiles, and the wine crates in the Wrath basement level. These objects have a base color with their textures, but also have color overlays in Unity as dictated by the code depending on the needs of the puzzle. For example, the puzzle cubes are one main color in the texture, but for the Lust Mahjong-style puzzle, the cubes are overlaid with different colors that the player then has to match, as shown in Figure 12.

Figure 12: Puzzle blocks as seen in Lust level

4.1.4. Structural Objects

To build the seven levels, the team created a tile set that would form the basic building blocks for creating the shapes of the rooms within each level. The tile set included a floor piece, a ceiling piece, a basic wall piece, a wall with a door, and a wall with an inset window. From these basic pieces, each of our levels were created and then populated with environmental objects.

The wall pieces were created in a way that would allow them to be textured very easily, so the same wall tile could be used with different textures for all of the rooms in the levels. Additionally, the tile set pieces tiled perfectly with their textures, so it was easy to build large spaces. To break up the visibly repeating patterns, 2D decals were created that were then placed around the levels for variety, as well as placing environment and puzzle objects to create more visual interest.

Unique structural objects were built that were not a part of the tile set, to add variety to the spaces within *Pandora*. The pillars in particular allowed us to build spaces that included multiple levels, such as second floors in the same room and balconies overlooking more of the level.

4.2. Pandora's Mansion

Our game takes place entirely within the grounds of Pandora's house, which is a stately Victorian mansion. However, the geometry of the house is somewhat askew due to the release of the evils, each of which has infested a specific room or area. Some rooms are bigger than they should be, and the evils have damaged parts of each room, causing things like damp patches and scratches to appear on the floor and walls. In addition, the overflowing magical energies have caused a number of objects to become infused with a small amount of magic and begin flying around the rooms.

4.2.1. Greed

The sin of Greed infests the library, shown in Figure 13 where Bruce and Pandora have hoarded all of their knowledge. The books in the library are mostly concerned with the artifacts of ancient civilizations, such as Greece and Egypt. A few of these were penned by Bruce himself. However, hidden among the dry tomes of ages past is Pandora's collection of adventure and mystery books which she takes refuge in when she doesn't feel like dealing with Bruce. Greed manifests itself in this room as a series of platforms which Pandora must 'collect' by jumping on all of them.

Figure 13: The Greed level in the Library

4.2.2. Wrath

Wrath has hidden itself away in the cavernous wine cellar where Bruce keeps his spare portraits and busts of himself, in addition to the large casks of wine.

Wrath does not want to be seen by anyone and has blocked off the entrance to the wine cellar with a series of pits and obstacles. Inside the basement itself, Wrath has corrupted three of Bruce's spare obelisks and will only be calmed by combining the special wine crates with each obelisk and then moving each newly colored obelisk to its correct place in the center of the maze of wine crates shown in Figure 14. However, if an obelisk is offered the wrong colored crate, it will react violently and throw the crate across the room in its fury.

Figure 14: The Wrath level, in the basement

4.2.3. Gluttony

Gluttony has naturally taken up residence in the large dining room, where Bruce and Pandora were supposed to be entertaining their guests. The dining room is shown in Figure 15.

Figure 15: The Gluttony level

Gluttony has combined many of the objects in the room into a large gluttonous mass which must be broken up in order to reseal Gluttony in the jar. Pandora accomplishes this by moving the mass of objects around the dining room using the previously acquired powers of Greed and Wrath. Pandora must use these powers to push the mass onto special tiles on the floor that tear some of the objects away from the main mass of objects and reduce the overall size of the mass until there is nothing left.

4.2.4. Lust

Lust has infested Pandora and Bruce's bedroom, creating a mass of multicolored blocks in the middle of the room. In order to overcome the sin of Lust, Pandora must pull matching pairs of blocks from the mass and combine them to form one complete block. Lust will be vanquished when all of the blocks have been paired up. The general layout of the bedroom is shown in Figure 16.
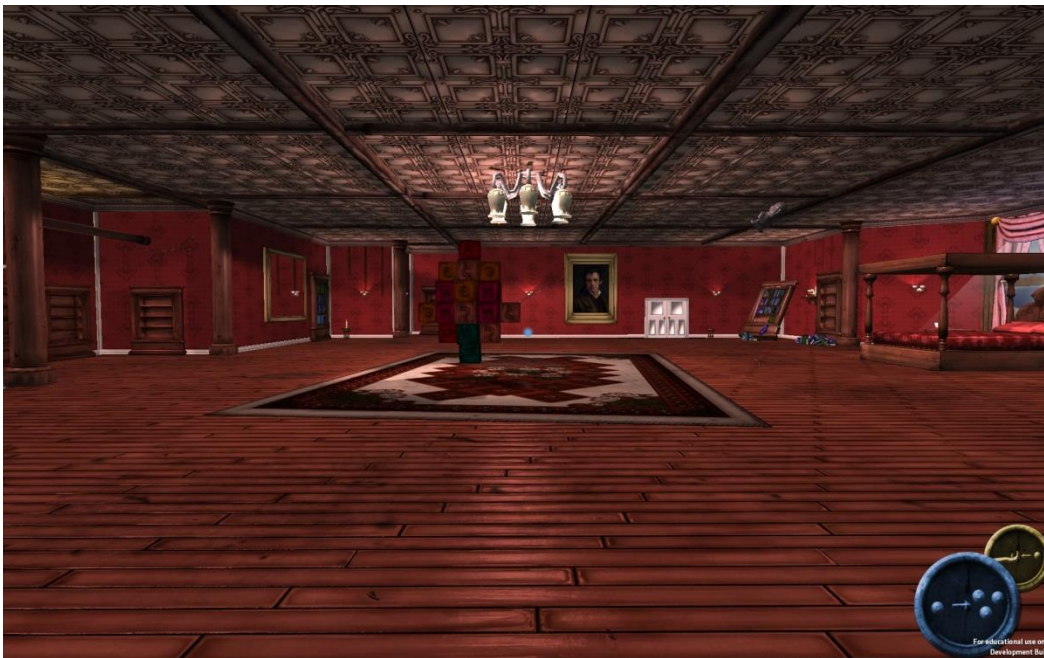
Figure 16: The Lust level in the bedroom

4.2.5. Envy

The sin of Envy has taken over the mansion's ballroom, shown in Figure 17, creating two vortexes that suck in nearby objects, including Pandora herself if she gets too close. Envy also constantly spawns blocks which are sucked into the vortexes. Pandora must find a way to navigate across the room and drop the room's skylight and cover the vortexes to seal away envy.

Figure 17: The Envy level, in the mansion's ballroom

4.2.6. Sloth

Sloth has fled to one of the mansion's gardens, taking up residence inside Bruce's favorite clock. Pandora must construct a ramp out of the materials lying around the garden and use it to bombard the clock with objects. This will restart the clock and force Sloth back into the jar.

4.2.7. Pride

The final sin, Pride, has infested Bruce himself, merging him with one of his statues and sealing him away in his study. Pride has the powers of all the other sins, just like Pandora herself at this point. Pride will use Greed and Wrath to throw objects at Pandora, create Lust blocks to deny Pandora access to her means of victory, spawn gluttonous masses to destroy the floor, and throw Envy and Sloth at Pandora to bring her to Bruce's statue and slow her down. Pandora must defeat Pride by first touching the portraits of herself to draw Bruce's attention to them and force him to remember who he was, then touch the statue itself to reaffirm her love for Bruce, which will cast out the sin of Pride and return the final sin to the jar.
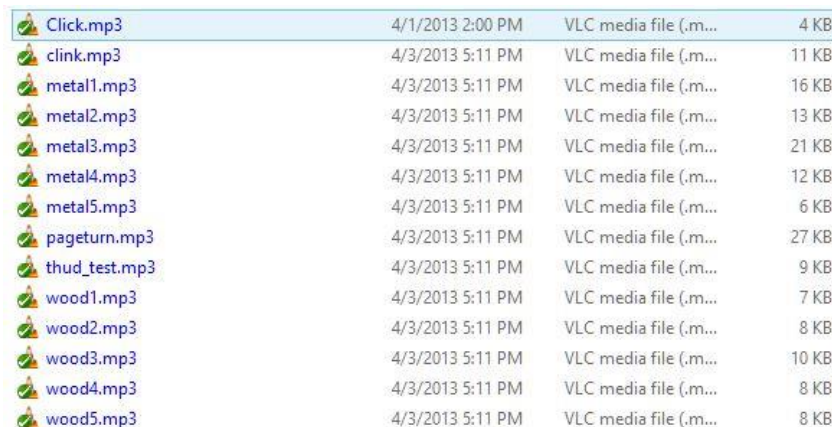
5. Sound Design

5.1. Ambient Music

To create a complementary soundscape that immersed the player in the Victorian era, it was essential for our team to implement unique ambient tracks into our game. Halfway through the completion of the project, we contacted another student who wished to compose music of his own specifically for *Pandora*. We had three meetings with the student overall, however the partnership eventually fell through. To remedy the situation, the team looked for open source music that could be placed immediately, but still fit the overall ambience of the Victorian era. A composer by the name of Kevin MacLeod from incompetech.com was found, and he had over four hundred suitable tracks to choose from. We determined that in order to create a non-repetitive and truly memorable soundtrack, seven overall tracks should be used, one for each sin, one for the main menu, and a final intense melody to capture the climactic finale.

5.2. Sound Effects

To create the sound effects for *Pandora*, the game includes a script that uses a very small number of sound files but plays a multitude of sounds for the player. This script takes in a base sound effect (Figure 18) that is indicated by what material a given object is made of. The script then alters the volume and pitch of the sound relative to the mass and velocity of the object. The sound effects were recorded in a simple foley set up.

