Designing for Ludonarrative Harmony

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***Executive Summary*—The purpose of this study was to create a process for game designers to use during development that would achieve ludonarrative harmony. This process includes a model that evaluated mechanics for ludonarrative harmony. The final thesis artifact included the ludonarrative design process, the ludonarrative models, and a level artifact that tested the process and models.**

***Index Terms*—ludonarrative harmony, game design, mechanics design, narrative design, evaluating mechanics, ludonarrative dissonance**

I. Introduction

Current discourse surrounding ludonarrative harmony defines ludonarrative harmony as a synchronization between mechanics and narrative that create a consistent and realized experience or story [1] [2] [3]. Games that achieve this synergy leads to an immersive gameplay experience. Ludonarrative dissonance, the opposite of harmony, disconnects the actions the player takes in-game from how and why they are performing those actions [4]. The goal of this thesis was to develop a design process for achieving ludonarrative harmony.

The designer developed a ludonarrative design process and model to evaluate synergy between narrative and mechanics. The designer included a level artifact to test the assumptions made on paper, and then refine the process for future use. This thesis researched the discourse surrounding ludonarrative dissonance and harmony, as well as ludonarrative resonance and cohesion. The thesis included the "The Four Keys to Fun" by XEO Design to understand how mechanics create immersive gameplay from the emotions those mechanics encourage [5]. The final thesis artifact included the ludonarrative models, the design process, and a level artifact in Unreal Engine 4.11 to test the methodology.

The level artifact had a review period every week for eight consecutive weeks where expert reviewers reviewed the artifact for ludonarrative harmony. The author submitted the final thesis level artifact on October 31st, 2016; and the author submitted this thesis as completed on December 1st, 2016.

A. Author Bias

The designer comes from a background in English Literature with an emphasis on reader-response criticism. Reader-response criticism focuses on the reader or audience reaction of a text, more than any objective meaning found within the text itself.[1] This criticism emphasizes the role of the reader as actively constructing the texts through reading, rather than passively consuming them. For this thesis, the author makes the distinction in games between a ludonarrative harmonious experience where a player *constructs* game narrative versus an experience where a player *consumes* game narrative.

B. Definitions

This thesis uses the following terms to identify how to achieve ludonarrative harmony within the context of this thesis. It was more important for a definition to have usefulness than to create a proper definition, as taken from Eric Zimmerman in *Re:Play* [6].

Term	Definition
Game	a series of willful, meaningful choices in an imposed artificial framework with uncertain outcomes [7]
Mechanics	actions taken by the player in a game that interact with the game's systems and are performed within the playspace [8]
Narrative	how the story is told and *why* the story exists; the communication of how and why the story exists [9]; the context of the story as it relates to the play space; & the experience of play through the use of game mechanics and interactions with systems
System	an underlying, automatic process that directly affects the game without the player's direct control, but can be altered by mechanics
Story	the sequence of events characterized by having a beginning, a middle, and an end
Playspace	the major area(s) of the game where the player interacts through mechanics with the game systems and experiences narrative [10]

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[1] For quick reference on reader-response criticism, please refer to the Poetry Foundation, https://www.poetryfoundation.org/resources/learning/glossary-terms/detail/reader-response-theory; for more detail, please reference the *Bedford Glossary of Critical and Literary Terms* 3rd Edition, Ed. Ross Murfin and Supryia M. Ray.

Ludonarrative harmony	the synchronized interaction between the mechanics and narrative supported by systems that creates a unified story
Ludonarrative dissonance	happens when a game has an unsynchronized interaction between the mechanics and the narrative; has gameplay unsupported by systems; and when interactions between the narrative and game mechanics creates a disjointed story

II. Research

A. Defining Ludonarrative Dissonance

Multiple critics have studied games for dissonance. Although ludonarrative dissonance can occur in any game genre, this thesis researched ludonarrative dissonance and harmony in first-person perspective games. This genre places the player in the protagonist's head, as the camera is the "player's eyes" in the world [11].

In 2007, Clint Hocking was one of the first to publish the term ludonarrative dissonance to talk about disconnect between a game and its narrative. In the majority of ludonarrative dissonance research, many cite Hocking's example as a classic example of ludonarrative dissonance. Hocking states that dissonance occurs when the game's mechanics do not match up with the game's narrative [4]. Hocking examples his experience with dissonance in *Bioshock*. When the game's mechanics emphasized self-preservation, but the narrative that drove the player through the game emphasized self-sacrifice, these elements did not create a unified story [4]. In one example, Hocking argues that harvesting the children is the only choice that does not create dissonance [4]. Atlas suggests to the player to sacrifice small children, called "little sisters," telling the player they will get more power from harvesting these children's abilities. Another character comes to the player and states that the children are *still* children and should be saved. Saving gives no immediate power. Instead, it restores the children to sanity and improves the player character's narrative standing with the side character. The side character leaves similar power-ups through the game, which players may or may not find [4]. Hocking argues this binary between harvesting or saving the children is a false choice. While both decisions lead to gaining power for the player, saving the children over time gives the player more power [4]. *Bioshock's* narrative is not about saving others; it's about saving the self. Harvesting encourages the narrative of self-power is worth any sacrifice. Saving does not. For this gameplay mechanic to require the players to save others, at the expense of the self, the gameplay mechanic would not match the narrative; therefore, this interaction between mechanics and narrative had ludonarrative dissonance [4].

Responding to Hocking's claims, recent criticism claims the choice to save or sacrifice the little sisters fulfills the narrative goals of the game. The player has agency, but the character rarely does. Choosing to save or sacrifice the little sisters is one of the only times Atlas asks the player to do something without saying "Would you kindly…?" [12] [13]. Meaning this is the only choice where the player character makes the decision freely. Whereas another critic goes so far to claim that dissonance at such a minute level requires the specific lens Hocking took to even count as dissonance [1]. This argument implies that there are multiple lenses with which to view dissonance in games.

Critics continued to expand on how and where ludonarrative dissonance occurred in games[2]. In *Watch Dogs*, the main narrative involves the death of a character's niece, but upon visiting her grave, the user-interface (UI) element prompts the player to parkour over her grave [14]. This prompt for gameplay that does not make narrative sense is dissonant, because the player is aware that the character their playing would *never* parkour over their loved one's grave. Decreasing the player's ability to contribute to a story whether through mechanics or narrative increases the potential for ludonarrative dissonance [14] [12].

