ENVIRONMENTAL STORYTELLING STRATEGIES IN DIGITAL

ENVIRONMENTS: A QUALITATIVE COMPARISON

A Thesis

by

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ABSTRACT

      Environmental storytelling is the use of designed space to convey narrative to an audience, rather than primarily through the use of characters or dialogue. The broader goal of this thesis was to understand how environmental storytelling strategies are used across existing platforms, and to explore the ongoing relationship between environmental design and narrative. The first objective of this thesis was to analyze environmental storytelling strategies in current video game environments. This was accomplished via a content analysis method developed by Henry Jenkins. The second objective of this thesis was to explore the implementation of embedded narrative strategies in the design of digital spaces. This was accomplished through the creation of multiple 3D environments based on the findings of the content analysis. This work represents a first step towards developing guidelines for the thematic use of environments in interactive storytelling.

DEDICATION

I am dedicating this thesis to my mom, Lisa Bartels Robert, who provided me with unconditional love and support throughout the brief time we spent together on this earth.

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1. INTRODUCTION

The conventional way for designers to convey stories to audiences has been - and remains - through the use of characters and dialogue across scenarios in books, film, video games and in many other domains that require narrative. Although alternative methods of conveying narrative to an audience have been generally underrepresented across platforms, some work has explored the inherent communicative potential of mise-en-scène. Mise-en-scène is a general term used to capture 'the contents of the frame and the way that they are organised', such as key props and the way in which objects are placed in an environment (Gibbs, 2002). Although mise-en-scène originates in the world of theatre and film, it has grown to encompass many different platforms, such as video games. The way a scene is arranged in video games is not only vital to the game mechanics, but to the delivery of narrative. *Environmental storytelling* is the creation of narrative events through the use of carefully constructed environments and spatial elements (Worch & Smith, 2010).

Empirical research in the area of environmental storytelling is scarce. Yet such research can contribute generally to our understanding of how the setting or surroundings of an event or action affects our understanding of the story. Previous research includes proposed definitions and strategies of environmental storytelling, analysis of one specific video game, or the introduction of a new immersive experience created by researchers (Worch & Smith, 2010; Tarnowetzki, 2015; Bevensee, Boisen, Olsen, Schoenau-Fog, & Bruni, 2012). While this research contributes to the field of

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digital storytelling, many of the studies focus primarily on interactivity in the environment through gameplay, rather than in depth investigations of the mise-en-scène and how it contributes to narrative understanding (Worch & Smith, 2010; Tarnowetzki, 2015). Research in this area could contribute to the design of more impactful narratives supplemented by carefully crafted environments, and possibly lead to the development of innovative ways to deliver narrative to an audience.

Media scholar Henry Jenkins believes that "environmental storytelling creates the preconditions for an immersive narrative experience" (Jenkins, 2004). From a theoretical perspective, Jenkins describes four spatial strategies that can be utilized for the design of environmental storytelling in video games. This thesis presents an initial study consisting of a qualitative analysis of a selection of video games using Jenkins' framework for environmental storytelling. The goal of the first part of this thesis was to analyze the effectiveness of environmental storytelling in environmentally-driven video games, and to understand how designers utilize spatial storytelling to convey narrative. The second part of this thesis discusses the creation of three digital environments designed using techniques and findings from the aforementioned analysis. The goal of this thesis was to begin building a foundation for guidelines to assist developers in the creation of narrative-driven environments.

2. BACKGROUND AND LITERATURE REVIEW

2.1. History of Mise-en-scène

Mise-en-scène, a French term literally meaning "place on stage," refers to all the visual elements of a theatrical production within the space provided by the stage itself (Lathrop & Sutton, 2014). The visual categories of mise-en-scène are setting (decor and props), costume/makeup, lighting, and staging (Bordwell, 2017). Props, an important element of mise-en-scène, has been underutilized in narrative development (Bordwell, 2017). A *prop,* or property, is defined as "an object in the setting [that] has a function within the ongoing action" (Bordwell, 2017). Writers in the world of theatre and film have the power to let the décor and props supplement the narrative as little or much as they desire. While some film settings are "only a container for human events", other filmmakers design the setting so that it may "dynamically enter the narrative action" and become "inseparable from the narrative" (Bordwell, 2017; Affron, 1995).

George Franju, a historically significant filmmaker in French cinema, cast the setting to play a crucial acting role in his films, and he often used "décor to produce meaning before narrative began" (Ince, 2005). In his 1952 short film, *Le Grand Méliès*, Franju used the setting to create an atmosphere that sets the mood for the narrative. As shown in **Figure 1**, Franju alters the drawing room set to indicate a passage of time to the viewer by "reveal[ing] the imprints of fresh cleanliness left by the removal of ornate upholstered furniture" (Ince, 2005). In this case, the absence of objects give narrative meaning to the viewers, and in other scenarios, the repetitive use of locations or props can contribute meaning to a narrative (Klevan, 2000).

In Alfred Hitchcock's *Vertigo* (1958), props are vital to the progression of the suspenseful narrative. As the ex-detective, Scottie Ferguson (*James Stewart*), investigates the mysterious actions of Madeleine Elster (*Kim Novak*), the film's props are a direct display of the increasing insanity of Madeleine. A necklace that initially carries a straightforward denotation gains narrative significance throughout its resurfacing near the climax of the film. As shown in **Figure 2**, Hitchcock reveals this major narrative event in a completely controlled moment, in which elements of mise-en-scène were utilized in order to fully captivate the audience. As John Gibbs states, "mise-en-scène therefore encompasses both what the audience can see, and the way in which we are invited to see it" (2002).

Figure 1. *Le Grand Méliès,* **(1952) screen capture of the drawing room.**

Figure 2. *Vertigo* **(1958), screen capture of the reveal of Carlotta's necklace.**

Throughout film history, filmmakers have implemented the techniques of mise-en-scène to set the scene for the audience. From the littlest prop, which creates the most shocking plot twist, to the spacious set that emphasizes the tension between characters,

environments directly impact the viewer's interpretation of a narrative. As storytelling

has transitioned from theatre to film, and now from film to video games, the ways in

which designers create environments are ever changing. Setting and props have become

even more narratively prominent due to interactivity between the player and their

environment.

2.1.1. History of Environmental Storytelling

As previously discussed, mise-en-scène has a long history in the world of theatre

and film. This is not the case, however, for environmental storytelling. A few researchers

have attempted to propose concrete definitions of environmental storytelling, and some

have divided environmental storytelling into categories of techniques and spatial

strategies. The first researcher to discuss the use of environmental storytelling in video

games is Don Carson, a pioneer of theme park design for Walt Disney. Carson designed

magically themed spaces by infusing the story element into the tangible environment,

creating worlds made to keep viewers immersed and entertained (Carson, 2000). Carson

argues that the environmental storytelling techniques he implemented to craft story-

driven park attractions, such as 'Splash Mountain', could be directly applied to the

digital world as was done in video games such as *Myst*. *Myst*, released in 1993 by Cyan

Worlds, is a prime example of the use of environmental storytelling in a video game.

Target platforms and audiences do vary across the many domains that require narrative,

however Carson poses a common challenge that these domains share: "How to bring

people into their created worlds and keep them immersed and entertained" (Carson,

2000).