Click.mp3	4/1/2013 2:00 PM	VLC media file (.m...	4 KB
clink.mp3	4/3/2013 5:11 PM	VLC media file (.m...	11 KB
metal1.mp3	4/3/2013 5:11 PM	VLC media file (.m...	16 KB
metal2.mp3	4/3/2013 5:11 PM	VLC media file (.m...	13 KB
metal3.mp3	4/3/2013 5:11 PM	VLC media file (.m...	21 KB
metal4.mp3	4/3/2013 5:11 PM	VLC media file (.m...	12 KB
metal5.mp3	4/3/2013 5:11 PM	VLC media file (.m...	6 KB
pageturn.mp3	4/3/2013 5:11 PM	VLC media file (.m...	27 KB
thud_test.mp3	4/3/2013 5:11 PM	VLC media file (.m...	9 KB
wood1.mp3	4/3/2013 5:11 PM	VLC media file (.m...	7 KB
wood2.mp3	4/3/2013 5:11 PM	VLC media file (.m...	8 KB
wood3.mp3	4/3/2013 5:11 PM	VLC media file (.m...	10 KB
wood4.mp3	4/3/2013 5:11 PM	VLC media file (.m...	8 KB
wood5.mp3	4/3/2013 5:11 PM	VLC media file (.m...	8 KB

Figure 18: Sound effects in the audio library

5.3. Narration

The narration and dialogue in *Pandora* come in the form of Pandora's internal thoughts as she explores her mansion and approaches the different puzzles she comes across. *Pandora*'s narration was utilized in several ways, including to reveal more of the backstory and current plot of the game, and to give hints and tips for the puzzles. The dialogue was divided into these 'driven' and 'casual' pieces when recording.

One of the team members provided the voice acting for Pandora, which was recorded and then implemented in-game. The dialogue dependent on location, such as a hint to a specific puzzle or a comment about something that Pandora sees, is triggered and played when the player enters a certain area. Some of the dialogue is not tied to one location, and is played randomly depending on which level Pandora is exploring and how long it has been since the player has last heard a piece of dialogue.

5.4. Ambient Music Manager

In order to fluidly switch between ambient music tracks found in every level of *Pandora*, we developed a simple lightweight component. The manager acts as one static class that polls the current level that the player is on. If the player completes or restarts a level, the ambient music manager tells the next level to load in the background. While the background task is running, the manager continues to play the same track during the loading screen in order to prevent large pauses of audible feedback. While the loading screen is being displayed, the next audio source for the loading level is currently streaming so that the instance the player is transported to the next scene, the new ambient track is played without any hesitation or noticeable loading times. The ambient music manager as a whole fits into our other managerial schema for other sound sources which will be explained further in the upcoming sections.

5.5. Sound Effect Manager

The sound effect manager is a script that was created for *Pandora* which allows the game to incorporate a wide range of sound effects without having to include a large number of individual sound effects. Whenever an object would produce a sound effect, such as a teacup falling on the floor, the sound effect manager starts with the base sound effect from the object's material, and modifies this sound based on the specific object's mass, and the velocity with which the object is moving when it makes the sound effect. This allows the game to present a large number of different sound effects when there are actually only a few base sounds files. In order to incorporate the sound effect manager into a scene, it must be placed on a game object and placed in the scene in the editor, as shown in Figure 19.
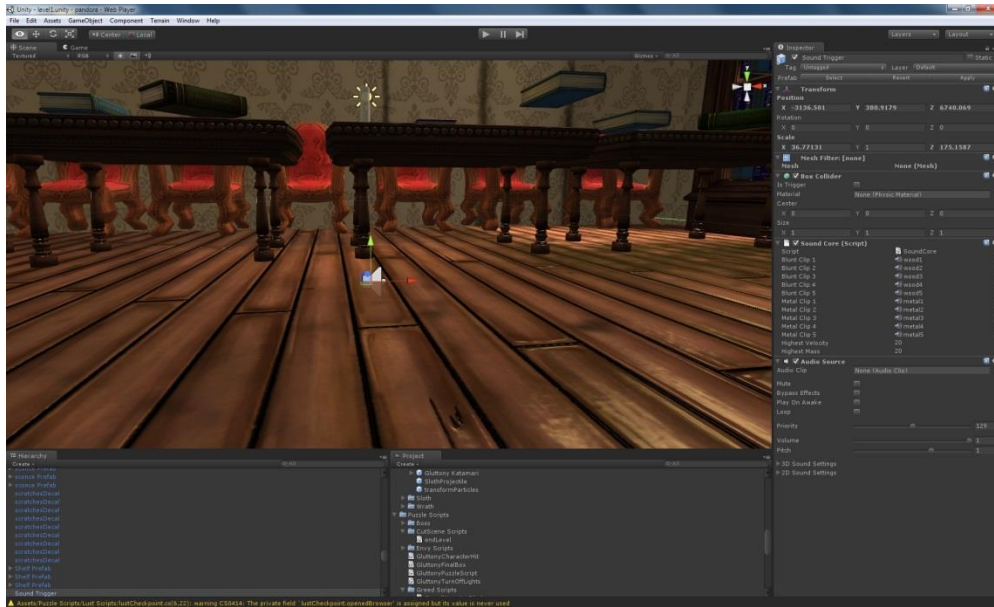
Figure 19: The Sound Effect Manager in the Unity Editor

5.6. Dialogue Manager

The dialogue manager in *Pandora*, whose high level code can be found in Figure 20, is used to store and keep track of all dialogue clips that are playable throughout the game. The dialogue manager had two main goals. The first goal was to create one portion of dialogue that could be randomly played at any time throughout a current level. The thought process behind this type of dialogue was to keep the player immersed into Pandora's thoughts throughout the completion of a puzzle. The other portion of dialogue had to be triggered explicitly by the player by walking in a specific area or interacting with a special object. Dialogue triggered in this fashion was created to give immediate feedback to the player in order to obtain information about the current puzzle. The second goal of the dialogue manager was to save the progress of dialogue in a given level, preventing the same dialogue from being triggered more than once. To accomplish these two goals, the dialogue manager keeps a running generic dictionary of all the dialogue clips available to the player. The dictionary data structure works by keeping a list of information segregated by two terms, the "key" and the "definition". Each dialogue clip has a name and associated Boolean variable, either true or false, which determines if the clip has been played. If a player enters a zone that has a statically placed trigger, the trigger will notify the dialogue manager, change the given clip's entry in the dictionary, and prevent the clip from playing repeatedly.

```
public void OnTriggerEnter(Collider col){
    if(dictionary.ContainsKey(col.gameObject.name) && !a2.isPlaying){
        if(!dictionary[col.gameObject.name]){
            a2.clip = ((AudioClip)Resources.Load("Dialogue Clips/" + col.gameObject.name));
            a2.Play();
            dictionary[col.gameObject.name] = true;
        }
    }
}

public void playRandomDialogue(float seed){
    if((seed == 0 || seed == 1) && !a2.isPlaying){
        if(Application.loadedLevelName.Equals("Level1")){
            if(seed == 0 && !dictionary["Clip-13"]){
                a2.clip = ((AudioClip)Resources.Load("Dialogue Clips/Clip-13"));
                a2.Play();
                dictionary["Clip-13"] = true;
            }
            if(seed == 1 && !dictionary["Clip-14"]){
                a2.clip = ((AudioClip)Resources.Load("Dialogue Clips/Clip-14"));
                a2.Play();
                dictionary["Clip-14"] = true;
            }
        }
```

Figure 20: The high-level code for the Dialogue Manager

6. Interactive Storytelling Methods

Because integrating the story of *Pandora* was one of the main project goals, several methods of interactive storytelling were used to drive the narrative over the course of the game. First, a comic-like sequence of storyboards was used to introduce the player to the narrative before they were put into the game world. Within the game, interactive scrolls provided information about the mechanics and the story to the players. Driven and casual dialogue provide insight to the story and to Pandora's thoughts, and camera "matinee" cuts scenes direct the player to story and puzzle elements that are important.

6.1. "Storyboard" Cut Scenes

To introduce the setting and story at the start of the game, a series of drawn storyboards was shown as soon as the game begins. Across several panels in the storyboard format, the backstory of Pandora and Bruce is shown, as well as the immediate events that lead to Pandora opening the Greek jar that contains the seven deadly sins and spurs the events of the game.

This method of storytelling showed the story up front to the players, rather than telling them about it through text. The drawn stories also echo the overall style of the game, which is semi-realistic with a drawn or sketched ink style and painted colors, as shown in Figure 21.

Figure 21: One of the panels of the starting narrative cut scene

The conclusion of the story, after the player beats the final boss, is also presented as a storyboard cut scene, revealing the aftermath of the events of the game. In the final cut scene, Pandora has been successful in capturing the Sins back in the jar, and has rescued Bruce from being infected by the sin of Pride. They happily reunite, and they are safe from the threat of the sins, which have been safely sealed back in the jar with no hope of accidentally opening it again.

6.2. Information Scrolls

In addition to Pandora's dialogue as a method of storytelling and learning, each level contains several scrolls that the player can read. These scrolls reveal more of Pandora's story and thoughts, as well as information on the powers and tips to the player about solving the puzzles presented to them. When the player hovers their mouse over the scroll, a dialogue box appears at the bottom of the screen with text that they can read about the story or puzzles. An example of the information scrolls is shown in Figure 22.

Figure 22: One of the information scrolls in *Pandora*

6.3. Driven and Casual Dialogue

Story moments are provided to the player through spoken dialog in addition to the scrolls and cut scenes. All of the narration had to come from Pandora, as she is the only character in the game until the player encounters the Pride-consumed Bruce. All dialogue that is present in *Pandora* can be found in

Appendix C: Dialogue Asset List. However, this narration would fit the game world more naturally if presented in a semi-reactive manner rather than a completely prescribed fashion.

The "driven" dialog is triggered when the player walks into specific trigger areas in each level. This then prompts Pandora to comment on something nearby or provide a hint to a puzzle. Some of these triggers are unavoidable and are placed directly in the essential path through the levels. For instance, the player cannot ascend the floating blocks in the library without triggering Pandora to muse that there were previously stairs there. However, some of the pieces of driven dialog are in side-areas, outside of the essential path. These are still triggered when the player moves into a particular area, but they will not necessarily find these areas. This allows the player to get feedback and entertaining commentary of vignettes set up throughout the mansion to add an element of environmental storytelling to the experience. One instance of this also takes place in the library. The player may find the bookshelf that has had its contents poured out upon the floor (Figure 23). If they do, Pandora will quip that "someone's not getting invited to the next party!" These pieces of dialog are not essential to the overarching story, but simply reward the player's curiosity.

Figure 23: "Someone isn't going to get invited to the next party."

To supplement the driven dialog, we also implemented "casual" dialog. These moments of dialog can happen at any point in a level, and are only meant to entertain the player. These are triggered by a script playing at a random time in the level, giving an element of variability and randomness to the player's experience. Pandora will comment on the general setting of each level in these lines, often in a lighthearted or observational manner. We had to ensure that these lines did not contain any

information that is essential to understanding the story since they may not play at all during a level. They simply add more flavor to the story, and provide further glimpses into Pandora's character.