1) Identifying and Preventing Ludonarrative Dissonance

Dissonance occurs when a game has an unsynchronized interaction between the mechanics and the narrative; has gameplay unsupported by systems; and when interactions between the narrative and game mechanics creates a disjointed story. According to Jenkins in his paper titled "Games as Narrative Architecture," the major factor with narrative that causes ludonarrative dissonance comes from the linearity of the past-tense that traditional storytelling (epics, books, and movies) dictates [15]. In some games, narrative in a traditional sense is a singular story with a beginning, middle, and end. This type of story is predetermined and does not react to the player's actions. Since the narrative design is being *told* to the player; the player cannot simultaneously *tell* that story. A traditional storytelling mindset naturally fights with a game's present-tense, active storytelling environment [15]. To create engaging narrative content, designers should recognize how interaction creates an active present-tense environment. Players press "x;" they jump, and then collect an item only to repeat. Jenkins argues the inherent narrative architecture of games create an inherent story to players that gives foundation to the more traditional storytelling elements that may be on top [15]. Since interactivity generates active loops, storytelling in games have immersion when they incorporate those loops into their narrative structures [15].

When designing for ludonarrative harmony, it was important to understand how a game's central theme influenced the mechanics and narrative. Included in his article, Hocking states that mechanics at the fundamental level encourage a type of player behavior [4]. The games' contract with the player allows the player to feel the themes of the game being expressed

[2] For more research on where ludonarrative dissonance occurs in games, see "Dissonance in Games: Refining Gamecraft" by Christian Erali published on Issu.

through performing those mechanics [11]. When the player performs a mechanic, the player expects a narrative that fits the theme of the game. To prevent dissonance, Harvey and Smith's Game Developers Conference talk argued that if the player cannot perform a mechanic, then designers should not show the potential for that mechanic in the game's environment [11]. When designing how the game's narrative theme, the fictional representation of that theme in the environment creates an expectation of what actions can be performed in that environment. This thesis used this methodology during development to ensure that when the player acted upon the environment the narrative reacted in a thematically consistent way.

B. Defining Ludonarrative Harmony

Current research is focused on defining what to call the opposite of ludonarrative dissonance. There are three terms used in different contexts to broadly mean that the mechanics and narratives have synergy. These terms are ludonarrative resonance, ludonarrative cohesion, and ludonarrative harmony.

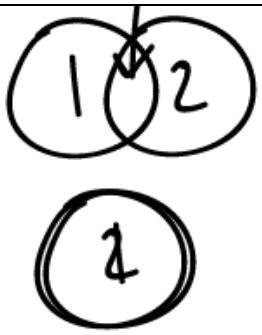
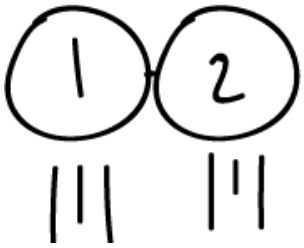
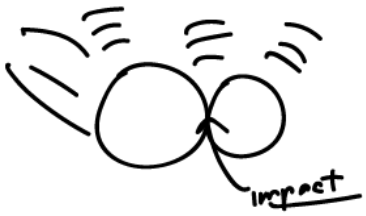
Ludonarrative Cohesion	when the thematic elements of a game are inherently tied to the player's narrative use of those mechanics.	
Ludonarrative Harmony	the synchronized interaction between the mechanics and narrative that creates a unified story.	
Ludonarrative Resonance	the reaction the player gets from experiencing a moment where the game mechanics and narrative impact each other.	

Table 1. Table comparing the three types of ludonarrative found in game research and their definitions

1) Ludonarrative Resonance

Game critics that use ludonarrative resonance talk about how the player responds to the game, not the interactions between those elements within the game [16]. Mattie Brice defines ludonarrative resonance as the successful use of mechanics to communicate a specific narrative experience [17]. The impact the mechanics have on the narrative in games directly amplifies or dampens the overall experience for the player. Resonance in this definition is the quality that makes something personally meaningful to someone [18]. In the game *Passage*, Mattie Brice states that players engage with the game not through traditional feedback system, but because there is a specific feeling the game wants to convey to the player [17]. Her critique argues gameplay can strengthen the narrative, but does not necessitate the synchronization of mechanics and narrative in the experience [17]. With ludonarrative resonance, narrative and mechanics are two separate entities.

Mechanics impact narrative in key moments that force player choice, or when using a mechanic enhances the player's overall

experience of the game. In Hagen's example of *Journey*, huddling during the blizzard level with another player character created ludonarrative resonance. Hagan was familiar with a mechanic that elicited a chirp sound and powered up another character and his own scarf when used. In the blizzard, this mechanic no longer worked. Yet for Hagan, even when the mechanic no longer provided warmth functionally, he stayed huddled with the other character on the screen for warmth narratively [16]. The narrative of keeping warm in a blizzard resounded when impacted with the inability to use a mechanic. Ludonarrative resonance is the reaction the player gets from experiencing a moment where the game mechanics and narrative impact each other.

2) Ludonarrative Cohesion

When critics use the term ludonarrative cohesion, they largely reference when the player's use of a mechanic overlaps with the narrative during specific gameplay moments.

An example of ludonarrative cohesion is Atlas' phrase "Would you kindly…" used to direct the player to complete certain objectives throughout the game. While players may think the phrase is a verbal tick, Atlas is actually saying a brainwashed command. Many times, whenever Atlas uses this phrase, the game objective updates to the request he made of the player [12]. The game objective updating when Atlas uses this phrase is an example of ludonarrative cohesion. Using this command phrase mirrors the players' inability to fight against the objectives set by Atlas; he has brainwashed their character to follow him [12]. Cohesion relies on overlap between mechanics and narrative to create a seminary game moment.

Critic and designer James Beans identifies ludonarrative cohesion as the combination of narrative and mechanics into a realized whole. *Mass Effect 2* is a role-playing game with multiple side quests, which build up the player's defenses and attack strength for the final battle. Yet right before the final battle, the antagonist of the game kidnaps the player's crew. Narratively, it makes sense for players to go straight to the final battle and get their crew. Mechanically, the player may not have all the end-game advantages needed from uncompleted side-quests that would help them get the ending where everyone lives [14]. If the player triggered the quest to end the game before they had completed everything, the game started a timer. The timer counted how long before the player accepted the end quest, and added a positive or negative modifier depending on how long they took [14]. The player that immediately went to rescue their crew had a higher survival rate, even if they did not complete the side quests [14]. Narratively, Shepard, the player character, may not be 100% ready, but that character would go rescue their crew. Mechanically, the game reinforced this narrative by having the timer. If players went to complete side quests before choosing the final battle, that player increased the chance that those captured crew members died in the final battle. This thematic consequence of a mechanic choice (to accept or not accept a questline) created ludonarrative cohesion.