Jenkins took up Carson's challenge and specified four spatial strategies that can be used for environmental storytelling in games: evocative spaces, enacting stories, embedded narratives, and emergent narratives. Evocative spaces rely on the audience to draw upon preexisting knowledge about the story world they are exploring to be able to comprehend the narrative. Enacting stories are designed into the game space as narrative events that take place as the player navigates the environment (Jenkins, 2004). Embedded narrative is akin to Carson's method of distributing narrative information mise-en-scène, specifically throughout the environment and props. Emergent narratives "take shape through the game play" due to choices that are made by the player (Jenkins, 2004).

Figure 3. Hollywood Tower Hotel lobby mise-en-scène, Disney World.
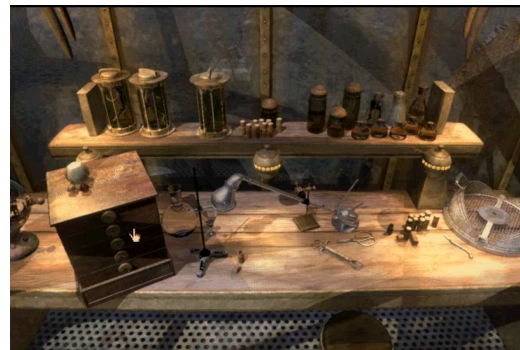
Figure 4**. *Riven* (1997) gameplay screen capture, the sequel to *Myst* (1993).**

Like Jenkins, Smith and Worch (2010) have also proposed broad categories of environmental storytelling techniques and adopt the perspective of the players' interpretations of the narrative as a whole in order to further the development of the game story. They present four characteristics, much like Jenkins, of environmental storytelling that not only rely on the creative narrative decisions of the designer but also the player. Similar to Jenkins's embedded narrative, these authors suggest that players must create connections between narrative elements in order to interpret the meaning of the story (i.e., "Association of Elements"). The second characteristic of environmental storytelling "fundamentally integrates player *perception and active problem solving*, which builds investment", which can be compared to Jenkins's enacting stories. The third characteristic of environmental storytelling is similar to Jenkins's evocative space strategy, arguing that the player *interprets situations* according to their previous experience. Lastly, *telegraphing* is presented as a helpful technique that consists of providing gameplay hints to the player through the staging of the environment.

Table 1. Jenkins vs. Smith & Worch: comparison of categories of environmental storytelling.

Author	Category	Definition	Pros	Cons
Henry Jenkins	Evocative Spaces	Instances of storytelling that rely on the user's previous knowledge of the story	- Strong sense of narrative investment - Easier to draw conclusions on narrative - Easier for designers to integrate narrative elements into game	- Relies upon player's previous knowledge - Can restrict creativity and learning due to previously set boundaries on narrative
	Enacting Stories	Instances in which the exploration of space led to the witnessing of a narrative event	- Builds investment due to interactivity - Player must come face to face with narrative events	- Overused in the world of gaming - Integrating narrative is more expensive to development
	Embedded Narratives	Instances in which the design of the environment contributes to the user's knowledge of the narrative	- Creates strong sense of atmosphere and -Piques player interest - Aesthetically pleasing - An inexpensive way to integrate narrative into the game	- Players could possibly miss narrative clues in environment because gaze cannot be controlled
	Emergent Narratives	Instances in which the narrative develops based on player choices	-High levels of player invest and understanding of narrative	-Developers have no control over narrative

Table 1 Continued. Jenkins vs. Worch & Smith: comparison of categories of environmental storytelling.

Author	Category	Definition	Pros	Cons
Matthias Worch & Harvey Smith	Association of Elements	Instances in which the player must interpret and connect elements in the environment to create a story	- Creates strong sense of atmosphere and -Piques player interest - Aesthetically pleasing - An inexpensive way to integrate narrative into the game	- Players could possibly miss narrative clues in environment because gaze cannot be controlled
	Player Perception	Instances in which the player uses perception and active problem solving	- Builds player investment	- Not always used as a narrative device - Focus is more on game mechanics rather than environmental storytelling
	Player Interpretation	Instances in which the player interprets situations based on previous experiences in game	- High levels of immersion due to player interpretation	- Designer's intentions for the narrative could be misinterpreted
	Telegraphing	Instances in which the environment is used to guide players through the game	- Can lead player to observe certain elements in the environment - Immersion	- Not used as a narrative device - Strictly for gameplay mechanics and navigation

2.2. Previous Studies of Environmental Storytelling

There have been a few studies that investigate the player experience of environmental storytelling or explore how spatial storytelling can be implemented in specific ways. Many of the existing studies are grounded in Carson's, Jenkins's, and Smith and Worch's proposed definitions and frameworks of environmental storytelling. An example of a relevant work is *Project Aporia*, a computer game created for the "exploration of the understanding of a narrative mediated through environmental storytelling" (Bevensee, Boisen, Olsen, Schoenau-Fog, & Bruni, 2012). The authors of Aporia also present a classification model (the P.I.N.G. model) to evaluate Aporia on the spectra of interactivity and narrative driven games. The validity of their project, however, is limited by methodological shortcomings and ambiguity surrounding their data collection methods and findings. For example, the authors state that they designed Aporia using two of the four strategies in Henry Jenkins' framework – evocative spaces (narrative is based upon preexisting knowledge of the audience) and embedded narratives (narrative information is engrained into the environment) – *but* the authors later describe the setting as static and the story is *not* developed based on prior user knowledge. The described setting thus fails to create an evocative space as described by Jenkins, despite the authors stating that they designed Aporia with the use of evocative spaces. The authors further acknowledge that the method of data categorization was flawed, and that a fifth of participants were unable to finish the game but were still counted as valid participants.

Dear Esther is another project that reports to be designed with embedded narrative techniques, yet the research appears focused primarily on the source engine used to build the game, as well as the audio techniques implemented to create a sense of engagement (Pinchbeck, 2008). One interesting contribution, however, is the emphasis on the use of audio as an environmental storytelling technique to convey narrative. Tarnowetzki (2015) used Smith and Worch's (2010) proposed characteristics of environmental storytelling to conduct a content analysis of one game, *BioShock Infinite*. The author used environmental storytelling concepts to examine features of the game, and she proposed that there are three different types of environments within the game: "the avatar's physical environment, the avatar's social environment, and the extradiegetic environment" (Tarnowetzki, 2015). This study, however, makes no claims to generalizability to other games and relies strongly on non-environmental methods of storytelling to complete the narrative.

3. PART I: CONTENT ANALYSIS

3.1. Methodology

3.1.1. Content Analysis

Content analysis is a technique that is widely used in media and communication studies to analyze semantic content (Krippendorff, 2013). The technique allows for the uncovering of patterns in media in a replicable and systematic manner. The goal of this part of the thesis was to measure the presence of environmental storytelling techniques in environmentally-driven video games, and to analyze and discuss the ways in which designers implemented environmental storytelling, especially mise-en-scène.

3.1.2. Game Selection

It was important that the video games selected for the content analysis contain minimal dialogue to increase the likelihood that environmental storytelling would have a significant role to play in the conveyance of their narrative. It was also important that the design of the video games permitted the exploration of the virtual space and that the gameplay structure needed to rely heavily on environment interaction rather than combat or character interaction through dialogue. The search procedures for games that met this criterion consisted mainly of surveying game review websites such as IGN and Metacritic for games similar to *Myst*. Games such as *Moss, Firewatch,* and *What Remains of Edith Finch* met the criterion in terms of environmental exploration and were initially explored, but later eliminated due to large amounts of narrative delivery through dialogue. **Table 2** shows the final list of games selected for analysis. *The Cave* contains

a great amount of narration, however it was kept as part of the selection, as the use of the narrator is mainly for comic relief, rather than to convey important narrative information to the player.