6.4. Camera Cut Scenes

To advance the story and plot line of *Pandora* explicitly, we introduced the notion of a camera cut scene which takes away control of the player's camera for a short time. The cinematics found in *Pandora* serve only to aid and educate the player, and completely refrain from supplementing player action. This important methodology keeps the immersive aspects of a game, while adding dynamic narration and instruction without explicit text or sound.

To facilitate the creation of several cut scenes found in each level of *Pandora*, a tool was created named Unity Matinee. The inner workings of Matinee stem from adding explicit cameras to each unity scene. The placed cameras are then eased together, transferring from one camera to the next when the previous camera reaches the position of the next camera in line. There are multiple parameters of the Matinee tool which can be altered at any given time including overall movement speed, ease speed, as well as camera switch distance. The Matinee toolset is also set up so that the current camera and its distance can be polled allowing certain events to be triggered at any given time as shown in Figure 24.
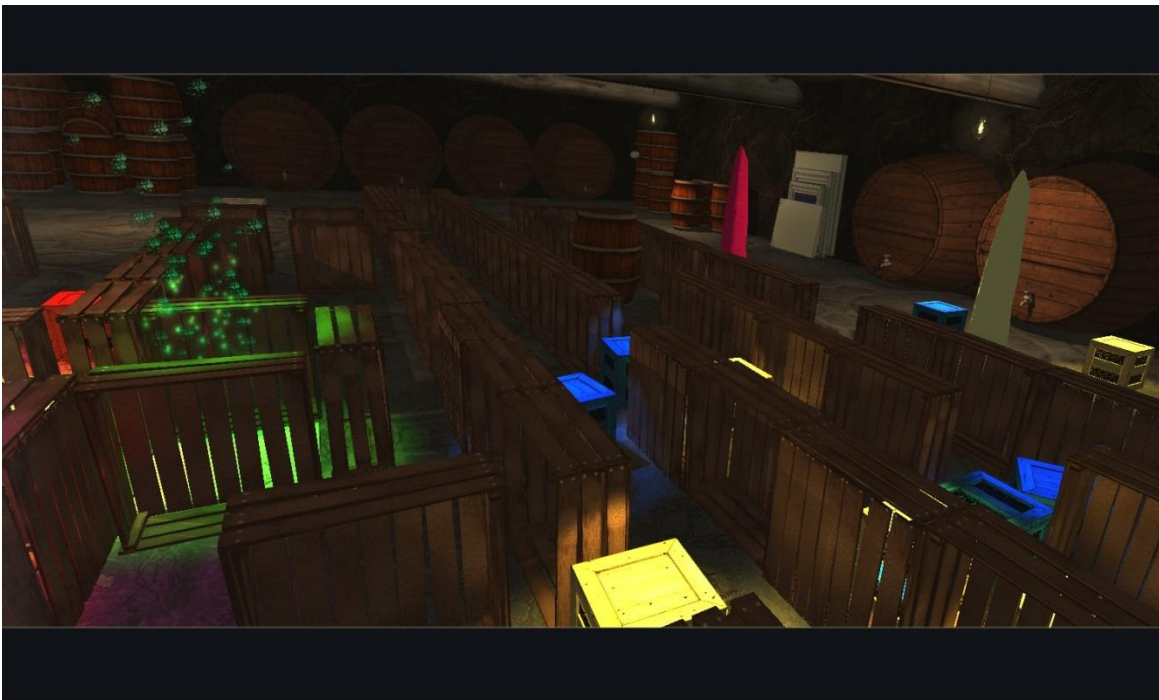
Figure 24: A letterboxed "matinee" cut scene to differentiate from gameplay

The final feature of the Matinee tool was its overall ease of use. Since design control was given to all members of our team, we wanted to be able to have all four members use Matinee without any involved coding. At any point, the entire Matinee functionality can be started with just one function call, and due to variable sized parameters, can also be adapted to use any number of cameras.

One problem our team faced with the implementation of the Matinee system was the frame rate reduction that occurred with five to six new cameras rendering in each level. To remedy the situation, certain plugins were given to Matinee allowing custom culling masks to be applied. These culling masks made sure to stop rendering any unnecessary models when the camera was not currently active. Although this fix did not totally reduce all frame rate issues, the Unity Matinee tool was extremely instrumental to easily implementing all camera control functionality in *Pandora*, as well as an effective device for overall storytelling.

7. Testing and Evaluation

For any game undergoing serious development, there is a need for definitive concrete results. Although hard data is difficult to acquire in the world of game development, our team attempted to create a very objective questionnaire which would give real feedback on our design decisions. At the beginning of D term 2013, we created a form on Google Docs (found in Appendix D: Tester Feedback Form) which our game testers could fill out in order to give the team solid feedback and direction.

7.1. Preliminary Testing

Two days before the "Made in MA" party on March 21, 2013, our team sent out a link to a demo of *Pandora* which included two levels from the actual game. In the subsequent 24 hours, we received over 30 questionnaire responses and close to 200 downloads. Sorting through all the responses, we found tens if not hundreds of bugs, most of which were graphical that needed to be fixed. In addition to all the cosmetic defects, most testers who filled out the open response questions really cited our lack of controls and instructions. Our original idea was to put all of the control information in scrolls that the user could look at in game. However, it was very clear that this information was not being conveyed and another approach had to be taken to easily inform the players of the controls.

Another really important piece of feedback we received was the tediousness of the tutorial level. Although the tutorial level was supposed to be a simple introduction to the game, controls, and art style, many users became frustrated with the platforming and simply gave up. All of the responses were incredibly useful as our team was very familiar with *Pandora*, and our preconceived notions blinded us at times to real gameplay problems.

7.2. Made in MA & PAX East

At both the Made in MA party, and the showcase of our game at PAX East, we knew *Pandora* would get a large number of players. Our preliminary testing yielded 17 major bugs that we needed to take care of before these two events, therefore, we worked diligently in order to apply damage control and bandage up the gameplay issues. Over the next four days, we received close to 200 more testers of the same demo we released in the preliminary testing. Most of the issues were fixed after the first round of testing were patched appropriately as we saw no recurring problems from the first round of testing. In addition, we received accolades at both Made in MA and at PAX East that our art style was well done and unique, and that it was refreshing to see the actual model of the main character in a first person game.

7.3. Testing Round Two

The second round of testing took place two weeks after PAX East, giving us a chance to evaluate on the changes we made in the intervening time. For each case in this round of testing, a member of the development team sat with someone outside the project as they played through two levels of *Pandora*. The team member took notes while observing the person play, and only offered hints when absolutely necessary. At the end of the two levels, the person was directed to the same questionnaire as the first round so that they could self-report their experience playing *Pandora*.

Players were able to figure out what the goal of each puzzle was within roughly a half-hour. This was due in part to the highlighting of objects when they are under the cursor. We also found that, despite our initial comparisons to *Portal*, *Pandora* actually plays closer to games like *Myst* (Figure 25) in that each puzzle requires some experimentation before the player figures out exactly what they need to do to solve that puzzle.

Figure 25: Screenshot from *Myst*
(https://upload.wikimedia.org/wikipedia/en/d/d0/Myst-library_and_ship.jpg)

7.4. Evaluation of Our Goals

Based on feedback from both rounds of testing, we found that overall more people wanted to play more of *Pandora*, and more people than not agreed that the game was entertaining. Unfortunately we found that most people neither agreed nor disagreed with the statement 'This game had an interesting story'.

While it seems that we succeeded in making an entertaining game, we have failed to create an exceptional story.

8. Postmortem

8.1. Ryan Casey

I worked on *Pandora* in two primary roles.

First, I was one of our artists. I primarily created 3D assets based on Jill's art style. This ranged from basic floor tiles to sculpted busts used as decoration. I also rigged and animated our main character, Pandora. Further, I designed and implemented the user interface and HUD for *Pandora*.

Second, from C Term onward I was also in charge of maintaining our online presence, and ensuring our presence at the MassDigi Game Challenge, Made in MA, and PAX East. I posted regular updates to the various social media outlets that *Pandora* was on, contacted press in regards to *Pandora*, and took care of the organizational issues of getting ready for the events we attended. I designed the promotional materials used for *Pandora* as well (posters, logo, website, etc.). Finally, I calculated our development budget and organized our upcoming Kickstarter campaign.

I am extremely pleased with *Pandora*. From initial concept to current state, we have worked together as a team efficiently, and we have reached nearly all of our initial design goals. This is thanks in large part to the amount of time dedicated purely to designing *Pandora* (nearly all of A Term) before ever creating a single asset. I am validated in these views by the overwhelmingly positive response we have received both from players and press.

Ultimately we could have done two things better in developing *Pandora*. First, we should have started testing earlier than we did. The feedback we got was useful, but, if we had done extensive testing prior to PAX East, *Pandora* could have been even more impressive than it already was. Second, we could have formally prepared for the marketing/business aspect of taking *Pandora* beyond being a simple MQP. None of us have any formal training in marketing, business, or entrepreneurship. Had we more accurately predicted *Pandora*'s future, we could have taken a class or studied these subjects instead of learning them as we went.

8.2. Michael Frankfort

In *Pandora*, I first and foremost, was a gameplay programmer. Alex and I programmed all of the puzzle logic, along with many other modules that are integral to *Pandora*'s polish such as the Matinee system, the dynamic difficulty system, and the sound and dialogue managers. Although I had done plenty of programming for *Pandora*, I also played a large role in the physical design of *Pandora*'s mansion. For the

first time on a large scale project, I had accomplished a large amount of design work, whether it was physically building the walls and architecture of the levels or carefully placing individual art assets through a room to tell a story.

Our team as a whole I felt was extremely strong, in the fact that almost everything we planned to do at the beginning of the year was accomplished. Our four-person team, although a fairly small group in terms of game development, was able to produce so much quality work because we all had extreme passion for making *Pandora* a real, immersive experience. The overall group dynamic was really put together well; we all had very different personalities but respected each other's opinion. At no time during the creative process did I feel my ideas, or anyone else's were being pushed ahead of others, which really allowed *Pandora* to flourish. My favorite aspect in developing *Pandora* was that each member got to wear many different hats which allowed each one of us to learn new things. Towards the end of the development cycle, I could do simple art tasks without having the artists help and the artists could edit a script to integrate some of their assets.

Looking back, the only element of our project that I wish we could have done better was improvement on user testing. Our schedules that we made after every term always listed alpha and beta testing as important deadlines, but when push came to shove, we never really aggressively started testing until the end of C term. Once we started the testing it was extremely useful, and we found tens if not hundreds of bugs that we wouldn't have found otherwise. I couldn't help to feel that if we really started our user testing when we planned to, our puzzles would be even more polished and the user experience of *Pandora* would be even better than its current state.