Ludonarrative cohesion exists through thematic consequences, as crew members die as a direct effect of the player's choice to not immediately rescue them [14]. Beans also cites *Papers Please* and *The Walking Dead* as examples of ludonarrative cohesion. Since dialogue choice both a mechanic and a narrative device, where dialogue choice is the most straightforward example of ludonarrative cohesion [14]. In these examples, ludonarrative cohesion is used to connote a thematic element designers intended for players to feel either through later consequences (*Mass Effect 2)* or through repeated gameplay (*Papers Please*).

Taking a literary perspective, Alexandra Orlando argues how *Bioshock: Infinite* does *not* create ludonarrative cohesion because the goals of the narrative are different than the goals of the mechanics [13]. In the game, the player character's history haunts him throughout the story. The combat system allows the player to slice enemies' faces off mercilessly without hesitation, which contradicts the character's motivations during explicit story moments [13]. Ludonarrative cohesion breaks in *Bioshock: Infinite* because mechanics and narrative do not overlap at key gameplay moments. From this research, ludonarrative cohesion is when the thematic elements of a game are inherently tied to the player's use of those mechanics.

3) Ludonarrative Harmony

Ludonarrative harmony is used to describe when two separate elements work in sync with each other and simultaneously build a consistent experience. Abraham uses ludonarrative harmony in his analysis of *Gone Home* to describe when the narrative and the mechanics of the game convey a singular experience [1]. This expectation derived from using mechanics of walking and reading in a way that created a horror narrative. It was unclear what lay around the next corner; environmental feedback created suspense that kept him on edge [1]. Abraham states that the expectation of horror, even when there was no actual threat, shows how the player's interpretation of using mechanics creates a narrative experience of ludonarrative harmony that otherwise, would be seen as dissonant [1]. The synchronized interaction between the walking mechanic and the horror narrative of that mechanic created the story that there was something he needed to watch out for. Without that horror narrative, walking would have felt safe. The designers intended the narrative to create a horror atmosphere for walking, and thus a feeling of being unsafe. Even when he knew better, Abraham felt that he could never be sure he was safe [1]. The synergy between this mechanic and narrative had synergy, which created a unified story. [3]

Additional research on ludonarrative harmony cites that ludonarrative harmony more accurately refers to the interactions between the mechanics and narrative during gameplay. Travis Pynenburg studied ludonarrative harmony as a critical approach to game design. In his research, he referenced Brice's earlier definition for ludonarrative resonance. He stated where Brice stressed how gameplay is suited for developing plot, he argued that gameplay is *necessary*

[3] Story, as defined by the thesis paper as the sequence of chain of events characterized by having a beginning, middle, and an end. This definition still holds true for multiple ending games as well.

for creating a narrative experience in interactive mediums. Ludonarrative harmony is a symbiotic relationship between mechanics and narrative that happens through playing the game [2]. To further this concept, Pynenburg dissects the control scheme of *Heavy Rain*. *Heavy Rain* allows player characters to die or fail and the story continues. When character's undergo great duress in the game's narrative, the player must perform increasingly difficult button combinations to do the simplest of actions. This interaction between narrative and mechanics in these two examples showcases how ludonarrative harmony occurs [2]. Playing a game with ludonarrative harmony increases immersion, because it allows players to feel what they're doing at an emotional level, not just a narrative level [2].When responding to the player's use of mechanics, ludonarratively harmonious game systems react to those mechanics in a way that creates a richer and meaningful experience.

According to Dr. Johansen Quijano, game researcher and literary professor at University of Texas Austin, dissonance deals with two elements that are not in sync. Ludonarrative resonance and ludonarrative cohesion do not require the narrative and mechanics to be synchronized. If dissonance is not in sync, then its opposite must be in sync; this makes ludonarrative harmony the opposite of dissonance [3]. Pynenburg shares the opinion that mechanics and narrative must be in sync to combat ludonarrative dissonance, citing ludonarrative harmony as the appropriate term [2].

Of all definitions, ludonarrative harmony is most consistently used to identify the concrete interactions between mechanics and narrative that is visible to players. when these interactions have synergy, they create a harmonious experience. This thesis focused on developing a process that could examine this synergy and accurately evaluate the mechanics and narratives for ludonarrative harmony.

C. Narrative Structures in Games: How Players Experience Narrative

Ludonarrative harmony requires an interaction between mechanics and narrative. Narrative is the communication of how and why the story exists; and also provides context for mechanics. To understand how to achieve ludonarrative harmony, this thesis researched the way games communicate this narrative to players. Eric Zimmerman and Katie Salen's book *Rules of Play: Game Design Fundamental* identify the narrative structures that designers use to present narrative in games to players. They categorize game narrative structures into two categories: embedded and emergent narrative. In the book *Re:Play*, Eric Zimmerman further argues that the game experience comes from the connections between systems and mechanics in the narrative of the game world [6]. Virtually every game combines embedded and emergent narratives. Understanding the differences between embedded and emergent narrative allow designers to see narrative in the context of interactive play [19]. Depending on the narrative structure used, players experience the story of the game differently.

The embedded narrative is narrative that comes from the player's experience of pre-determined events. Whether through environmental storytelling, dialogue, or scripted sequences, the embedded narrative requires players to draw conclusions based on designed scenarios within the game world [19]. Dating sims—text based, dialogue choice driven games with the sole purpose of romancing another character—are a prime example of embedded narrative. Voltage, a Japanese company that specializes in dating sims, exemplifies the emebedded narrative design that allows player choice. Their dating sims put players on one pre-defined story path despite having the freedom to choose what to say [20]. Switching to another character in a Voltage game requires the player to switch to entirely different story, where the events of the first play through never happened [20]. Player choice is confined to designed scenarios within the playspace; and players cannot freely quit a romance halfway through or start another romance with another character. Embedded narratives are pre-determined by the designers and cannot be altered by the player's use of mechanics.

By Salen and Zimmerman's definition, any narrative not explicitly stated to the player is an emergent narrative. The emergent narrative comes from the rules governing interactions players take within the system, and requires players to use mechanics [19]. The emergent narrative is a direct result of the player's in-game actions. Jesper Juul's study of narrative in games states that all games, except dating sims, have an emergent narrative present [21]. These emergent narratives are characterized by expression and action, where players use mechanics to generate their own narrative scenarios [21]. The emergent narrative requires player interaction with the game's systems and environment. By incorporating a shared, tangible goal shared by both mechanics and narrative, the designer can achieve, or enhance, ludonarrative harmony [2] [3].

This research helped differentiate between the two distinct game design approaches of *Journey* and *The Stanley Parable*'s mechanics design in the methodology section. As emergent narrative required player use of mechanics, the thesis methodology focused on incorporating emergent narrative in the design of the level artifact.