Table 2. Games selected for content analysis.

Game	Synopsis	Avg Duration	Developer	Year
RiME	A young boy must solve emotionally charged puzzles through five levels that represent the stages of grief.	6 hrs	Tequila Works	2017
Hob	Players must save a thriving world that is under attack by poisonous forces.	10 hrs	Runic Games	2017
Riven	Player must save Atrus's wife from his power-hungry father in a foreign, expansive world.	11 hrs	Cyan Worlds	1997
Journey	A robed figure travels through the remnants of a once thriving civilization to the great mountain in the distance.	2.5 hrs	Thatgamecompany	2012
Obduction	Players must solve puzzles to return home after being transported to an alien world.	12 hrs	Cyan Worlds	2016
Inside	A young boy must overcome great obstacles in order to free the enslaved in a dystopic world.	3.5 hrs	Playdead	2016

Table 2 Continued. Games selected for content analysis.

Game	Synopsis	Avg Duration	Developer	Year
The Cave	Players must control three characters as they explore their dark personalities.	4.5 hrs	Double Fine Productions	2013
Unravel	Yarny, a small creature made of yarn must solve puzzles to collect memories for a grandmother's family album.	6 hrs	ColdWood Interactive	2016
ABZÛ	A diver must navigate extensive underwater environments in order to save sea life and restore nature.	2 hrs	Giant Squid	2016
Hello Neighbor	A young boy must discover his neighbor's secret that is locked away in the basement without getting caught.	7.5 hrs	Dynamic Pixels	2017

3.1.3. Game Analysis Method

Jenkins's spatial strategies framework (see Section 2.1.1) was used as the rubric to code the ten selected environmentally-driven video games. **Table 3** provides the descriptions of each spatial strategy adopted from Jenkins for the purpose of this analysis. The process of coding was conducted for each game as follows: 1) The detailed synopsis of the game was read from IGN; 2) The game was fully played through once for purposes of mechanic and game space familiarity; 3) A second playthrough of the game was done, with attention being paid this time to instances of environmental storytelling. All possible endings and discoverable content were explored by reviewing gameplay walkthrough videos on YouTube, as the design of some games would require starting a new game in order to view specific content; 4) For each instance observed, a

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description of the instance itself and the context in which it happened was recorded in a spreadsheet. Additional relevant notes were recorded as needed of each instance. Further, the instance was coded with one of Jenkins's four strategy types: *evocative spaces, enacting stories, embedded narratives,* and *emergent narratives*. It was important that each instance of environmental storytelling was coded with *only* one of Jenkins's strategy types, as the addition of multiple codes to every instance could result in an unclear analysis, as well as create more room for error by straying away from the clear definitions of each spatial strategy. After the first round of analysis, the spatial strategy *evocative spaces* was omitted from the framework due to difficulty in assessing players' preexisting knowledge since prior experiences are subjective in nature.

Table 3. Jenkins's spatial strategies adapted for the initial coding scheme.

Spatial Strategy	Definition
Evocative spaces (Omitted)	Instances of storytelling that rely on the user's previous knowledge of the story
Enacting stories	Instances in which the exploration of space led to the triggering or witnessing of a narrative event
Embedded narratives	Instances in which the design of the environment and props contribute to the user's knowledge of the narrative
Emergent narratives	Instances in which the user makes a decision, resulting in the narrative changing or moving in a certain direction

An *instance of environmental storytelling* was defined as any visual environmental event in the video game that pertained to the development and delivery of narrative to the player. It was important to note that instances of environmental storytelling were distinguished from the design of the game mechanics. Many times the puzzles in the games appeared to be an instance of environmental storytelling that could

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be coded as both an embedded narrative and an enacting story. After further analysis, it was discovered that the action of solving the puzzle itself (*enacting story*) was not what provided more information to the narrative, rather the image revealed after the puzzle was completed was what delivered explicit narrative information. **Figure 5** portrays an instance of environmental storytelling in which it was important to separate the spatial strategy from the design of the game mechanic for the purposes of coding the instance of environmental storytelling correctly. At this instance of gameplay in *RiME*, the player must solve a puzzle using light and shadows to fill the silhouette of the statue that is missing. This action of the player could be initially mistaken for an enacting story; however, by definition, the moment neither lead to the witnessing of a narrative event, nor did the action provide any narrative information to the player. By contrast, the use of lights and shadows engraved into the wall, coded as an embedded narrative, did contribute to the underlying narrative relationship between father and son.

Figure 5. RiME, screen capture showing instance of environmental storytelling by embedded narrative strategy.

3.2. Data Collection and Analysis

A qualitative coding analysis was performed on the descriptions of the environmental storytelling instances, their contexts, and any associated notes to find common themes in terms of the specifics of how the narrative was conveyed for each narrative delivery method. For example, an instance coded as using the narrative delivery method of *narrative image* was further coded as a static 2D image in the form of a photograph. Other instances also coded with *narrative image* could be further coded as using a mural engraving instead. **Table 4** shows an example of two instances of storytelling from *RiME* and how they were identified and coded.

Table 4. Example from qualitative data sheet.

Game	Instance	Narrative Significance	Strategy Type	Narrative Delivery Method
RiME	An engraving of the figure in the red cape on the wall of the cave room	The engraving shows the figure, the boy's father, morphing into a dark monster, symbolically representing his journey through grief.	Embedded	Narrative Image
RiME	A figure in a red cape appears and disappears throughout different stages of gameplay	The figure in the red cape is the boy's father, as shown later in cutscenes. The boy never reaches his father in time before he leaves, which is representative of the father not being able to save his son from death.	Enacting	Cutscene

3.3. Findings

3.3.1. Distribution of Environmental Storytelling Strategies

Across all games a total of 563 environmental storytelling instances were recorded, with an average of 56 instances per game. Among those, there were 159 instances of strategy type *enacting story*, 399 instances of strategy type *embedded narrative*, and 5 instances of strategy type *emergent narrative*. *Enacting stories* and *embedded narratives* are the most dominant spatial strategies employed in all of the games examined. *Emergent narratives* are used only once in five out of the ten games.