Simply put, I am extremely proud of my team's work. Our deadlines were always met, the suggestions from our advisors never went unnoticed, and most importantly, we all had fun designing, developing and polishing our major qualifying project.

8.3. Jillian Sauer

My main role in *Pandora* has been as an artist, in whatever capacity we needed. At the beginning of the creation of *Pandora*, I made traditional ink concept sketches of Pandora as well as the environment, which ended up being the inspiration for the overall look and artistic style of the game: hand-drawn ink and sketchy lines. I sculpted, UV mapped and textured Pandora, the main character of the game and the only true character model we have. I also modeled, mapped, and textured a large number of the environmental objects and puzzle objects in the world of *Pandora*. In addition to texturing in Photoshop,

I also created the wallpaper patterns and the digital paintings of Bruce and Pandora that are seen in frames throughout the game.

Overall, I think the development of *Pandora* went very well and I am proud of what we have accomplished over the four terms of working on our game. Our team has gotten along well from the first meeting we had, where we discussed our initial ideas and came up with the concepts that would become *Pandora*. We did a lot of initial planning, which seemed very time consuming at the time, but the thought we put into the design of the game is reflected in what we have now in the final stages of the project. All of the decisions around *Pandora* were made together, with lots of discussion with the whole team; we all put in a huge amount of effort and thought into our work, and I hope the finished game reflects this.

If we could go back and change anything about the development process of *Pandora*, I would like to start testing earlier, even before we had all of the art assets in the game. We could have sorted out some of the gameplay and puzzle issues earlier in the process if we had started testing earlier; in addition, this would have allowed us to iterate further on the designs of the puzzles, which make them even more polished and fun. As they stand, the puzzles are good and the player feedback we got was invaluable; it would have been nice to start earlier and get more of it!

I am proud of my personal achievements and contributions to the game, and I think that our work truly is a capstone to our four years at WPI and shows off all that we have learned and accomplished. I am excited that we are taking the game beyond the scope of WPI and working on releasing it after graduation.

8.4. Alex Thornton-Clark

My primary role in *Pandora* was as a programmer. Michael and I worked together to create all of the puzzle logic, the power effects, and several things we added to extend Unity such as the dynamic difficulty and sound manager. I also contributed to the design of several of the puzzles and powers. In addition, I had a hand in some of the level design.

Pandora has come out extremely well, and I am honestly surprised how popular it has become. I knew from the start that we were making a good game, but I never expected that we would be able to continue developing our MQP into a commercial product. I would credit this to how well our team worked together and was able to play off each other. Each of us was always able to bring something

useful to our discussions and our skill sets combined to create what turned out to be a great game. I would be remiss in not also thanking our advisors here since their input was always helpful.

Since I come from more of a computer science background than my teammates, my favorite part about working on *Pandora* has been contributing to a surprisingly strong technical side of the project and seeing how complex the technical elements could get in a game that seems fairly simple from the outside. Michael and I managed to fit in a dynamic difficulty system, seven unique puzzles with their own logic, and six physics-based powers, among other things, into a game that already has amazing art thanks to Jill and Ryan.

In terms of process, I think we owe a lot to the fact that we spent most of A term on pure design instead of spending time creating assets that might not have appeared in the final product. This time spent on design meant that we knew exactly what we were supposed to do once we started implementing parts of the game.

The problem with our process was that we did not truly start testing until more than halfway through the project. If I could do this project again, I would want to start testing as soon as we had made puzzle prototypes. The feedback from this would have allowed us to configure the puzzles so that we could ensure that the player was having fun as much as possible. Despite our late start on testing, the feedback we did get was very helpful in finding bugs and tweaking the puzzles so that they could be even more polished.

Overall I am very proud of *Pandora* and the fact that I was able to meaningfully contribute on such a strong team to create such a strong product. It is definitely a worthy culmination of our work at WPI and I am excited to think of where *Pandora* can go in the future.

9. Promoting *Pandora*

9.1. Events & Competitions

From the inception of *Pandora*, one of the primary goals was to submit to the Independent Games Festival (IGF). That goal helped drive *Pandora* into something that we felt was truly unique and worthy of recognition at such events. However, IGF was more of a long-term goal, as submission doesn't open until late 2013. However, as development continued, *Pandora* was submitted to more immediate competitions and events.

The first of these events was the MassDigi Game Challenge (Figure 26) on March 2-3, 2013. The Game Challenge was hosted at Microsoft NERD Center in Cambridge, MA and allowed indie developers and college teams to pitch their game to a crowd of fellow developers while receiving feedback from locally known figures in the games industry. We were the first WPI team to participate in this event, so we went in with little precedent. The Game Challenge was ultimately extremely useful to *Pandora* in two ways. First, our pitch was honed to a concise, attractive sound bite that would later be used at PAX East and other events. Second, the mentors provided excellent feedback on *Pandora* itself, refining the game even before starting widespread testing. Ultimately, we came away from Game Challenge with the Honorable Mention in the College level.

Figure 26: *Pandora* with other winners of the MassDigi Game Challenge

Following Game Challenge, Penny Arcade Expo (PAX East) and the Made in MA party, both game development shows hosted in Boston that allow players to see upcoming games, became the next major milestone. *Pandora* was selected as one of four MQPs that would be shown at WPI's booth. Again, we were in uncharted territory, as WPI had never had a booth at PAX East. We further refined *Pandora* for a simultaneous start in testing and PAX East demo. The PAX East debuted on the *Pandora* website (www.backinthebox.net) a day before the Made in MA party. Following initial feedback from testing, we made some last minute tweaks and were ready for Made in MA and PAX East. Made in MA served as an invaluable PR opportunity for *Pandora* as developers from around the country played our game and talked to us. Our prominent position in the Student Showcase further drew players to try our game, and eventually we came in second place in a popular vote for the best game in the Student Showcase. The following day, *Pandora* was shown at the WPI booth at PAX East. During the PAX weekend over 200 people played *Pandora* (Figure 27). This event served a dual purpose of providing player feedback and of promoting *Pandora* in a very direct, tangible way. Players could finally try out the game. Foldable "puzzle cubes", which included a QR code that pointed to the *Pandora* website, were given to visitors of the WPI booth, and were particularly successful. These helped *Pandora* stand out as a creative game in players' minds. The feedback from PAX East solidified the decision to take *Pandora* beyond a WPI project and to a commercial release.

Figure 27: *Pandora* set up at PAX East

We plan to submit *Pandora* to the Boston Festival of Indie Games (Boston FIG) and in IGF following completion of *Pandora*.

9.2. Social Networks & Online

In order to spread the word about Pandora, it was essential to create an online presence. This started with a simple website (Figure 28) and a trailer on YouTube. Within one month that particular trailer had been viewed nearly 1,000 times, and there is a second trailer with just as many views. We distributed this trailer only on our own site and on the Reddit indie gaming board (http://www.reddit.com/r/IndieGaming). We created a Facebook page and a Twitter account shortly after the relative success of the trailer. Regular updates to both services and our site drew further attention to our game, readying us for a future commercial release.
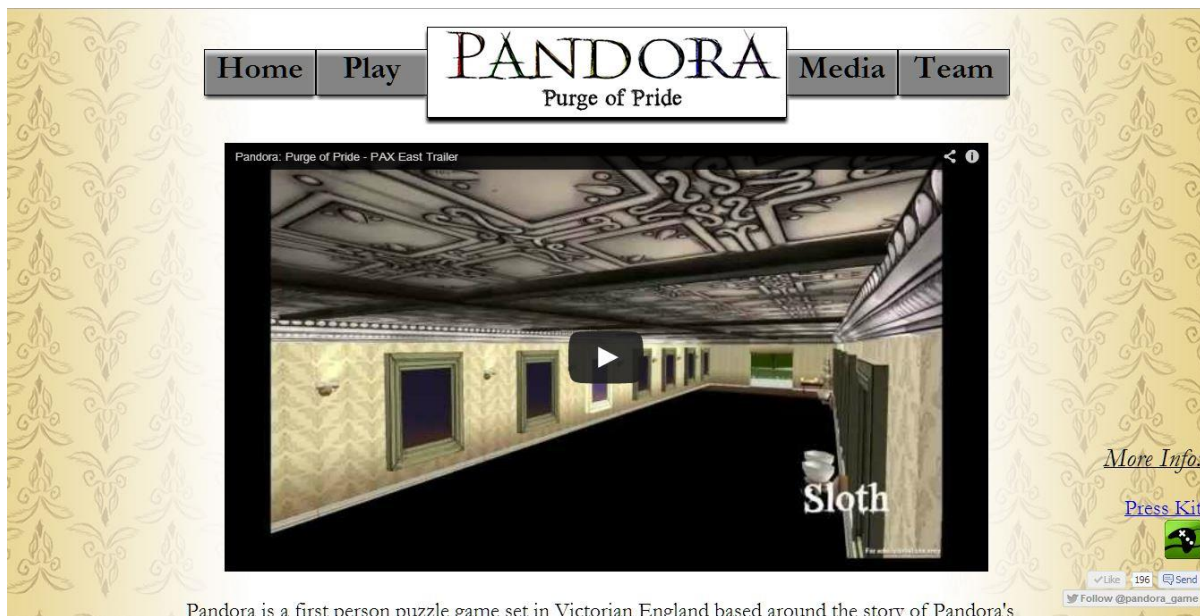
Figure 28: *Pandora*'s web site

A brief experiment in online advertising was held in anticipation of a commercial release. Two advertising campaigns were set up: one on Facebook and one on YouTube. With a roughly equivalent sum spent on each campaign, the YouTube campaign proved to be a much more efficient method of advertising. Our Facebook ad was viewed by about 6,000 people, but only lead to 30 page likes, whereas the YouTube ad was viewed about 4,000 times and lead to 250 clicks through to our site. This data will inform the full-scale advertising budget once *Pandora* is released commercially.

Further, *Pandora* started receiving press coverage as soon as we entered in the MassDigi Game Challenge. A handful of sites covered *Pandora*, but a formal press release was written and sent to press outlets prior to PAX East that was picked up by sites as prominent as Gamasutra. *Pandora*'s appearances

at Made in MA and PAX East also facilitated conversations with games journalists that led to further coverage.