D. The Four Keys to Fun: Connecting Mechanics with Player Emotion

The Four Keys of Fun study by Nicole Lazzaro aimed to identify the role of emotions in game outside the context of story [5]. Lazzaro identified that players experienced emotions from gameplay, outside of embedded narrative, and categorized those emotional experiences into keys of fun. The findings of 45 participants including hardcore, casual, and non-players found that people played games for the emotions felt during the moment-to-moment gameplay experiences. [5]. The major focus of the study was to identify what players precisely *felt* when playing those games during key gameplay moments.[4] The

[4] The 4 keys required their findings to be supported by largely accepted psychology theories and other theories [5]. A major psychology included in the criteria is Flow, by M. Csikszentmihalyi.

emotions included in the Four Keys of Fun had to meet the following requirements: they were already present in popular titles, were the most liked aspect of the play, created a unique emotion without story, and supported by larger studies and psychology theory [5]. Lazzaro correlated the mechanics against the emotions players felt before, during, and after distilling them into four distinct keys of fun: hard fun, easy fun, serious fun, and people fun [5]. While there are four keys, this thesis examined hard and easy fun.[5]

In hard fun, Lazzaro discovered that games with a choice of strategies that required players to challenge themselves instilled *fiero*—the Italian word for personal triumph over adversity [5]. Different levels of difficulty achieved hard fun by emphasizing player actions that tested their skills against the game's challenges. The emotions associated with the hard fun key included *fiero* and frustration. The easy fun key focuses specifically on invoking a sense of curiosity in players [5]. Lazzaro observed that players needed to feel immersed in a world that had more than game rules to feel a sense of adventure. The emotions associated with easy fun were wonder, discovery, and awe [5]. Lazzaro discovered that each of these four keys can be present at multiple times in a single game, but come from specific moment-to-moment encounters during play [5]. Her showed how various mechanics directly associate with specific feelings in players directly from using those mechanics. This thesis used the Four Keys of Fun as a point of reference for assigning a specific emotion to a mechanic in the methodology.

III. Methodology

This thesis focused on achieving ludonarrative harmony and used the hard and easy fun keys as a point of reference for finding the emotions [1]. The goal was to develop a process for evaluating mechanics and narrative for ludonarrative harmony. This thesis methodology established two distinct game design approaches for achieving ludonarrative harmony; created a process for evaluating mechanics and narrative for ludonarrative harmony; and included a level artifact to test and refine the design process. This thesis took the level artifact from concept to Alpha quality level.

A. Ludonarrative Game Design Approaches

Salen and Zimmerman's research on embedded and emergent narrative showed that players experience games differently based on their narrative structures [19]. The designer compared this research with two critically acclaimed game titles for having ludonarrative harmony: *Journey* and *The Stanley Parable*. Both designers went into the game development process with a specific player experience in mind that could only be achieved through mechanics [22] [23]. Despite their different approaches, their games achieved ludonarrative harmony. The designer played both titles, researched the design philosophies of each designer, and categorized each designer's game design philosophy as a distinct game design approach when designing games with ludonarrative harmony in mind.

There are two distinct ludonarrative game design approaches: designer-directed and player-directed approach. The player-directed approach places the player as the direct agent of the narrative and uses the game's systems and mechanics to convey that story [19]. The game *Journey* designed by Jenova Chen exemplifies this approach. The designer-directed approach creates an objective, third party character where the majority of the story happens to the player alongside their use of mechanics or systems to experience that story [19]. Davey Wreden and his game *The Stanley Parable* exemplifies this design approach.

1) Player-Directed Approach

In *Journey*, Chen spent the majority of the development discovering which mechanics would encourage a cooperative, compassionate style of play. By focusing on the emotions those mechanics encouraged, Chen was able to create *Journey* as a ludonarrative harmonious experience [22]. The ludonarrative of *Journey* revolves around jumping in a multiplayer context. Players use a jump ability that allows them to fly. Finding hidden pickups in the playspace allows players to increase the set flight duration. As players progress through levels, they meet other players that guide them to these pickups and then teach players through example that by activating their charge ability next to another player they can begin to fly indefinitely [24]. The interactions between these separate mechanics of jump and collecting created the compassionate play Chen envisioned. Chen aimed to create an experience where players had the choice to use mechanics in certain ways, or refuse that choice, and have that choice dictate their individual experience of the game [22]. In game criticism, *Journey* is highlighted as having one of the most tangible form of ludonarrative harmony.[6]

Chen's design philosophy put player agency as the driver for narrative experience. Even though the goal of every player is the same—reach the top of the mountain and finish the game—the moment-to-moment experiences from using the mechanics creates different stories that comprise the journey of *how* the players got there. This approach for player choice that allowed for multiple emergent stories is indicative of a player-directed approach.

2) Designer-Directed Approach

Wreden originally wanted to create a feeling of player-directed experiences, where players walked through doors and were free to choose where to go. However, as development progressed, Wreden realized *The Stanley Parable* narrative thrived when the game's mechanics could critique on how players are never truly free. The opportunity to tell a narrative that directly commented on the relationship between the player and the game's systems directly influenced Wreden to design the game that told that story the best [23]. All of *The Stanley Parable's* areas are unlocked through the successful use of the

[5] For more on the 4 Keys to Fun, please reference more of Nicole Lazzaro's work on her website: http://www.nicolelazzaro.com/the4-keys-to-fun/

[6] In references to *Journey*, [16] uses ludonarrative resonance to discover their personal experience—as [2] references ludonarrative harmony, as a development approach.

mechanics. Figuring out how to use the game's mechanics propels the narrative to its inevitable end—Stanley's "escape." The only way to complete the game is to fight against the narrator, choose another path, and eventually go through enough of the loops to reach the credits screen [25]. *The Stanley Parable* created a narrative that encouraged defiance of the narrator's narration, while simultaneously telling the player that their defiance was planned for [23].

Players experienced *The Stanley Parable's* narrative as a chain of events that were intentionally designed by Wreden. Like *Journey*, *The Stanley Parable* has a singular goal, but the moment-to-moment interactions create the same story in each play. This emphasis on player-choice as the medium for conveying narrative, but with a singular story and experience in mind is indicative of the designer-directed approach.

B. Ludonarrative Design Process

The designer started the development process with the player-directed approach. The game idea started with a player in first-person perspective using a light to navigate a dark room. This high concept gave the initial game mechanic (light) and narrative (navigating a dark room) with an implied game system of first-person perspective movement and camera controls. The designer chose first-person perspective, because it allowed for minimal art assets and highlighted the environmental interactions between the player and the playspace [11]. Each phase in the process is followed by prototyping, which called on expert reviewers to test the prototype and provide feedback.