Delivery Method Count per Strategy Type
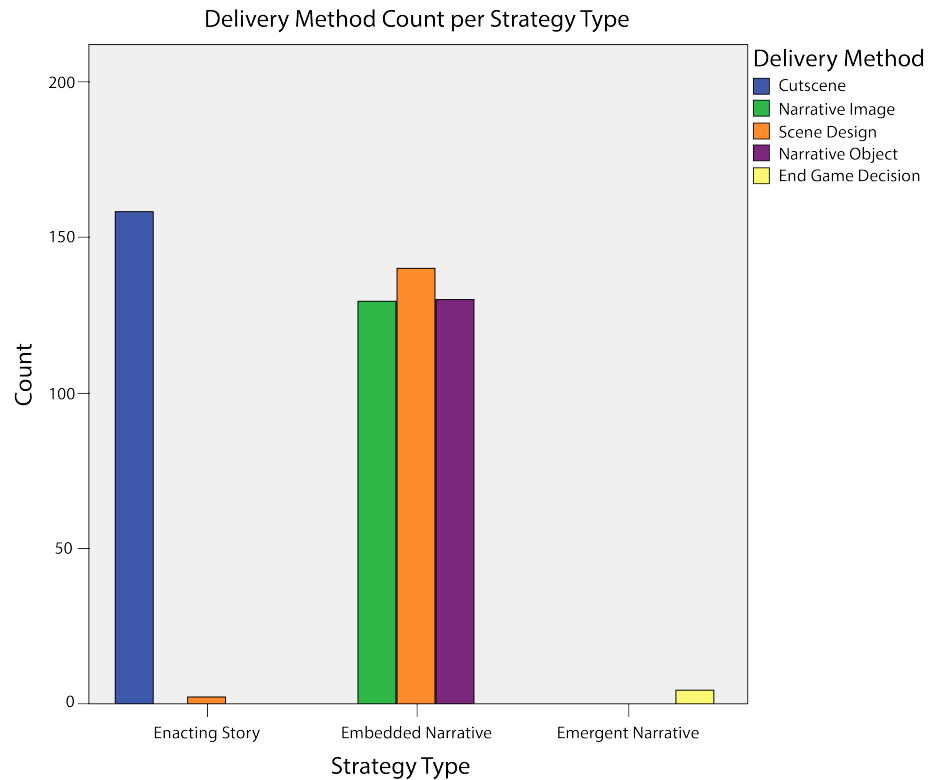
Figure 6. Bar graph depicting distribution of narrative delivery method per strategy type.

3.3.2. Narrative Delivery Methods

Five general methods were discovered in terms of how narrative was generally delivered to the player, also known as *Narrative Delivery Methods*. These methods are *Cutscenes*, *Narrative Images/Text, Scene Design, Narrative Objects*, and *End Game Decisions,* as described in **Table 5**. As can be seen in **Figure 6** narrative delivery methods are the most varied within instances of embedded narratives. Enacting stories instances are primarily delivered through the use of cutscenes, and all emergent narratives instances are delivered through required player decisions.

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Table 5. Description of narrative delivery methods.

Delivery Method	Definition
Cutscenes	Embedded videos or actions that are witnessed actively by the player or in the background of gameplay
Narrative Images or Text	Images that reveal narrative information to the player
Scene Design	The design of the scene contributes to narrative meaning and/or holds symbolic meaning to the narrative
Narrative Objects	Specific objects that are explicitly featured in the narrative, usually interactive
End Game Decisions	Choices the player makes that influences the direction or outcome of the narrative

3.3.3. Environmental Storytelling Themes

Further analysis of the five narrative delivery methods took place in order to discover patterns in how designers specifically delivered narrative information to the player. Five *Environmental Storytelling Themes* were found in terms of how the instances of environmental storytelling were implemented in the games analyzed. The five themes are *Positionality of Cutscenes, Use of Color and Light, Crystallized Narrative in 2D Images, Statues as 3D Objects,* and *Objects as a reminder of Key Narrative Points*.

3.3.3.1. Positionality of Cutscenes

The manner in which cutscenes are presented used common models across the games. Cutscenes were either presented in game by taking place at the player's current position in the midst of gameplay at the diegetic level, or outside of gameplay at the extradiegetic level once the player has completed a certain interaction, triggering a fade to either white or black and the playing of the cutscene. The implementation of cutscenes

within these games provides a way for developers to deliver narrative to the user in a controlled manner, forcing the player to observe important narrative information with little to no interaction.

Figure 7. *Unravel*, **screen capture showing cutscene playing in background during gameplay.**

3.3.3.2. Use of Color and Light

A common theme for embedded narratives across the games is the use of strategic lighting and color placement to highlight objects and scene design features that have narrative importance. One example of the use of color and lighting in the game *Inside* (see **Figure 8**) to convey the narrative that the antagonist of the game is closely monitoring society in order to find and eliminate people in which brain control is not effective. The player character is dressed in red for two purposes: 1) To create visual

contrast for ease of locating the character; and 2) To signify that this character is

different from the rest of the zombie-like population.

Figure 8. *Inside*, **screen capture showing use of color and lighting to highlight important moments of environmental storytelling.**

3.3.3.3. Crystallized Narrative in 2D Images

Images were a common method of conveying embedded narratives. These took

the form of representations that were "hung" into the game world. Common

representations were found across the games, and included wall engravings, paintings,

drawings, and even as flat animated textures. Other forms of 2D images were delivered

as still graphics to be unlocked by players, and even as translucent holograms. These

collected images (see **Figure 9 & 10**) provided narrative information to the player

through the use of detailed pictures. As the player collects more images, more narrative

information is given in which the player can use to draw conclusions about the story.

Figure 9. *The Cave***, screen capture of crystallized narrative in 2D images.**

Figure 10. *RiME,* **screen capture of crystallized narrative in 2D images.**

3.3.3.4. Statues as 3D Objects

Despite the fact that a variety of 3D objects can be found in the games, it was

somewhat surprising that those that conveyed narrative were very often in the form of

statues. For example, many of the games displayed stone statues of an important

character or narrative theme. These statues were placed in the environment either as a

still prop to be observed and interpreted, or as a method of transportation into narrative

cutscenes.

3.3.3.5. Objects as a reminder of Key Narrative Points

Objects that were revealed in important cutscenes were later integrated into the

game environments. For example, in *Hello Neighbor*, the player witnesses a car crash in

one of the dream-like cutscenes revealed during gameplay. In the scene, the villain of the

game is shown rushing to the wreckage, grieving over his wife, whose shoe is strewn

across the pavement. Later in the game, the player stumbles upon the same shoe in the

environment. The embedding of cutscene objects into the game environment serves to remind the player of key narrative segments, and thus hold narrative significance. Another example of this theme takes place in *RiME*. The cutscenes in *RiME* show the death of a boy from a shipwreck. Pieces of the shipwreck appear recurrently in the environment of the game, as shown in **Figure 11 and 12** below.

Figure 11. *RiME*, screen capture of shipwreck pieces.

Figure 12. *RiME*, screen capture of shipwreck pieces.

3.4. Discussion: Part I

There has been so far little empirical research on environmental storytelling. Much of what we know about the topic is encapsulated in industry practices. Currently, designers find ways to convey narrative through spatial elements in games based on their creative means, prior experience and instinct. The goal of our research was to analyze existing games to determine whether any systematicity can be found in industry practices so as to be able to eventually move towards the development of guidelines for novice designers. Thus, the outcomes of this study are intended to be stepping stones for

deeper exploration in environmental storytelling. Future research will examine the effects of different spatial storytelling strategies on player experience.

Embedded narratives and enacting stories were most prevalent in the games. As previously stated, evocative spaces were omitted from this study due to the nature of subjectivity in prior knowledge. Emergent narrative instances occurred only five times across all games, admittedly because it is a much harder strategy to design for and employ. These emergent instances all took place at the end of the games in which the player's explicit actions determined which narrative cutscene was provided. In order to determine what counted as an emergent narrative, it was important to analyze what decisions affected the narrative discrepancy between actions that change the narrative versus regular gameplay decisions. Based on these findings, it is assumed that environmentally-driven games can deliver a narrative through the use of only cutscenes, narrative images, and intentional environment and prop design (see **Figures 7-12**).