In addition to the success of all of these promotions, IndieDB (www.indiedb.com) proved particularly successful (Figure 29). IndieDB's indie-focused community was very welcoming to *Pandora*, and within one day it had breached the top 100 games on the site, and the company page was the third most viewed on the site for a day. IndieDB was also useful thanks to their partnership with Desura (www.desura.com). Desura is a digital distribution website that allows game developers to sell their games to a marketplace of indie game fans. Thus, *Pandora*'s IndieDB page could easily be changed into a Desura store listing, allowing players to pre-purchase our game with no cost to us.

Figure 29: *Pandora*'s page on IndieDB

10.   Conclusion

Ultimately, most of the *Pandora: Purge of Pride* project goals were achieved. Originally, the design called for seven distinct levels with each corresponding to one of the Seven Deadly Sins. The final build contains all seven of the originally planned levels. In connection with these levels, the design called for an art style which is unlike any other MQP thus far. The art assets have been hand-painted following our concept art, and the color palate of each level corresponds to the Sin the player encounters in that level. Pandora, herself, is one of the most detailed art assets fitting her role as the protagonist of the game. The art style is used on Pandora as well as the rest of the assets. Pandora was portrayed as the protagonist and, more importantly, counter to gender stereotypes in video games, which fulfills one of the original design goals as well. The story incorporates Pandora, the Sins, and other elements in order to convey an interactive narrative. However, in initial testing, the story was not as well received by players as initially hoped. Further storytelling methods have been incorporated into the final build, but that build has not been tested as extensively. Nonetheless, the majority of the original goals have been met, and *Pandora* can be considered a successful MQP. Future MQPs should devote more time to playtesting their games in a scientific method. The earlier the testing begins, the more useful the feedback they receive will be. In addition, successive MQPs can inspect the storytelling methods in *Pandora* and evaluate how suitable those methods are for their own projects.

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Appendix A: Game Design Document

Pandora Game Design Document

Ryan Casey, Mike Frankfort, Jill Sauer, Alex Thornton-Clark

11.1. Introduction

A Victorian woman, Pandora, discovers a mysterious box during a party for her husband. She opens the box and unleashes the evils of the world into their mansion. Using Hope, the only item left in the box, she must solve puzzles and recapture the evils she set free. Players will experience the transformative power of the released evils through the eyes of Pandora. Each tribulation will yield a new ability which can manipulate objects in the mansion in a unique way. Once all of the evils have been cleansed, Pandora must combine all of her acquired powers to free her trapped husband from a golden statue which has manifested from decades of excessive Pride.

11.2. Project Goals

We would like to make a game that is engaging, entertaining, unique and worth playing more than once. We will achieve this by various methods.

First we will center the game around Pandora. She will be a strong, likeable, and (most importantly) not-clichéd female lead to our game. We will avoid the problems that so often plague female game characters, and we will make her interesting in her own right by revealing more of her story as the game progresses, changing her as she faces the challenge before her, and making her an integral part of the game as a whole beyond simply being the player character. We will also be conscious to avoid making her nothing more than a stand-in for a character that could just as easily be male.

In regards to the story of the game, we will "show, not tell". We will embed the story into the game world as much as possible, avoiding cutscenes and other non-gameplay exposition. This will come both from the level design, but also from the audio design. The music will be accurate to the Victorian setting, but will change to match each evil's level.

Finally, we aim to make a game that stands out visually from other games, particularly other WPI-produced games. We will use a series of references to inform our visual design. However, we will not directly copy any one of these references, as we would like to keep our game truly unique. We have settled on a visual style that will use pen and ink drawings and a paper texture on top of any normal texturing techniques to achieve this unique style. To accentuate both the ink and the paper we will use subtle coloring on the textures.

To achieve the level of quality we want from all of these aspects we must commit sufficient time to the design and testing phases of development. We want to avoid the trap that most WPI projects fall prey to of only focusing on the content-creation phase of game development.

11.3.

Player Character

Overview:
The main player character is Pandora, a Victorian-era noblewoman whose husband is an international explorer. Pandora is quick-thinking, brave, curious, and will stop at nothing to achieve her goals once her mind is set.

Pandora opens the jar containing the seven evils at the start of the game, and must return the evils back to the jar in order to prevent them from spreading throughout the world and wreaking havoc. As she returns each evil to the jar, she gains a power associated with that evil to use in capturing the subsequent evils.

History:
Born to a wealthy family, Pandora is an upper-class Victorian woman and has been her whole life. As part of her upper class upbringing she was exposed to a great amount of history and literature through her studies, which fostered her curious nature. When she came of age, Pandora married a well-to-do businessman and explorer, Bruce. Despite their common interest in history, Bruce's frequent trips around the world on archaeological expeditions left Pandora home alone for several months at a time. Additionally, Pandora finds Bruce's haughty attitude and boasting grating; however, she still loves him and enjoys the treasures and stories he always brings when he returns.

Pandora follows the role of Victorian wife when Bruce is home in England, helping organize the parties in his honor. However, the freedom she has when he is not there helps her curiosity and wit grow, and she is very capable of solving problems and thinking her way through unexpected situations.

Powers:
At first, Hope is the only power Pandora has, as it is the only item left in the jar of evils she unleashed. As Pandora solves puzzles and traps each evil back in the jar, she gains the powers associated with that evil, as listed below.

Hope:
Hope is the only thing left in the jar, and is Pandora's first power to use to capture the evils she has released. Hope's abilities are "Transforming" and "Uplifting." The Transforming aspect of Hope allows the player to reset the level in case he feels stuck, or wants to start the puzzle from scratch. The Uplifting part of Hope allows Pandora to jump higher than normal to reach greater heights and cross greater distances when jumping.

Additionally, Hope unveils hints about the puzzles or Pandora's environment when triggered specifically for that purpose by the player, in case the player is stuck within a puzzle and cannot proceed. Pandora has these powers immediately after she opens the box, and she keeps the powers over the course of the game.

Unlike the other powers, Pandora cannot overuse and lock-out the Hope power, so it does not have an exaggerated state or a cool-down period.

Greed:
Pandora receives the Greed power after she completes the first set of levels, conquering the Greed-related levels and final puzzle to recapture Greed. The Greed power allows Pandora to pull a selected environmental object towards her.

When used over abundantly, the Greed power becomes exaggerated such that the objects Pandora tries to draw towards her increase in velocity until they are hurtling towards her, possibly colliding with her and pushing her back. After a cool-down period of time, the Greed power returns to its normal baseline settings.

Lust:
Pandora earns the Lust power after solving the Lust level puzzles and final puzzle, and Lust has been purged and returned to the jar. The Lust power allows Pandora to select two objects and attract them to each other, causing them to stick together. Only a limited number of pairs of objects can be magnetized together at a time with Lust; after Pandora reaches the limit, the pairs fall apart.

When overused, Lust causes the two selected objects to speed towards each other until they collide and stick together. At higher levels of Lust the objects have a chance to just bounce off of each other and not actually stick. Eventually Lusts' power returns to normal.

Sloth:
Pandora gets the Sloth power after she has conquered the Sloth levels and related puzzles, and the sin of Sloth has been captured in the jar. The Sloth power allows Pandora to slow down time on a selected object for a short period, meaning that the object falls slower and has a diminished effect from any other powers Pandora uses on the object.

When the player overuses Sloth, Pandora herself also gets affected by the time-slowing properties of the power, meaning that she moves slower and falls slower until the power wears off of the object. Sloth's effect returns to normal after a cool-down period.

Gluttony:
The Gluttony power comes to Pandora after Gluttony is captured in the jar, at the end of the Gluttony-themed puzzles and levels. When Pandora selects an object with Gluttony a duplicate of the object is created adjacent to the original. The duplicate is exactly the same as the original and can be affected by Pandora's powers just like the original.

Overuse of Gluttony causes more than one duplicate object to be created from the original. This effect only lasts for a little while, and then Gluttony will only create a single duplicate again.

Wrath:
Pandora acquires the Wrath power after solving the series of Wrath-related puzzles and trapping Wrath in the jar. Wrath has the opposite effect of Greed, namely it allows Pandora to select an object that is then pushed away from her.

Similar to Greed, overusing Wrath increases the force it applies to objects, meaning that they speed away from Pandora instead of being gently pushed. Wrath also requires a cool-down period before its effects return to normal.

Envy:
The Envy power is given to Pandora after she solves the Envy level puzzles and returns Envy to the jar. When Pandora uses Envy on an object, Pandora herself is pulled towards the object, allowing her to cross large gaps by using Envy to pull herself to an object on the other side of the gap.

As Pandora overuses Envy, she flies towards the object faster. As with Pandora's other powers, Envy returns to normal after some time.

Pride:
Despite being released from the jar along with the other powers, Pandora does not actually get a power related to Pride, as Pride is the last evil that Pandora needs to return to the jar. Returning Pride to the jar completes Pandora's tasks and she loses her other powers.

Plot

Overview:

Pandora is a woman in Victorian England, married to one of the world's greatest explorers and archaeologists of the time. To celebrate her husband's most recent return and the discoveries that he has made, Pandora hosts a great party. While getting ready, she discovers a box of artifacts she has never seen before, including a beautifully painted Greek jar. Curious, she opens the jar, and unleashes a host of evils, which take the form of the seven deadly sins: greed, lust, sloth, gluttony, wrath, envy, and pride. The evils corrupt everything they touch within the mansion, distorting reality and infecting every part of the house.

Pandora takes it upon herself to capture the evils back into the jar, as she was the one who had unknowingly opened it. The only item that remains the jar is Hope, which is the first power Pandora has to use to capture the seven evils. Hope gives her the ability to jump to greater heights, as well as to give her hints about the puzzles that she must face to trap each evil.

The first evil Pandora faces is Greed, which has taken over the library and study in the mansion and created a series of rooms with puzzles. Using Hope, Pandora moves through the library level; she narrates about her past as she does so, revealing her love for reading and books growing up, which has helped her to become so quick-thinking and knowledgeable in the present. Pandora solves the hardest puzzle for Greed, which allows her to trap it back in the jar. This gives Pandora Greed's ability, to pull a selected object towards her.

With Hope and Greed under her belt, Pandora progresses to the next area, overtaken by the evil Lust. This series of rooms contains bedrooms and sitting rooms, and are lavishly decorated. As she solves the puzzles, Pandora narrates about meeting her husband, and their shared love of ancient cultures and knowledge. She reveals, however, that their marriage isn't always happy, as he constantly lusts for adventure and leaves her alone, at home in England. After conquering the hardest puzzle for Lust, Pandora captures it in the jar and gains its power. Lust allows Pandora to choose two objects and attract them to each other, binding them together.