Figure 1: ludonarrative design process includes prototyping to test assumptions after every major phase

After Analysis and Interactions, there is a prototyping phase. Synergy is a prototyping phase, where the designer tested the assumptions of all the Analysis and Interactions as they related to the game as a whole. The designer wrote a Game Design Document (GDD). The GDD established the foundations for the core gameplay of the level artifact, as well as the world's overall fiction. The designer used this document in tandem with the ludonarrative model throughout the process. Although the designer adhered to the ludonarrative model to evaluate the mechanics, the designer had central gameplay in mind written in the GDD. This document was before the start of the process, and after the final Analysis prototype. This central gameplay is found in the Interactions phase.

The high concept statement was based on a simple game idea created the initial global context and goals of the game. This high concept statement is: the player must navigate a dark environment with a light in pursuit of knowledge. Darkness started as an environmental obstacle to overcome in the pursuit of knowledge. The designer used the high concept statement to create a starting theme for the level—never give up—that changed to themes of escape and ascension. The designer used this model from both a mechanics-first and narrative-first perspective, with slight deviances as refinement of the model progressed through development. The ludonarrative design process references the relevant coursework taught at SMU Guildhall and the associated game design philosophies[7]. The designer developed the following model for ludonarrative harmony.

[7] These texts include *Game Design Workshop, 2nd Edition* by Tracy Fullerton, *21st Century Game Design*, by Chris Bateman, *The Art of Game Design* by Jesse Schell, *Rules of Play: Game Design Fundamentals*, by Katie Salen and Eric Zimmerman, and *Game Mechanics: Advanced Game Design* by Ernest Adams.

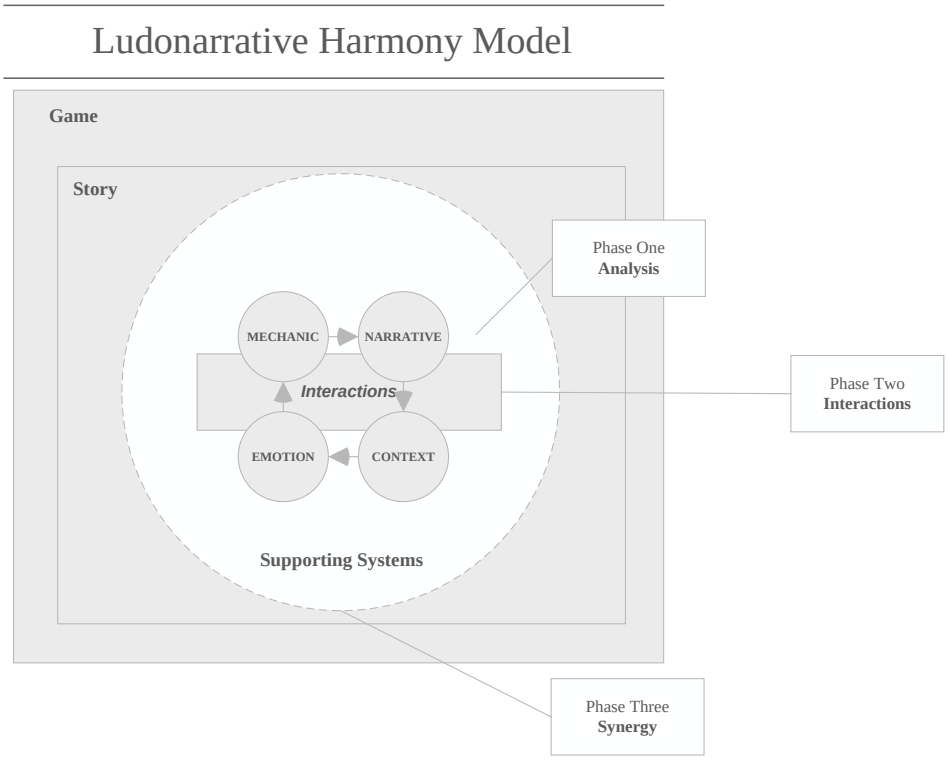


Figure 2: the ludonarrative model with the phases broken out beside it.

The Analysis phase captures the four central elements of ludonarrative harmony. These elements create a flow within a specific interaction that comes from players performing the mechanic in that flow. This flow is called a ludonarrative loop. It is possible to start at any point of analysis, such as starting with the narrative rather than the mechanic. However, the flow remains the same.

The Interactions phase establishes the connections between the ludonarrative loops from the previous phase. These connections show how gameplay directly affects the player's perception of narrative in-game. This phase creates a central ludonarrative loop based on the designer's chosen gameplay. Once the designer decided that the core game loop and the core ludonarrative of the game had achieved ludonarrative harmony, the designer moved to synergy.

Synergy happens when the ludonarrative elements work within the greater context of the game to create a realized, ludonarratively harmonious experience. Systems design creates a foundation, and level design establishes encounters and architecture that encourage the existing ludonarratively harmonious structure of the individual game mechanics, narratives, etc. In order to achieve synergy, the designer created a global context that defined what the player would, or would not, expect from the game experience.

The designer set the game world in an abandoned, far future environment. This meant that there could be more magical-looking assets, but any magic had to be grounded in a 21st century understanding of how technology works. This fiction contextualized the entire experience, and influenced the designer's decision making process. This fiction is not completely captured in the ludonarrative model.

The designer also created a model for identifying ludonarrative dissonance. If at any point in the game experience the narrative and emotions are removed from the player's use of the mechanics, this would create ludonarrative dissonance.

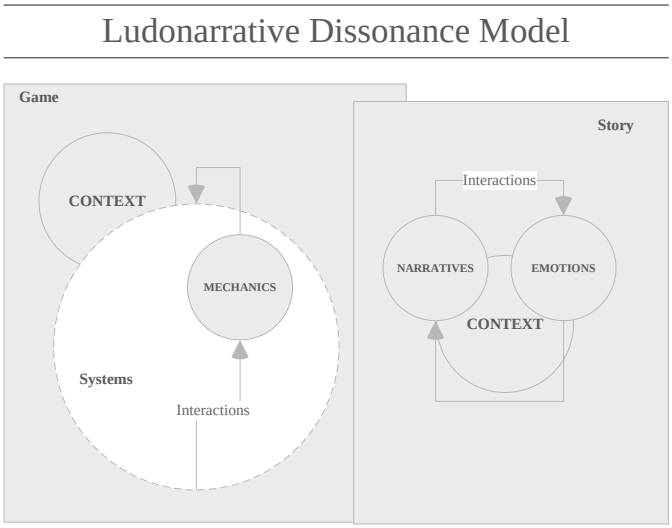


Figure 3: model for ludonarrative dissonance

1) Phase One. Analysis

The Analysis phases identified the mechanics and what narratives those mechanics should encourage; established the context for using the mechanics; and identified the emotions associated with those mechanics to create an emotional satisfying experience. This is analyses outlined in four areas: mechanic analysis, narrative analysis, context analysis, and emotional fulfillment. The final part creates initial individual ludonarrative loops, linking these four areas together. This section starts with mechanic analysis and follows the flow ending with emotional fulfillment. This is for explanations sake. In reality, the designer did not always start with the mechanic analysis.