It was observed that the pattern of the flow between gameplay and narrative delivery was similarly structured across all games. The games would begin with an initial narrative cutscene for the purposes of exposition, continue to the introduction of mechanics and gameplay, and as the user would explore the environment and complete the puzzles, narrative images and cutscenes were revealed. Nearing the end of the game, the narrative intensifies as does gameplay, and eventually resolves in the final resolving cutscene. The narrative/gameplay structure across games that are environmentally-driven

seems to all be the same, as narrative delivery completely relies on enacting stories and embedded narrative strategies.

All of the games contain high instances of embedded narratives, followed second by instances of enacting stories. *Hob* and *Inside* do not comparatively follow the trends of the rest of the games as closely, using enacting and embedded strategies at a near equivalent frequency. *Hob* is classified as an environmentally-driven game, but also requires a great deal of combat in the gameplay unlike the rest of the games selected for this study. This resulted in a below average amount of environmental storytelling instances in proportion to the length of gameplay (34 recorded instances for an estimated 10 hours of gameplay). For purposes of comparison, *Journey* had 32 instances of environmental storytelling for 2.5 hours of gameplay. The majority of gameplay time in *Hob* was used for combat in order to navigate throughout the game, whereas the remaining games in the study used gameplay time for narrative delivery as well as puzzle solving. In addition to the puzzler/combat hybrid gameplay, the environment was more repetitive in design and less symbolic than the rest of the games analyzed (see **Figure 13**). *Inside*, however, is crawling with environmental design, but the narrative is highly ambiguous and interpretive, which created difficulty in distinguishing explicit instances of environmental storytelling (see **Figure 14**).

Figure 13. *Hob*, **screen capture showing the repetition in the design of the overall environment.**

Figure 14. *Inside*, **screen capture showing strong environmental and narrative design.**

Although this study demonstrates that environmentally-driven video games can deliver a complete narrative through the use of only two out of the four spatial strategies, some form dialogue was required to fully understand the narrative and begin the gameplay. This presents the issue of if it is possible for players to fully understand narrative solely through the use of the environment.

4. PART II: IMPLEMENTATION OF EMBEDDED NARRATIVES

4.1. Methodology

4.1.1. Environment Creation using Embedded Narrative Methods

As stated in the previous analysis, five narrative methods were discovered using Henry Jenkins' framework to identify and categorize instances of environmental storytelling in environmentally-driven video games. Three out of five of the narrative delivery methods were categorized primarily as embedded narratives.

4.1.2. Narrative Detail

In the past, designers have implemented environmental storytelling elements into films, television shows, and video games at different levels of narrative detail (Chapman, n.d.). Many filmmakers use environmental storytelling broadly for expositional purposes by presenting a general setting to the audience, such as **Figure 13** from *The Haunting of Hill House (2018)*. It is obvious to the viewer from a first glance at the house from this horror series that some narrative event has taken place here. The destruction in the foreground, the overgrown vines, and boarded windows are only some of the elements that give the audience just enough information to imagine the type of story that took place at this house. The design of environments with *broad narrative detail* is extremely common, especially for setting the overall mood and scene in film, television, and games.

Figure 15. Screen capture of the house from *The Haunting of Hill House (2018)*.

More commonly in both film and games, scenes are designed with *moderate narrative detail,* meaning the narrative information is translucent such that the information in the scene to be discovered provides the viewer with guideposts regarding prior events that have shaped the present. Scenes designed with *moderate* narrative detail usually require the audience to piece together snippets of information here and there, much like the scene taking place in **Figure 14** from *BioShock Infinite*. The more obvious parts of the scene (the dead bodies, bloody footprints, and the bloody message on the wall) give the player an idea of what happened here, and after further exploration and interaction with environmental elements during gameplay, the story becomes more

evident. In film, the exploration of a scene is usually done by scripted interaction

between the actor and their environment.

Figure 16. *BioShock Infinite***, screen capture showing an example of moderate
narrative detail in a scene.**

Lastly, some environments are designed with *specific narrative detail*, in which

designers have embedded every necessary narrative piece of information into the scene.

These types of scenes are more common in video games, which require the player to

really read the fine print. Much of the information in these scenes are delivered via text,

usually embedded into textured assets, which is important in video games with little

character dialogue and interaction. Usually the information discovered in these scenes in

video games would be equivalent to information delivered via dialogue in film.

Based on these observations, the three digital environments were designed at three different levels of narrative detail: 1) *Broad* narrative detail: sets the scene and gives expository information to the audience; 2) *Moderate* narrative detail: not explicitly detailed, but enough information is present to provide the audience with a loose interpretation of the narrative; and 3) *Specific* narrative detail: the scene is comprised of highly specific narrative information.

4.1.3. Narrative Conceptualization

Based on the design for varying levels of narrative detail between the three environments, the creation process was slightly different for each of the stories. The narratives were created with the assistance of the *Pixar Prompt* (Bunting, 2012). Narrative and visual inspiration was taken from browsing concept art and images for setting ideas, and once a setting was decided upon, a portion of the Pixar Prompt was used to write the complete story. The *Pixar Prompt*, created by Pixar Animation Studios, is a six-sentence template that helps users to create a compact, yet effective story with ease. Four out of the six sentences were used to write the narratives for the environments due to the narrative being mid-progress, as the entire narrative would be revealed through player interaction. The fill-in-the-blank template is presented as: "Once upon a time there was _____. Every day,_____. One day_____. Because of that,_____. Because of that_____. Until finally_____." (Bunting, 2012) An example of this template in use is: "Once upon a time there was a dog. Every day, the dog played fetch with his owner in the front yard. One day his owner accidentally threw the dog's ball into the street while

playing fetch. Because of that, the dog jumped over the fence and chased the ball into the street. Because of that, the dog ran away and got lost. Until finally some friendly neighbors found the dog and returned him to his relieved owner." The template was a simple, yet effective way to create the remaining two compelling narratives. The story was then broken down into important narrative information, then further detailed to decipher what assets would be vital in order for such information to be evident to the user, depending on level of narrative detail. These assets, their details, and the arrangement of them within the environment, would ideally make up an instance of environmental storytelling.

4.1.4. Environment Creation: Technical Process

The three digital environments were created using various computer programs. The models and compiled scenes were created in Autodesk® Maya® 2018. The models were then exported into Adobe® Substance Painter for the texturing process. Specific textures and graphics required the supplementation of Adobe® Photoshop® and Illustrator®. The texture maps were then exported as image files formatted for Marmoset Toolbag™. The final scene was set up in Marmoset Toolbag™, in which models and texture maps were imported, materials were applied to the assets, the scene was lit, and rendered.

4.2. The Three Digital Environments

4.2.1. The Witch Hut

4.2.1.1. Narrative

The story of *The Witch Hut*:

"Once upon a time there was a kind witch that lived in a bustling kingdom. Every day, she was ridiculed, shunned, and feared by the people of the kingdom. One day, she was captured and thrown out of the city into the swamplands. Because of that, she grew full of hatred and became bitter, vowing to never return to the heart of the kingdom, and she lived out the rest of her days in isolation in her hut on the swamp."

4.2.1.2. Design of Narrative Elements

The Witch Hut was designed with a *broad* level of narrative detail. We wanted to explore an exterior environment to emulate establishing shots most commonly seen in films. We wanted this exterior environment to create a specific visual mood, help the viewer imagine what kind of events would take place in this scene, and externally represent the character that inhabits the environment.