Pandora moves forward to the next evil, Sloth, which has infected the interior courtyards and gardens of the mansion. With the sin overtaking the series of gardens and courtyards, there is an overall feeling of lethargy and calm throughout the level. Pandora solves the related puzzles put against her, and speaks about the time she spends alone in England, which are hard for her to bear knowing that her husband is out in the world on his adventures. After she solves Sloth's final puzzle and traps it in the jar she gains its ability, which allows her to slow time down on objects, making them react slower to the world around them.

The fourth evil that Pandora faces is Gluttony, in the kitchens and dining rooms of the mansion. The rooms are filled with tables, chairs, plates and bowls with abundant amounts of food. As she makes her way past each puzzle, Pandora remarks on how her husband's thirst for fame and fortunate is all-consuming, and that each trip is never enough to satisfy him. Even when he is home, he is still thinking

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about his next adventure and the discoveries that he will make. While Pandora likes history and culture, she does not let it consume her as much as her husband does After Pandora completes the final Gluttony puzzle and recaptures it, she gains Gluttony's power: to duplicate and multiply a selected object.

The next evil Pandora faces is Wrath, in the wine cellar and basement of the mansion. It is darker and older here, less polished than the rest of the mansion, which is the part that guests always see. Pandora narrates about how the nature of her relationship with her husband has changed over time, and the anger she sometimes feels at his actions, and the arguments they have about his profession. When Pandora completes the final puzzle in the level and traps it, she gains the power of Wrath, which pushes selected objects away from Pandora.

The sixth evil that Pandora confronts is Envy, which has infected the ballrooms and parlors. Pandora can hear the partygoers at times, but knows she shouldn't open any doors to try to get to them, lest she let the evil enter another room and hurt the people inside. Pandora narrates about herself, and the possible reasons that her life has turned out the way it has – and the underlying root of her current unhappiness, which is the envy she has for her husband. Conquering the final puzzle of the level and trapping Envy back in the jar gives Pandora Envy's power, but also helps her let go of her own envy of her husband. Envy allows Pandora to pull herself towards a selected object across a distance.

The final evil that Pandora faces is Pride, the root of all evils, which has overtaken the exhibit halls her husband uses to display his prized artifacts from his expeditions. When Pandora defeats the final puzzle for Pride, the evil returns to the box and the mansion is purged of all of the evil – it rearranges to become as it should be again, with everyone at the party still safe and unaffected. Pandora solved all the puzzles on her own and held herself responsible for her action; she was able to independently solve her problems and face them head-on.

11.4. Gameplay

Pandora is a first person action puzzle game, where the main character, Pandora, will manipulate objects to progress further into the story. In order to defeat the evils lurking in her mansion, Pandora acquires abilities from evils she vanquishes throughout her adventure. She will first start with "hope," which was all that remained in Pandora's box in the Greek myth. Hope will give Pandora the ability to jump and "transform" the current room, in essence resetting the current puzzle. In general, Pandora will encounter small rooms to act as a tutorial level for our users when they first receive a new power. After accomplishing the relatively simple puzzle, the player will be required to use all the powers they have learned previously in a strategic way to defeat the evil infecting the current area.

Encountered puzzles will have multiple solutions based on the players' preference of gameplay. Each puzzle will have elements of action and careful decision making to appeal to both styles of gameplay. The puzzles will include an adaptive difficulty system which will judge the player on a number of factors, and produce a rating for each puzzle. If the player is improving, the upcoming puzzles will prove more difficult, whereas a player who is struggling will experience the puzzles at a more relaxed pace. Action based puzzles will scale linearly with difficulty and power effectiveness which will test player's reflexes' at a higher rate. By contrast, decision based puzzles will introduce more gameplay objects to interact with, increasing overall complexity of the puzzle.

Each main encounter (where Pandora will receive a new ability for completing the puzzle) will have a general theme encompassing the essence of the present evil. These themes will be portrayed through the accompanying puzzles and art style featured in the puzzle rooms.

Puzzles:

Evil	Manifest/Environment: How Evils are Presented	Puzzle Ideas
Hope	Pandora's Box	You search around a room whose location is overheard from your husband. As you enter the room, there are conveniently out of place items you must interact with. Once all items are used, an audio or visual queue displays the box.
Greed	Ornate golden tiles in a rather lavishly decorated room.	Pandora must jump (using hope) on the golden tiles so that they all turn into another color (TBD). However, when Pandora jumps back onto an over turned tile it turns gold again. Pandora must jump onto the tile sin order so

		that they all are over turned at the same time. If the player gets stuck they can use transform (from hope) in order to force turn a piece.
Lust	Giant tiles scattered around the room that look like pieces from ancient Greek architecture.	Each tile has Greek letters and symbols and you must match two tiles together by pulling them into each other with greed. Once you match a tile, they will disappear. Once all the tiles are matched the doorway will open.
Envy	Swirling tornado that behaves as a black hole sucking objects (and you) towards it. (Kills you, restarts, if you are sucked into it. Portal Style)	Create barriers by pulling objects toward you in order to traverse the room without being sucked in. The more the barriers are fortified with lust, the strong the barriers, hard to get sucked into the black hole.
Gluttony	Mass of fused objects (mostly food) *Katamari*-style, blocking entry and exit points.	Maneuver the giant ball into traps which will be put together by Pandora using previous powers to chip the ball into smaller pieces, revealing escapable doorways.
Wrath	Three dark energy clouds of different colors are scattered across the room.	There are three colored holes in the middle of the room that will thwart the energies powers. However the colors of the energies must match the holes, and by default they are not the same. The player must envy colored objects in the room to the energies to turn the colors of the energies into the colors of the holes.
Sloth	Giant grandfather clock.	Position crates with greed to block dark energy that will, on contact, "kill" Pandora. These crates however are pushed by the energy; therefore the opening gap only lasts a few moments. The player has to quickly either run past the energy, or envy to another object in the room. Each progressive energy level is

		stronger, giving the player less time to traverse the area.
Pride	Statue of "Bruce," Pandora's husband encased in solid gold.	Amalgamation of previous puzzles over an entire hallway spanning 3+ rooms.

11.5. Art Style

Our art style will be based largely around combining a pen and ink style of drawing and hatching with a paper texture over normal textures. However, we will use subtle coloring in the normal textures to allow the paper and ink to really shine through. We will also make use of bump mapping to accentuate the paper feel. This style was influenced by many games, including Borderlands, Bastion, Braid, Prince of Persia (2008) and LittleBigPlanet and their methods of using hand-painted textures and ink. We also looked at games like Dear Esther for its subtle, cohesive color palates and at Dinner Date for its simplified forms in a 3D environment.
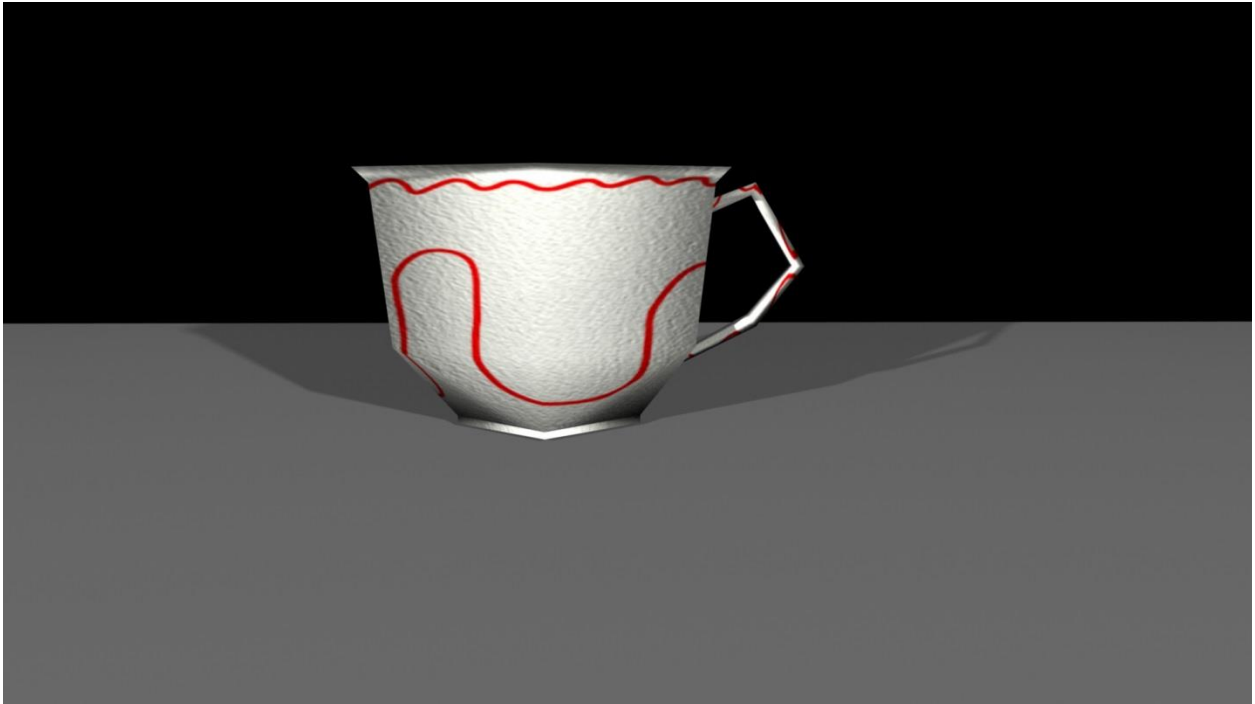
We will leave no surface un-detailed. This is necessary as we want to keep the Victorian influence as much as possible. Victorian design is full of lush detail everywhere it could be added. However, we will simplify the Victorian style to keep with our ink and paper style mentioned previously. Much of this extra detail will come from bump maps in order to keep our geometry simple, but we will also paint extra details into the textures, making liberal use of floral patterns in particular.
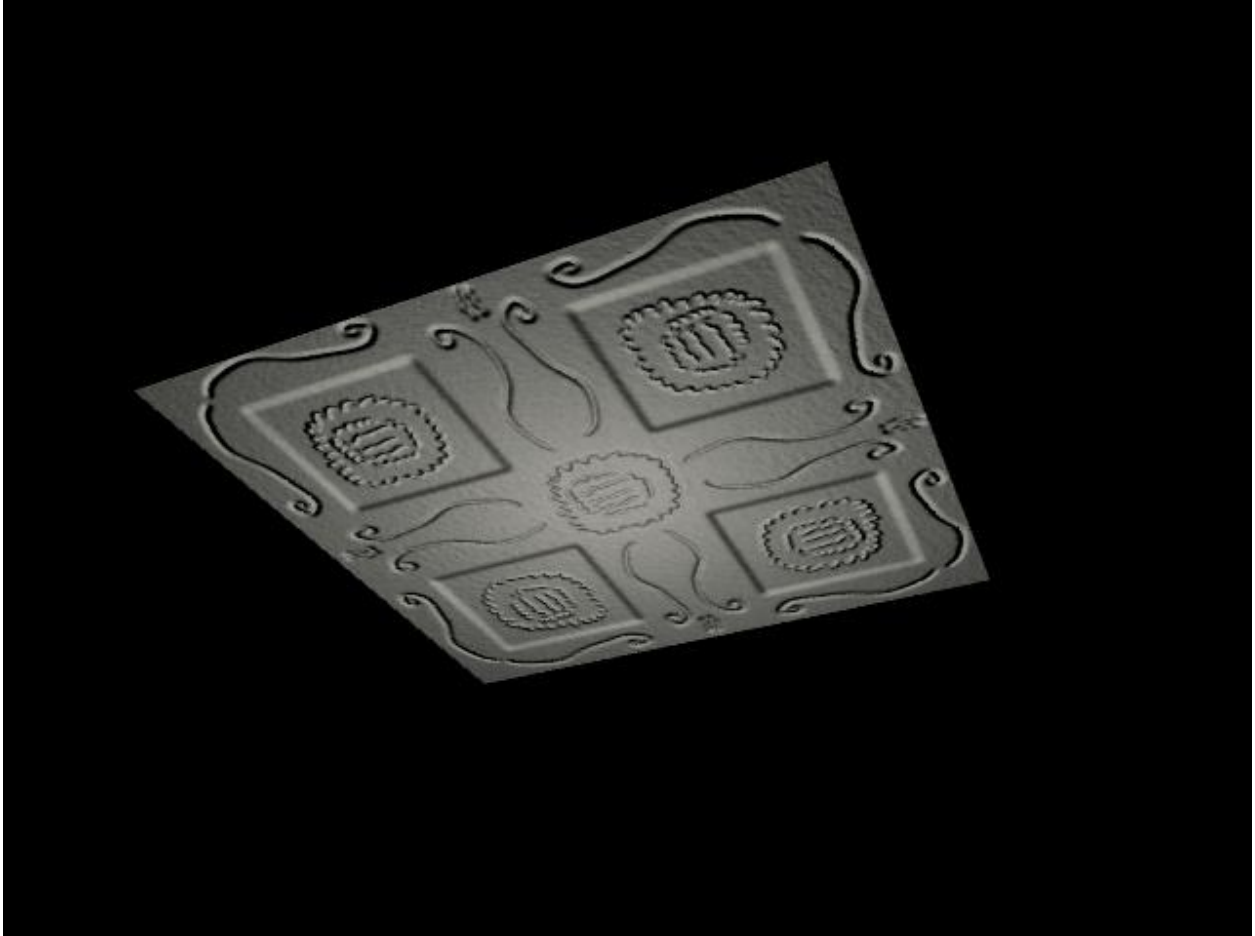
We will keep all menus and UI within the Victorian theme. For instance, font faces for menus will be taken from Victorian times. The HUD during gameplay will be kept to a minimum, showing only an aiming reticle during normal gameplay. This reticle will fold out when the player is selecting their active power. The reticle will change color in accordance with the selected color to remind the player of which power they have selected. We are also considering a view of Pandora's face as part of the HUD. This would include her more in normal gameplay, but we will have to test this to see how it actually works. Finally, all in-game instruction will be provided through Greek frescoes (in evil-infected areas) and paintings (in uninfected areas) throughout the mansion.