a) Mechanic Analysis

The mechanic analysis identified what action the player took in-game. The high concept of the game was "the player must navigate a dark environment with a light in pursuit of knowledge." Players need to navigate. The designer wanted the experience to consist of mainly environmental interactions, where navigation was the primary focus of the level. Running would bypass the focus of the level, which was the environment. The designer chose walking to navigate. Because the environment was dark, the designer chose to use a casting light mechanic. Walking in the dark did not necessitate a casting light mechanic. The designer chose to a light mechanic so players would have control over what they saw and when they saw it. At this point in the process, the designer did not know the visual representation of how to cast light; and that knowledge was not needed for this step in the process. The high concept statement also stated in pursuit of knowledge, which created an initial purpose for walking. This meant that something that to be worth walking for, and there had to be way a find it. The designer decided that there would be collectables in the environment. These collectables would guide players, acting as anchors for the right way to go. Collecting was added to the table; and an additional way to find collectables would be to listen. The designer added this information to the table.

Ludonarrative Analysis			
Mechanic	**Narrative**	**Context**	**Emotion**
Walking			
Casting Light			
Collecting			
Listening			

The designer added mechanics to the table as actions the player could take, not after the system that supports them. For example, the designer added "listening" as a mechanic, which during development was also labeled "Geiger Counter" after the system that enabled the player to listen. The system worked by players holding a device that clicked to alert them when collectables were nearby. This device would beep at intervals of varying frequency and volume. The player would have to listen to the device to use the mechanic. Listening is what players did during the level to use the mechanic. It was the functional, active part of the mechanic. The designer used this same reasoning for the other mechanics using the present-tense verb (-ing) for mechanics.

b) Narrative Analysis

Narrative is how the story is told and why that story exists. As it relates to gameplay, narrative is how and why the player performs an action. To determine narrative, the designer looked at the function of the mechanics and a potential inherent narrative created when using that mechanic. The reason *why* the player performs a mechanic needed to be specific enough to ensure that there was a clear, identifiable reason for using a mechanic [26]. For example, navigation is an inherent narrative to walking. The narrative of walking represented the player's motivation for using the mechanic. Walking forward or backward inherently moves the player from one location to another. While navigation can serve a narrative purpose, a navigation narrative for this thesis was not specific enough.

The narrative of a mechanic established the reason for using that mechanic in-game. The designer chose walking as a core mechanic. This provided a starting point. Players must move forward through the playspace. In narrative analysis, the designer had to decide why walking was necessary to navigate. Players *needed* to walk through the space, because there was something about the space that required walking. The playspace was dark; therefore, players had to find their way through a dark space. Finding a way through a space is called exploration. The designer chose the narrative of walking as exploration.

Exploration encapsulated a thematic and situational use for the walking mechanic. Players walked, not for walking's sake, but to get *somewhere else* or to find *something*. Walking in the thesis was not just walking, but *exploring.* Changing the verb of a mechanic to its narrative function established the initial connection between performing the action and experiencing the narrative in-game. Exploration also carried an inherent situation. *Something* had to be worth exploring in order to be considered exploration. Narrative was not just how the story is told (theme), but also why that story exists (situational premise).

A mechanic can have more than one narrative. Casting light revealed more of the world to the players, and showed players where to go in the level. Casting light also allowed players to discover something: the way forward. Walking was how players moved forward, while casting light was how to find the way to go. This gave casting light a discovery narrative. Since players were constantly searching for the way to go, darkness represented a challenge to overcome. Casting light overcame that challenge by being a literal light in the darkness. Casting light to find the way through darkness meant darkness was an obstacle to overcome. This gave casting light the narrative of overcoming an obstacle.

Ludonarrative Analysis			
Mechanic	**Narrative**	**Context**	**Emotion**
Walking	Exploration		
Casting Light	Discovery		
Casting Light	Overcoming an Obstacle		
Collecting	Discovery		
Listening	Discovery		

The narrative analysis established a holistic picture of performing mechanics in-game. The contextual analysis is how the designer communicated that narrative to players.

c) Contextual Analysis

Contextual analysis determined how the designer communicated how and why the story exits. This formed the context of the story as it related to the playspace. Contextual analysis came after narrative, because the designer needed to know which narrative was being told, before identifying the contexts that would support and encourage that narrative.

In *On Writing*, Stephen King emphasized how description in novels is what makes the reader a sensory participant in the story [27]. Description is key to further the narrative goals of the story. Visualizing an intended experience writers want the reader to experience is crucial for being able to discern how to describe a situation and how much description is too much [27]. Similarly, in the player-directed game design approach, narrative can convey different things to players using the same gameplay [19]. The designer needed to understand how the context of using the mechanic related to its narrative, in order to make the player a participant in the story [27]. Visualizing the narrative as an experience allowed the designer to match gameplay with intended narrative consequences [19]. Looking at all of the mechanics and narratives together, the designer saw that the majority of narratives were discovery. The context of discovery, overall, meant that whatever players discovered would need a system that supported finding it. This global context also meant that the system had to handle finding multiples of the same, and the level design had to encourage finding all those items. Although systems are part of the Synergy phase, figuring out a global context established which systems would be necessary.

To determine context, the designer identified the situations where players experienced gameplay. From the high concept statement, a dark environment required walking to navigate and that walking was essential to finding a way through darkness. This dark environment actually had two contexts: darkness and an environment. The first context was that the environment was dark. This situation encouraged gameplay of casting light. Casting light was necessary to see in darkness; but darkness did not inherently limit the player's ability to walk. Instead, a dark environment created context for walking—the player did not know where they were going. A dark environment was an unknown environment. Darkness did not limit the player's ability to walk in the environment; it limited the player's knowledge of what environment they were walking in.

Walking was necessary to explore an unknown environment. Because the environment was unknown, casting light made this environment known by lighting up the darkness. Lighting up the darkness increased the player's knowledge, because it revealed the unknown. The context of a dark environment encouraged the mechanics to facilitate the exploration and discovery narratives. At this point, the designer wrote the situational premise of the level.

Players started the game have fallen into a hole with no way out but down. But where they came from is outside and lit up; going down is dark and unknown. Immediately, players know they need to get out. How do they do that? They traverse this unknown space to find a way out. Context carries both the weight of *why* the player's mechanics matter narratively, *how* those actions fulfill the narrative, and *where* those actions take place within the playspace. This situational premise became the introduction section of the level that would introduce to players the global context.