4.2.1.2.1.1. Implementation of Embedded Narrative Techniques

Unlike the other two environments created for this thesis, there are not any assets in this environment that deliver specific narrative information to the viewer. Due to the use of *broad* narrative detail in this environment, rather than *moderate* or s*pecific*, the narrative information in this scene relies upon the assets working together as a whole to set the overall mood for the narrative. Certain assets provide insight to the type of

character that inhabits the hut, however these assets are dependent on generalized stereotypes of fantasy character design. The cauldron, broom, scattered bones, and spooky "Beware" sign, as well as the mood of the scene, indicates that a witch lives here. Smaller details, such as the hat on the chair, the shrunken head, the circular sign portraying the phases of the moon, and the coffin under the hut add to the narrative, but these assets might not be as obvious to the audience as other narrative elements (see **Figure 19 & 20**).

The overall *use of color* in *The Witch Hut* is the most dominating embedded technique implemented in this environment. The colors in this environment heavily influence the mood for this ill-omened narrative. The use of darker, muted browns and greens throughout this environment are commonly used in movies to create a dark, ominous, or threatening atmosphere (How to use color in film: 50+ examples of movie color palettes, 2019). Additionally, the bright red of the "BEWARE" sign creates a warning flash of danger and violence intended to ward off unwanted visitors.

Another element embedded into this environment that assists in setting the right mood for this narrative is the *shape language*. The triangular shape of the hut, chair, and smaller elements in *The Witch Hut* "elicits fear, distrust, and suspicion." (How cinematographers use geometric shapes to tell stories with visuals, 2016) In fact, most shapes in this environment create a sense of unease, as they are quite angular and jarring, rather than smooth and curved.

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4.2.1.3. Final Environment

Figure 17. *The Witch Hut,* **final render 1.**

Figure 18. *The Witch Hut,* **final render 2.**

Figure 19. *The Witch Hut,* **hat and shrunken head.**

Figure 20. *The Witch Hut,* **coffin under the house.**

4.2.2. The Unexpected Launch

4.2.2.1. Narrative

The story of *The Unexpected Launch*:

"Once upon a time there was a rocket scientist was working in his lab. Every day, he modified and checked his code for errors in his launch sequence. One day, while he was updating the code, an error occurred and the code was rejected. Because of that, the rocket prematurely launched through the window, injuring the scientist in the process, and creating chaos in the lab."

4.2.2.2. Design of Narrative Elements

The digital environment created for *The Unexpected Launch* was created with *moderate* narrative detail. From a first glance at the scene, the larger and more dramatic narrative elements imply that something has happened here, which creates the questions, "who, what, how, and why did this happen?" These questions remain unanswered until further exploration of the scene takes place.

4.2.2.2.1. Key vs. Background Assets

Like most movies, television shows, and games, this scene is comprised of two different types of assets in relation to narrative information: 1) *Key* Asset: the asset carries significant narrative importance in the environment; and 2) *Background* Asset: the asset adds to the general aesthetic of the scene, and possibly supplements the narrative, but the narrative would still be intact if this object disappeared from the scene. **Table 6** shows a breakdown of the key and background assets in the environment, what type of asset they are, and why they are classified as either a key or background asset.

The remaining assets in the scene not listed in **Table 6** are assumed to be background

assets, as they mostly contribute to the overall environmental design of the lab.

Table 6. *The Unexpected Launch***, key vs. background asset breakdown.**

Asset	Type	Why
Computer **(Figure 21)**	Key	The bright yellow caution symbol, as well as the visible coding errors (red text) tells the audience that something has gone wrong. The "Launch" button on the keyboard tells the audience that this computer is directly related to the launching of the rocket.
Launchpad **(Figure 22)**	Key	The rocket blast stain and design of the launch pad shows the rocket took off from there, and the absence of the rocket poses the question: "Where has it gone?" The placement in the scene helps the audience create connections between the rocket, the launch pad, the debris, and the smashed window. The text on the motor attached to the launch pad reads "ERROR", which implies something has gone wrong.
Window	Key	The window shows something crashed through it, leaving glass shards and a big hole. The safety glass shatter pattern serves as a background detail for general environmental design of a rocket lab.
Ground clutter **(Figure 23)**	Key	The spilled coffee, broken glass, dropped goggles, and blood show the location of the scientist when the accident occurred, and it also shows that this accident recently took place.
Rocket(s)	Background	The rockets in the scene are mostly background assets. However, if all rockets ceased to exist within the scene, the narrative might not be as explicitly clear to the audience due to lack of environmental design.

Table 6 Continued. *The Unexpected Launch*, **key vs. background asset breakdown.**

Asset	Type	Why
Crane	Background	The crane is just décor that contributes to the design of the rocket lab environment.
Tools/pencil	Background	These small items show someone inhabited this environment and they were working there.
Notebook/Papers **(Figure 21)**	Background	These assets show someone inhabited this environment, and details on the papers show rocket equations to provide background details.
Planets/Wall Posters **(Figure 24)**	Background	The planets and poster of space contribute to the overall environmental design, however the safety poster supplements the narrative and hints at the accident that occurred in the lab.

Figure 21. *The Unexpected Launch,* **computer, papers, and rocket.**

Figure 22. *The Unexpected Launch,* **launch pad and notebook.**

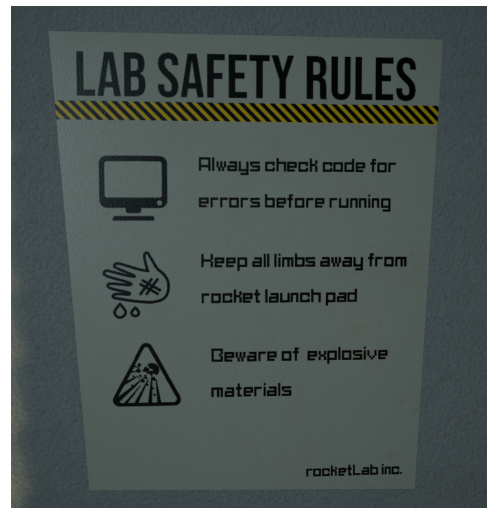**Figure 23.** *The Unexpected Launch,* **floor clutter.**

Figure 24. *The Unexpected Launch*, **safety poster.**

4.2.2.2.2. *Implementation of Embedded Narrative Techniques*

Embedded narrative techniques found in Part I of this thesis were implemented in the design of *The Unexpected Launch* in various ways, the prominent technique being the *use of color and light* (refer to Section 3.3.3.2) throughout the environment and its assets. Strategic lighting in the scene was used to direct the viewer's gaze to key assets, such as the window, launch pad, and floor debris. The directional lighting highlights these assets, while most background assets purposefully lie in the shadows in the environment. Additionally, the use of the color red and the glow effect on specific assets such as the computer (**Figure 21)** and the motor (**Figure 22)** attached to the launch pad actively grabs the attention of the viewers. The text on these assets, read as "ERROR" and "LAUNCH", provide embedded narrative details that help the audience draw conclusions about the narrative.

Additional embedded narrative elements in the environment include varying narrative images and symbols. The lab safety poster, as shown in **Figure 24**, provides narrative information through the use of embedded text and symbols. These symbols, specifically the explosive symbol, are repeated throughout the environment. This technique is similar in theory to the *Objects as a reminder of Key Narrative Points* technique discovered in the content analysis (refer to Section 3.3.3.5). The symbols are meant to act as a reminder of narrative events, just as certain objects would appear in the environments in the games studied to help players recall certain cutscenes involving narrative information. These symbols also give the viewers an explanation for certain

assets in the environment, for example the bloody handprint and the injured hand symbol

on the safety poster are meant to assist the audience in making narrative connections.