Default   Greed   Lust   Sloth   Gluttony   Wrath   Envy   Pride

Default Active   Greed Active   Lust Active   Sloth Active   Gluttony Active   Wrath Active   Envy Active   Pride Active

Power Selection Wheel

11.6. Component Breakdown

1.0 Unity-Aided Assets

    1.1 Cameras

        1.1.1   First-person camera

                -Insert camera, then add a smooth look at script to the camera and select the main character game object in the script. Manipulate the X, Y, Z coordinates as desired.

                1.1.1.1 Field of view

                    - Change the field of view integer on the camera to desired value

                1.1.1.2 Blur Effects

                    - Insert blur script onto camera, change the area value to desired area, and change blur amount to desired value.

        1.1.2   Rotational cutscene camera

                -Insert camera and set up a trigger to change the depth higher than the main camera when the scene should be triggered. Once the depth has been changed animate the camera to rotate in the desired way/angle.

        1.1.3   Stationary still-shot camera

                -Insert camera, choose the desired field of view, change the depth of the camera once triggered.

    1.2 Character

        1.2.1   Movement

                -Insert player character controller script provided in unity to the main character.

        1.2.2   Collisions

                -Choose capsule collider for main character's game object.

        1.2.3   Physics

                -Automatically enabled correctly when character script is added to game object.

    1.3 UI

        1.3.1   Pocket watch info menu

                -Create script attached to main character's game object. On button press, play check watch animation. Then have it display stats based on current player's progress

        1.3.2   "Crosshair"

                - Create UI script which will be used for all UI elements, add 2d Image to script which will change based on power active, and current power level

        1.3.3   Power Usage

                -Reflected in crosshair as glow effect, will be dynamically changed using a function over 2D images to change RGB values.

    1.4 Manipulated Objects

1.4.1 Physics

-Click physics checkbox on any item under their rigidbody script properties to enable physics. Change mass and material to get desired effect.

1.4.2 Collisions

- Insert collider script based on the approximate shape of the item.

1.5 Sound

1.5.1 Ambient tracks

-Insert 2D sound with low desired volume whose radius spans the size of the current level.

1.5.2 Space dependent ambient sounds

-Insert 3D sound with low desired volume whose radius spans the size of the desired area.

1.5.3 Sound effects

-Insert "playsound" function in desired listener to play when a sound effect should be triggered. Attach sound to script.

1.5.4 Dialogue

-Insert "playsound" function in desired listener to play when a sound effect should be triggered. Attach sound to script.

1.6 Technical Artistic Elements

1.6.1 Seamless animations

-Use "crossfadequeued" function with desired time variable and animations, to add smooth transitions between animations.

1.6.2 Applying animations

-Insert maya binary animations, don't split animations, and bake. Apply animations to specified gameobject.

1.6.3 Applying suitable colliders

-Add best fitting colliders to animations and tweak variables as necessary to envelop the entire model correctly with negligible clipping.

1.6.4 Triggered effects

-Add particle and lighting effects to desired areas on screen. Choose the correct script for the particle such as "fire once" or "loop". Enable the effect at a specific time or when the level is loaded through the triggered function that all particles have in their default library.

2.0 "From Scratch" Elements

2.1 Powers

2.1.1 Greed

-Make sure target under crosshair is movable, apply force vector on object towards Pandora. Magnitude of force depends on how much greed corruption Pandora currently has.

2.1.2 Lust

-Check to see if crosshair is on a movable object. If it is, mark the current target. If this power is used on a movable object while another object (a reasonable distance from the first) is marked, apply force vectors on the objects towards each other. When they collide they form one whole object. The magnitude of the force vectors depends on Pandora's lust corruption level. If Pandora has too much corruption, there is a chance that the objects will just bounce off each other when they collide.

2.1.3 Envy

-Check whether the object under the crosshair is the right kind of object. If it is, apply a force vector to Pandora that launches her towards the object in an arc. Magnitude of the force vector depends on Pandora's envy corruption.

2.1.4 Sloth

-Create a field at the crosshair where any force (including gravity) applied to an object is countered by a lesser, opposite force. Pandora herself slows down as her sloth corruption increases.

2.1.5 Hope

-Jump: Allow Pandora to jump in mid-air as though she was standing on an object.

-Transform: Check whether Pandora is targeting a corrupt object. If she is, replace the corrupt object with the normal version of that object.

2.1.6 Gluttony

-Create a duplicate of the targeted object immediately adjacent to the object. Depending on Pandora's gluttony corruption, additional duplicates of the object may be created.

2.1.7 Wrath

-Create a force vector away from Pandora on the targeted object. The magnitude of the force is based on Pandora's wrath corruption.

2.2 Puzzles

2.2.1 Difficulty Adjustment

-Increase the effects of each of Pandora's powers as she uses them more (see individual power descriptions for what this actually does). If Pandora is constantly using a certain power, disable it for a time.

2.2.2 Reset-ability of our project

-Pandora can use hope's transform power to reset an area. This takes the form of the area whiting out, the scene being redrawn, and then the scene fading back in, reset to the default configuration.

2.2.3 "Win/Lose" "condition" "affecting" "Fibonacci" "score"

--Adjust future puzzle difficulty based on how long it took the player to complete the previous two puzzles, how many times the player used powers during those puzzles, and how many times the area was reset.

2.3 Shaders
2.3.1 Mirror

-Use additional cameras in mirrors to simulate reflections, with a shader on top.

2.3.2 Reflective surfaces

-Create appropriate shader for reflective surfaces

2.3.3 Metal

-Create appropriate shader for metal textures

2.3.4 Ceramic
-Create appropriate shader for ceramic textures
2.3.5 Glass

-Create appropriate shader for glass textures

2.3.6 Wood

-Create appropriate shader for wood textures

2.3.7 Fabrics
-Create appropriate shader for fabric textures
2.4 Scene Management
2.4.1 Division of scenes based on game progress

-Except for the starting area, all scenes have an 'infected' and normal version. As Pandora defeats the evils, 'infected' areas revert back to normal.

2.4.2 Manager to keep track of "infected" areas

-Class that keeps track of which areas are currently 'infected.' Once it detects that an evil has been defeated, the manager swaps the infected version of the appropriate area for the normal version.

11.7. Asset Breakdown

The following assets are the necessary components to fully flesh out the game. These art, text, and sound assets provide the game's overall look and feel as well as the key building blocks for creating the immersive gameplay experience.

Art Assets:

Pandora:
As the player character, Pandora will be modeled in 3D and textured in line with the artistic style and vision. She will be within a reasonable polygon count, and will have the necessary maps to bring her to life in Unity, including diffuse, bump, and specular maps.