The high concept statement specified in *pursuit of knowledge* as the reason for navigating. The collecting mechanic gave players something to pursue. Players needed to explore to *find* the collectable, but once players found it, they would *discover* the collectable. At this point in the process, the designer did not know what specifically players would discover, or how the collectable would inherently increase player knowledge. The context of collecting should be to increase knowledge.

Since the designer did not plan on explicit narrative, knowledge would not be explicitly told to the player. Therefore, whatever the player collected would only represent knowledge. The gameplay of walking and casting light would be what increased player's knowledge. Players explored a dark environment in pursuit of knowledge, and cast light to acquire the knowledge of the environment. Knowledge became a stand-in for something valuable; players would collect valuables that would help them find a way out. The designer defined the collectable mechanic as pursuing knowledge, because through discovering collectables, players discovered where they were and how to find a way out. Collection gave players a tangible environmental goal to make a meaningful choice about where they explored and how. The collection mechanic made the pursuit of environmental knowledge purposeful.

Finding a way out became another global context for the player's actions, and was not included in the ludonarrative analysis table. This global context—that answers why the player uses multiple mechanics—is instead reflected in the high concept statement and design documentation. The designer repeated this process for each mechanic in the table, contextualizing the overall experience and inserting that situation into the context column of the table.

Ludonarrative Analysis			
Mechanic	**Narrative**	**Context**	**Emotion**
Walking	Exploration	traversing an unknown environment	
Casting Light	Discovery	illuminate a dark space	
Casting Light	Overcoming an Obstacle	Overcoming an encroaching darkness	
Collecting	Discovery	Finding treasure	
Listening	Discovery	Searching for a treasure	

Once the designer had the mechanics and narratives lined up, the next phase of analysis was to determine which emotions those narratives evoked.

d) Emotional Fulfillment

Emotional Fulfillment is why players felt compelled to continue to use a certain mechanic [26]. In traditional design,

this is presented in game as a reward for using the mechanic [7]. Emotional fulfillment gave players a sense that they "correctly" used a mechanic. To determine emotion, the designer used traditional narrative structure and the hard and easy fun keys as points of reference. In Lazzaro's study, the emotions players felt from performing mechanics were separate from story, even if those emotions created emergent narratives [5]. The designer used the hard and easy fun keys as tools to identify which emotions best fit the mechanics and their narrative contexts.

In hard fun, different levels of difficulty in the game emphasized mechanics that required players to use multiple strategies or test their skills to overcome them. The theme of the artifact was to "never give up." The theme required an element of the game to warrant a challenge against player skill. Players had to feel gameplay moments that challenged them to not give up. The designer started with the emotion associated with overcoming a challenge, *fiero*, which is requires personal triumph. As the game primarily used navigation for exploration, barriers to navigation that required skill to overcome would be the main obstacle for players. In order to create scenarios that felt perilous to the player, the designer wanted to challenge players to overcome environmental hazards. Since the designer also wanted to have a mechanic that could also encourage exploration, the mechanic with a narrative of challenge would also be used to explore. As the designer had already analyzed exploration as a form of navigation, and as the designer had outlined that the hazards would be environmental, the designer chose jumping. After every jump, players should feel triumph at having overcome an obstacle. Likewise, jumping helped establish the fiction that the environment was breaking apart. This fictional context was used to execute the scenarios for jumping. Also in hard fun, casting light also had a narrative of overcoming an obstacle. The obstacle was darkness. Casting light should have a sense of desperation, where players want to constantly shine the light to overcome this challenge.

Easy fun has emotions that convey a sense of lingering in a world that makes players wonder [5]. The walking mechanic's exploration narrative falls in line with the easy fun key. For walking, the designer identified that navigation mechanics can be primarily associated with easy fun, which stemmed from novelty—figuring something out and discovering something new [5]. In the level, the player was surrounded by darkness and would not always know where to go. Darkness created a sense of mystery in the level. Walking in the level needed to invoke mystery in players. The same reasoning went to casting light—where discovering the next part of the level was the narrative. The emotion of casting light encouraged feelings of ambiguity. The player should not know what is around the next corner if they had not discovered it already. In this way, casting light revealed areas to the player all around them. The following is the initial test chart for the Analysis Phase.

Ludonarrative Analysis			
Mechanic	**Narrative**	**Context**	**Emotion**
Walking	Exploration	traversing an unknown environment	Mystery
Casting Light	Discovery	illuminate a dark space	Ambiguity
Casting Light	Overcoming an Obstacle	Overcoming an encroaching darkness	Deprivation
Jumping	Challenge	Overcoming barriers to navigation	*Fiero*
Listening	Discovery	Searching for a treasure	Wonder
Listening	Challenge	Navigating around barriers to search	*Fiero*
Collecting	Discovery	Finding treasure	Awe

Figure 4: The initial thesis level artifact's ludonarrative analysis table

Once the designer made the chart, they used this chart to develop ludonarrative loops that would aid in prototyping the initial analysis for ludonarrative harmony.

e) Creating Ludonarrative Loops

The designer broke down each row of the table, as an individual mechanic to create a ludonarrative loop. The ludonarrative loop comprises the four analysis phases in a left-to-right order. This order establishes a cause and effect within a singular ludonarrative experience of the mechanic.

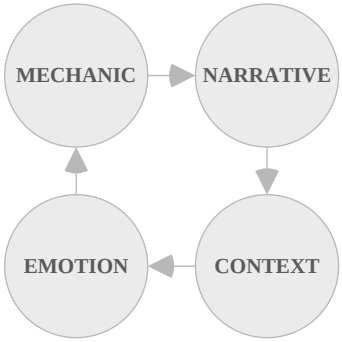


Figure 5: the individual ludonarrative loop

Each circle of the ludonarrative loop leads into the other. The flow from one circle to the next establishes ludonarrative harmony from the player's perspective. The player's instinctual focus in games is on the mechanics [15]. There is narrative reasoning for performing that mechanic, which takes place in a specific context. These elements create a satisfying emotion that encourages the continued use of that mechanic. To fill in these circles, the designer distilled the questions from the individual analyses.

1. **Mechanic: How is the player doing an action?**
2. **Narrative: Why is the player doing the action?**
3. **Context: Where is that action happening (broadly); does the action fulfil the narrative; and why does the action matter?**
4. **Emotional Fulfillment: What purpose does that action serve for the player?**

The designer answered the first two questions by slotting in the appropriate mechanics and narratives from the initial table into their corresponding circles. Mechanics remained in the "-ing"

form of the verb, while the narrative became the infinitive[8] form of the verb followed by the word "to." According to Lazzaro, the emotion of an action carries an inherent story associated with that emotion [5]. The designer took this principle and executed it. The emotion is the driving force behind the ludonarrative loop. For example, walking to explore an unknown environment provides a sense of mystery that encourages players to keep walking.