4.2.2.3. Final Environment

Figure 25. *The Unexpected Launch,* **final render 1.**

Figure 26. *The Unexpected Launch,* **final render 2.**

4.2.3. The Vanity

4.2.3.1. Narrative

The story of *The Vanity*:

"Once upon a time there was a beautiful Broadway star named Carolyn Romano. Every day, she sat in front of her vanity to get ready for the big show. One day after her show, she went to meet her husband, Tony, for drinks at the Ritz, but he died in a mysterious car accident on his way to meet her. Because of that, she spends every minute she possibly can investigating his unresolved and untimely death."

4.2.3.2. Design of Narrative Elements

The Vanity was designed with *specific* narrative detail embedded into the scene. The environment was designed to be similar to detailed environments in video games in which players must interact with assets such as books or journals. Usually these assets contain large amounts of textual information that are helpful in understanding the overarching narrative. From afar, this scene seems to be an ordinary vanity, with the exception of some key assets, such as the funeral hat, that are designed to intrigue the audience. When taking a closer look, the scene proves to be more than just a beauty vanity, and narrative information unfolds as the audience delves into the finer details.

4.2.3.2.1. Key vs. Background Assets

As discussed in Section 4.2.2.2.1, two asset types, *key assets* and *background assets,* were used to create this environment. These assets are detailed below in **Table 7.**

The remaining assets not listed in **Table 7** are assumed to be background assets, as they

mostly contribute to the overall environmental design.

Table 7. *The Vanity,* **key vs. background asset breakdown.**

Asset	Type	Why
Tony's Fedora **(Figure 27)**	Key	Tony's fedora ties many narrative aspects together. 1) It is tattered and torn, showing something happened to it. 2) He is seen wearing it in photos, so it ties him to the scene. 3) It is mentioned in the newspapers that a fedora was stolen from the crime scene of the car accident.
Newspaper/Clippings **(Figure 28)**	Key	The newspapers and clippings give all the background information as to why Carolyn is keeping these items. It also implies that she is personally connected to, and possibly obsessing over these stories in the papers.
Black hat with veil	Key	This asset is helpful for catching the audience's eye when taking a first glace at the scene. This also implies that someone has died, and that Carolyn recently attended the funeral.
Photographs	Key	The photos give background information on how the people in the narrative are connected to one another.
Vase of flowers **(Figure 28)**	Key	This is one of the assets that ties Carolyn to Tony, who signed the card on the vase. The dead flower petals create symbolize Carolyn's refusal to accept her husband's death.
Fan mail	Background	This asset is not vital, but it supplements the narrative and background information. The fan letters attribute to the fame of Carolyn, but when taking a closer look the letters express condolences.
Chocolates	Background	The chocolates show that someone inhabits this space, as well as implies that she is famous or possibly has romantic connections.
Chair	Background	The chair also shows someone actively inhabits the space, and the star on the back hints at fame.

Table 7 Continued. *The Vanity,* **key vs. background asset breakdown.**

Asset	Type	Why
Gun	Background	The gun creates unease and gives the audience the feeling something is not right here.
Autographs	Background	The autographs show the audience this person is famous, and they also display her name, Carolyn Romano.
General clutter	Background	The makeup, jewelry, perfume, boa, and hand mirror all provide insight to the character that inhabits this environment.

Figure 27. *The Vanity,* **Tony's fedora. Blood stains, wear and tear from car wreck.**
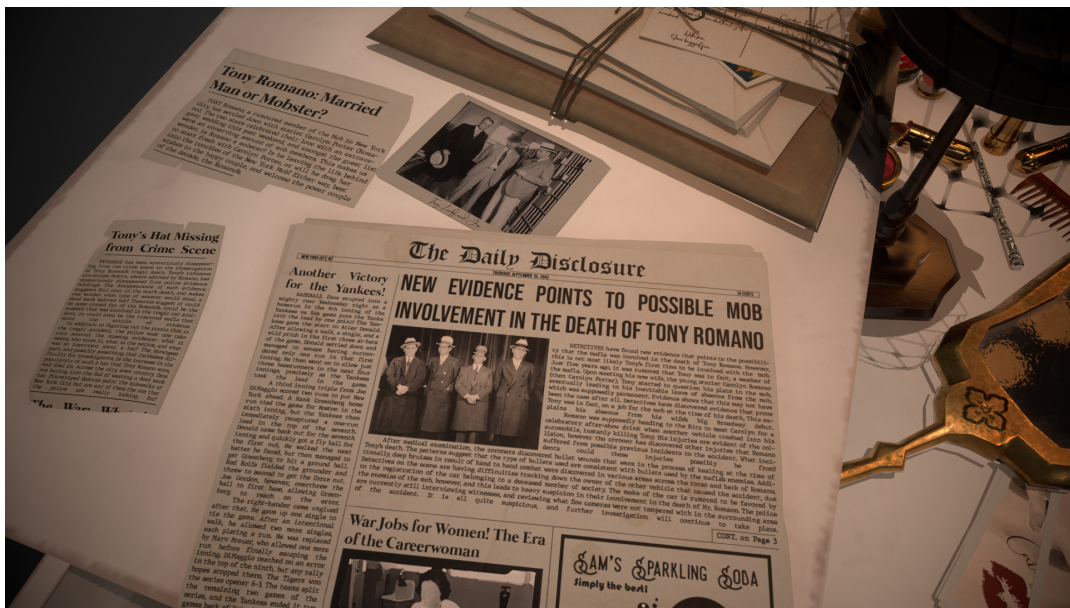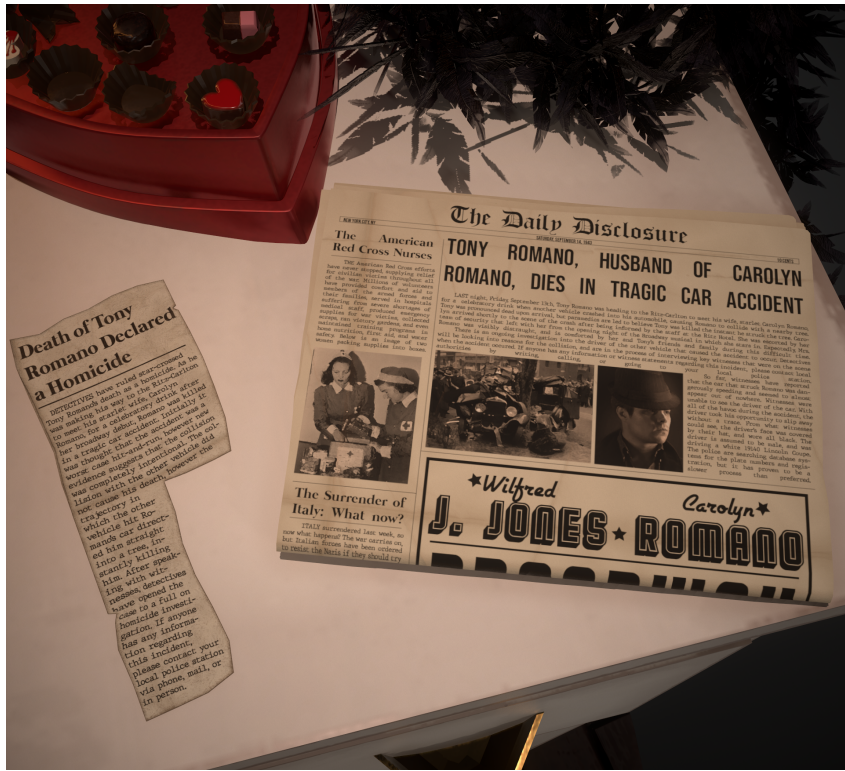
Figure 28. *The Vanity***, close-up of newspaper articles and photographs.**