Room Tile Set:
To build the different rooms, we will have a basic tile set that we can arrange as needed to create our levels. The basic tile set includes:

- Basic wall
- Floor
- Ceiling
- Window
- Various crown molding pieces
- Stairway
- Doorway

Environment Objects:
The bulk of the three-dimensional art assets are the environmental objects that will make up the setting of the game, as well as its look and feel. The following environmental assets have been broken down by the level in which they will be placed:

- Level 1, Greed: the libraries and treasure rooms
  - Bookshelf and books
  - Sculpture bust
  - Paintings
  - Leather chair
  - Coffee table
  - Couch
  - Lamp
  - Curtained windows
  - Desk
  - Papers

- o Globe
- o Fireplace
- Level 2, Lust: bedrooms and sitting rooms
  - o Floor lamp
  - o Canopy or four-poster bed
  - o Chair
  - o Bedside table
  - o Vanity
  - o Wardrobe
  - o Dresser
  - o Curtains
  - o Clothing
  - o Rugs
  - o Mirrors
  - o Washing basin
- Level 3, Sloth: Gardens and interior courtyards
  - o Bush, various shrubs, topiary
  - o Patios
  - o Sculpted statues
  - o Fountains
  - o Outdoor furniture
  - o Column
  - o Clocks and giant grandfather clock
  - o Mosiacs
- Level 4, Gluttony: Dining rooms and kitchens
  - o Table
  - o Plate, serving platter
  - o Silverware, knives
  - o Food
  - o Teapot, teacups
  - o Sideboard
  - o Countertops
  - o Sink
  - o Cutting board
  - o Drawers
  - o Cabinets
- Level 5, Wrath: wine cellar and basement
  - o Storage boxes
  - o Barrels, casks
  - o Canvas bags
  - o Explorer paraphernalia

- o   Half-unpacked boxes of treasures
- o   Rock wall foundations
- Level 6, Envy: ballrooms and parlors
  - o   Music stands
  - o   Instruments
  - o   Small tables
  - o   Chandeliers
  - o   Sculpted statues
- Level 7, Pride: Exhibit halls
  - o   Shelves
  - o   Pedestals
  - o   Relics and treasures
  - o   Boxes
  - o   Paintings
  - o   Jewelry
  - o   Scrolls, ancient tomes
  - o   Ceramic jars
  - o   Paraphernalia from ancient cultures

Menu and User Interface Assets:

The two-dimensional menu and user interface assets necessary for the game are minimal, but should reflect the style of the game. These assets include:

- Main menu screen
- Menu buttons and sliders
- Reticle in heads-up display
- Hover and selected versions for buttons and sliders

Text Assets:

The text assets necessary for the creation of Pandora include a variety of elements that will be present in-game, or will aid in the production of other integral assets. These include:

- Tutorial text for introducing important gameplay elements and mechanics
- In-game tips for puzzles, if the player gets stuck or is having trouble
- Scripted dialogue for Pandora, as when she is interacting with objects in-game
- Story narration from Pandora over the course of the plot

Sound Assets:

To bring the environment and story of Pandora to life, we will need sound assets that reflect the style and theme of the game. Through well-crafted sound design, we can accentuate the detailed environment and highlight the story. The necessary sound assets include:

- Background music following Victorian theme, with different tracks for each level and evil being faced
- Sound effects for interacting with objects
- Sound effects for using each of the seven powers
- Scripted dialogue from Pandora as feedback when interacting with objects and using powers
- Story narration from Pandora to flesh out the history and plot within the game
- Ambient sounds for various rooms and environments; background party noises, running water, footsteps, etc.
- User Interface and HUD feedback sounds
- Success feedback music or sound effects for when puzzles are completed

Appendix B: Art Asset List

Library Assets	Who?	Due	Dirtied	Unified
Banister	Jill		yes	yes
Banister Column	Jill		yes	yes
Book	Ryan		yes	yes
Bookshelf	Jill		yes	yes
Ceiling	Jill	29-Jan	yes	yes
Chair	Ryan			
Crown molding	Jill		yes	yes
Desk	Ryan			
Floor	Jill	29-Jan	yes	yes
Mirror	Jill		yes	yes
Pithos	Jill		yes	yes
Rug	Jill		yes	yes
Shelf	Jill		yes	yes
Stool	Jill		yes	yes
Strut	Jill		yes	yes
Tiles				
Wall light			yes	yes
Wallpaper	Jill	29-Jan	yes	yes
Window	Ryan			
Double doors			yes	yes
Wood column	Jill		yes	yes
sconce	Jill		yes	yes

Basement Assets

	Who?	Due	Dirtied	Unified
Cask	Jill		yes	yes
Barrel	Jill		yes	yes
Stone floor	Ryan		yes	yes
Stone wall	Ryan		yes	yes
Obelisk	Ryan		yes	yes
Wood crate	Jill			yes
Wine crate	Jill			yes
Tile				
Lightbulb	Ryan		yes	yes
Wine bottle	Ryan		yes	yes

Dining Room Assets

	Who?	Due	Dirtied	Unified
Ceiling			yes	yes
Blue wallpaper	Jill		yes	yes

Floor			yes	yes
One leg table			yes	yes
Four leg table			yes	yes
crown molding			yes	yes
banister			yes	yes
banister column			yes	yes
Tile				
Rug			yes	yes
Spiral column				
Marble Column				
sconces			yes	yes
double doors			yes	yes
teacup				
Mirror			yes	

Bedroom Assets

Bed	Jill		yes	yes
Floor			yes	yes
Ceiling			yes	yes
Tables			yes	yes
Crown molding			yes	yes
Sconces			yes	yes
Rug			yes	yes
Doorway			yes	yes
Banister			yes	yes
Bookcase			yes	yes
Wallpaper			yes	yes
Fancy chair				
Wood column			yes	yes
Frame			yes	yes

Ballroom Assets

wood column			yes	yes
banister			yes	yes
banister column			yes	yes
furniture column			yes	yes
floor			yes	yes
ceiling			yes	yes
struts			yes	yes
carpet			yes	yes
window				yes

molding			yes	yes
spiral column				yes
crate				yes
door			yes	yes
scroll				yes
sconce			yes	yes
paintings			yes	yes
fancy chair				yes
tile				

Pride Boss Level

Spiral column				
floor				
carpet				
puzzle cube				
wallpaper				
ceiling				
crown molding top				
bottom				
bookshelf				
books				
painting				
gluttony ball				
chandalier				

Appendix C: Dialogue Asset List

Dialogue

1. Triggered Dialogue
   a. Greed
      i. "This is a mess, someone isn't getting invited to the next party" 1
      ii. "I seem to remember having actual stairs here" 2
   b. Wrath
      i. "Maybe I should be careful, I don't feel like falling into a pit today" 3
      ii. "I hope the 1864 Chateau Brideaux hasn't gotten smashed!" 4
   c. Gluttony
      i. "My…it is awfully dark around here…" 5
      ii. "I don't usually block off my entire dining room with banisters" 6
   d. Lust
      i. "What is this infernal contraption doing in front of my bedroom" 7
      ii. "Oops…I wasn't expecting that to happen" 8
   e. Envy
      i. Something scattered all of Bruce's precious columns all over the place! 9
      ii. Maybe this is where all the guests went… 10
   f. Sloth
      i. This looks precarious… 11
      ii. Ahh, I really needed this fresh air. 12
   g. Pride
      i.
2. Incidental Dialogue
   a. Greed
      i. "Get back here book, I haven't finished reading you!" 13
      ii. "This seems a bit odd, I wonder where everyone is?" 14
   b. Wrath
      i. "I haven't gone down here in a while, Bruce usually just stores his superfluous mementos" 15
   c. Gluttony
      i. "Huh that's odd, I would expect Bruce to be here with the guests…Speaking of the guests, I wonder where everyone is. 16
      ii. "I'll need to have the staff clean this place up." 17
   d. Lust
      i. Hmph, Bruce isn't here either, but really that's not too much of a surprise… 18
   e. Envy
      i. I hope I get those back 19
      ii. I need to stop this before it hurts anywhere else 20

  f. Sloth

    i. Even in the middle of all this madness, this garden is still pretty relaxing 21

    ii. I do hope Bruce is in his study… he can't be anywhere else in the house 22

  g. Pride

    i. There seems to be a weird blockade to Bruce's Study 23

    ii. Is…is that bruce?!?!?!?!?!??!?! 24

3. Narration Dialogue

4. Puzzle Hints

  a. Greed

    i. "Since I can't get to the other side, I might as well try and jump on all the platforms." 25

  b. Wrath

    i. "Why are Bruce's extra Egyptian obelisks different colors?" 26

    ii. "Maybe I can clear away these extra wine casks" 27

  c. Gluttony

    i. "At least someone had the great idea to light this candle." 28

    ii. "Let's shine a little light on this problem." 29

    iii. "I should find a way to break up this conglomeration of clutter." 30

    iv. "What are these strange symbols on the floor. 31

  d. Lust

    i. The door seems stuck closed, I'll need a way to force it open 32

    ii. "These blocks seem like they're part of one of those exotic puzzles I've seen before…I think it was called Mai-jings 33

  e. Envy

    i. I'm glad these columns are of different height 34

    ii. This wall looks pretty weak, but the ballroom should be on the other side 35

    iii. Maybe if I combine these pots it could do enough damage. 36

  f. Sloth

    i. I really seem to be drawn to these portraits 37

    ii. It seems Bruce's favorite clock has stopped, maybe I can give it a kick start. 38

  g. Pride

    i. These tapestries seem to have definitely lost their luster… 39

    ii. I need to remind him of what he's lost, I need to break down his barriers 40

Appendix D: Tester Feedback Form

Pandora Playtest Feedback Form

You've just played Pandora, and now we want your opinion! What was good? What could be improved? Let us know here, and Pandora will be even better once it's fully released!

I could easily control the game*

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

This game had an interesting story*

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

This game was entertaining*

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I would like to play more of this game*

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

This game is set in...*

(What is the time/place setting of this game?)

The main character of this game is...*

(Enter main character's name below)

The main character's spouse is...*

(Enter the name of the main character's spouse below)

This game is about...*

(What do you think the game's story is about?)

I most enjoyed...*

(What was most appealing, thinking of everything in the game so far?)

I most disliked...*

(What was least appealing, thinking of everything in the game so far?)

I experienced the following bugs...*

Please detail any bugs, glitches, or crashes you experienced while playing.)

I would improve this game by...*

(Please note any further improvements you would like to see in the game.)

(Optional)Include your email below

(If you think we are awesome don't mind us asking questions about your Pandora experience, include your email address here.)