Figure 29. *The Vanity,* **picture of Tony and flowers. The note reads: "Meet you at the Ritz! –Tony"**

4.2.3.2.1.1. Implementation of Embedded Narrative Techniques

The most prominent embedded narrative technique in *The Vanity* is the use of

narrative images and text. Assets such as the newspaper articles, photos, and notes (see

Figure 28) integrated into the scene provide the complete backstory that explains why

Carolyn Romano's vanity is covered in such an array of items. The photos in the

environment are meant to establish who Tony and Carolyn Romano are, what the nature of their relationship is, as seen in their wedding photograph in the top left corner of the vanity's mirror. Furthermore, many of the headlines and information in the newspaper articles directly relate to specific assets in the environment that create connections between the characters. For example, the newspaper clipping on the left in the first image of **Figure 28** that reads, "Tony's Hat Missing from Crime Scene", is referring to the hat that is sitting in Carolyn's chair. Additionally, the newspaper headline in **Figure 28** that reads, "New Evidence Points to Possible Mob Involvement in the Death of Tony Romano", is next to a corresponding photo of Carolyn's that pictures Tony with the mob, or possibly even as a fellow member. This detail also relates to the third article on that side of the vanity, which says "Tony Romano: Married Man or Mobster?" The finer text in the articles reveal even more specific details of the narrative that paint a complete picture of the tragedy Carolyn Romano faces. The assets that the articles direct the viewer towards also serve as *objects as reminders of key narrative points*. The fedora and the funeral hat are reminders of Tony's death, and the flowers are a constant reminder to Carolyn, and the audience, of her and Tony's relationship, as well as the tragic evening in which he died.

4.2.3.3. Final Environment

Figure 30. *The Vanity,* **final render 1.**

Figure 31. *The Vanity,* **final renders 2 & 3.**

5. CONCLUSION

This two-part thesis studied the implementation of environmental storytelling across multiple forms of media, specifically video games. The first part of this thesis consisted of a content analysis in which Henry Jenkins' framework for spatial strategies was used to qualitatively analyze environmentally-driven video games. Findings from the content analysis showed prevalence in the use of embedded narratives as a tool for infusing narrative information into an environment. Common themes and patterns were discovered in the use of embedded narratives, and further investigated. These themes were then used to create three digital environments in Part II of this thesis. These environments were designed specifically with embedded narrative techniques in order to demonstrate the effectiveness of environments as narrative devices.

The few studies previously conducted in the area of environmental storytelling report the use of either Henry Jenkins' spatial storytelling strategies or Worch and Smith's characteristics of environmental storytelling to conduct analyses of one video game, or to create immersive experiences based on these frameworks (Tarnowetzki, 2015; Bevensee, Boisen, Olsen, Schoenau-Fog, & Bruni, 2012). This thesis combines both of these approaches, as it provides an in depth analysis of multiple games, as well as the creation of digital environments based upon findings from the analysis. Additionally, previous research focuses more on spatial elements within gameplay interaction, whereas this thesis focuses on the methods in which space delivers narrative information to players. The amalgamation of multiple methods used in previous studies,

as well as the focus on digital environments as narrative devices in this thesis allows for a more innovative approach to research in the field of environmental storytelling.

      This thesis contributes to the field of digital storytelling, as it could help designers create immersive environments that are intentionally designed to tell stories. This research provides details for delivering narrative in innovative ways, and it discusses the many ways in which environments contribute to the overall understanding of stories and their characters. The goal of this thesis is to provide an initial foundation for the creation of guidelines that will be useful for designers aiming to deliver narratives through environmental design. This thesis serves as evidence that designing narrative environments through the implementation of embedded narratives is both feasible and effective. Ideally, one day there will be guidelines for all four of Henry Jenkins' strategies of environmental storytelling.

REFERENCES

Affron, C., & Affron, M. J. (1995). *Sets in motion: Art direction and film narrative* Rutgers University Press.

Bevensee, S. H., Dahlsgaard Boisen, K. A., Olsen, M. P., Schoenau-Fog, H., & Bruni, L. E. (2012). Project aporia – an exploration of narrative understanding of environmental storytelling in an open world scenario. Paper presented at the *Interactive Storytelling,* 96-101.

Bordwell, D., Thompson, K., & Smith, J. (2017). *Film art: An introduction* (11th ed.). New York: McGraw-Hill Education.

Bunting, J. (2012). Once upon a time: Pixar prompt. Retrieved from https://thewritepractice.com/once-upon-a-time-pixar-prompt/

Carson, D. (2000). Environmental storytelling: Creating immersive 3D worlds using lessons learned from the theme park industry. Retrieved from http://www.gamasutra.com/features/20000301/carson_01.htm

Chapman, H. (n.d.). How to build your story's setting. Retrieved from https://www.novel-writing-help.com/story-setting.html

Gibbs, J., & Gibbs, P. J. (2002). *Mise-en-scène: Film style and interpretation* Wallflower Press.

How cinematographers use geometric shapes to tell stories with visuals. (2016). Retrieved from https://nofilmschool.com/2016/10/how-cinematographers-use-geometric-shapes-tell-stories-visuals

How to use color in film: 50+ examples of movie color palettes. (2019). Retrieved from https://www.studiobinder.com/blog/how-to-use-color-in-film-50-examples-of-movie-color-palettes/

Ince, K. (2005). *Georges franju. kate ince* Manchester ; New York : Manchester University Press, 2005. Retrieved from http://ezproxy.library.tamu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cat03318a&AN=tamug.2622625&site=eds-live

Jenkins, H. (2004). Game design as narrative architecture. In N. Wardrip-Fruin, & P. Harrigan (Eds.), *First person: New media as story, performance, and game.*(pp. 118-130) Cambridge: MIT Press.

Klevan, A. (2000). *Disclosure of the everyday: Undramatic achievement in narrative film* Trowbridge. Retrieved from https://kar.kent.ac.uk/9163/

Krippendorff, K. (2018). *Content analysis: An introduction to its methodology* SAGE Publications.

Lathrop, G., & Sutton, D. O. (2014). Elements of mise-en-scene. *Retrieved on January, 3* Retrieved from http://www.proseproductionsink.com/1102_licata_elements_of_mise-en-scene_modified.pdf

Pinchbeck, D. (2008). Dear esther: An interactive ghost story built using the source engine. Paper presented at the *Interactive Storytelling,* 51-54.

Tarnowetzki, L. (2015). *Environmental storytelling and BioShock infinite: Moving from game design to game studies*

Worch, M., & Smith, H. (2010). GDC 2010: "What happened here? – environmental storytelling". Paper presented at the *Game Developers Conference,* Retrieved from http://www.worch.com/2010/03/11/gdc-2010/