Figure 6: initial example ludonarrative loop for walking

Casting light would help solve that mystery left unsolved simply by walking.

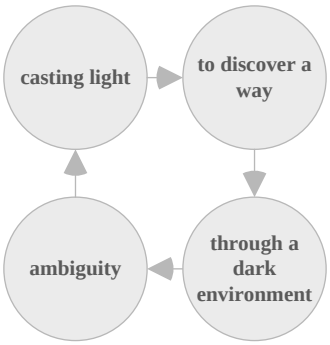


Figure 7: an example ludonarrative loop for casting light

The environment remains ambiguous to players, so they must continue to cast light. The emotion leads directly back into the mechanic, which creates an individual loop of interaction between the four elements.

The analysis can start at any area, but the ludonarrative loop requires the same flow. For example, the analysis table could start with emotional fulfillment, but would have the column next to it be mechanics, followed by narrative, and then context. Although the included table shows the designer starting with the mechanics and then moving to the other areas of analysis, this was the designer's preference for the majority of mechanics, but is not a requirement of the process.

f) Analysis Prototype

The Analysis prototype tested the assumptions of the table against their ludonarrative loops. This is also the initial prototyping of the mechanics on paper. Overall, the gameplay of exploration was weighted as higher priority than gameplay of challenge. The designer wanted an experience that would encourage exploring a mysterious, tomb-like environment. Set in the distant future, the original environment was intended to be large, desolate, and breaking apart. Initial reviews revealed that walking did not feel like exploring they could not see well enough to explore. While casting light in a dark environment did convey ambiguity, the range of the light negated exploration in large spaces.

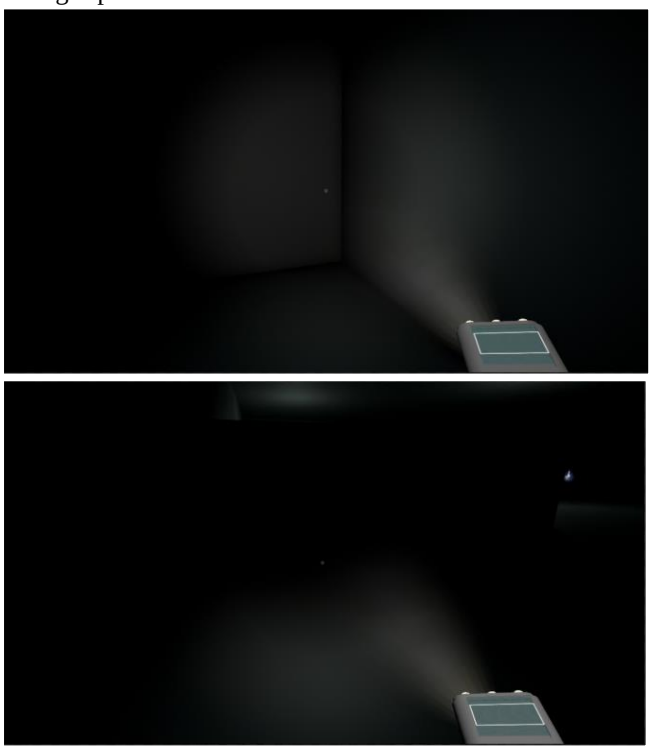


Figure 8: the image on the TOP shows how the light accurately displays walls and corners but in large spaces BELOW is swallowed by the darkness

Although the casting light did convey the discovery narrative, reviewers would not want to discover a way forward in large spaces. Casting light in large areas was too challenging and created frustration. Darkness did create a challenge, but with no immediate way to overcome the challenge, reviewers would not explore in large areas with darkness. Since reviewers would not explore large, wide-open areas, the casting light mechanic needed smaller spaces to encourage exploration. The casting light mechanic needed smaller spaces to encourage exploration. Contextually, smaller spaces are more confining. Casting light's context changed to not just illuminating a dark space, but a confined space. The player would not know where they are, and they would not know in the context of a smaller, constricted space. The deprivation aspect of casting light directly competed with the narratives of discovery and exploration. The designer cut the overcoming obstacles narrative from the casting light mechanic, and added the context of confinement. This created a situation where players would cast light to know where they

[8] The infinitive form of a verb is the simplest form of the verb and requires "to" in front of it to make sense. Write is an infinitive that requires "to," such as "to write" so that it makes sense in a sentence: "He drinks coffee to write."

were, but would still feel deprived without sacrificing another mechanic's integrity within the game.

Challenge was necessary to create the feeling of *fiero*, and also adhere to the fictional theme of a building in the far-future breaking apart. Jumping was navigational, required minimal skill to execute, and required changing the environment to present obstacles to overcome. Jumping also presented a point of contention that the designer would need to solve in the interactions and synergy steps: falling. Expert reviewers saw potential for *fiero*, but felt frustration when exploring a small space when the inability to jump did not allow them to explore areas of the test map. The designer gave jumping the narrative of "overcoming an obstacle" instead of challenge. This ensured development of jumping areas would provide challenge, but not so much that it would lessen the effects of exploration. To enhance exploration further, jumping was given an exploration narrative so that it would be designed with the intent for navigation of vertical spaces.

Jumping as overcoming obstacles created a new context for using jump. If casting light had a context of confinement, jumping would have a context of escaping that confinement. An obstacle prevented the player from moving forward, and would keep the player in a darker, confined space. Jumping would allow players to move forward and away from confined areas. The designer added escaping confinement to jumping. This context also affected the global narrative of the playspace. If jumping and casting light both had elements of breaking free from confinement, then breaking free needed to be incorporated into global context that reinforced the need to break free. The designer added on to the existing global fiction: players explored this environment to break free.

However, exploration is not inherent to escape. With the additional context, the designer recognized that the high concept statement's *pursuit of knowledge* also needed encouragement directly in the ludonarrative interactions. Fictionally, the environment was very devoid of knowledge. It was desolate, confining, and perilous. From prototyping, the designer identified that exploring for exploring's sake could feel purposeless. The designer chose to create a tangible reward for players that could only be obtained by exploring. This reward was called a "rune." Finding a rune and collecting runes became the global context for the game, and fit into the fiction of exploring a far-future environment. Runes were a technological source of power.

Ludonarrative Analysis			
Mechanic	**Narrative**	**Context**	**Emotion**
Walking	Exploration	traversing an unknown environment	Mystery
Casting Light	Discovery	illuminate a dark and confining space	Ambiguity
Jumping	Overcoming Obstacles	cross chasms to escape confinement	*Fiero*
Listening	Discovery	searching for a rune	Wonder
Listening	Challenge	navigating around obstacles to search	*Fiero*
Extracting	Discovery	acquiring a rune (making an unknown object known)	Awe
Jumping	Exploration	finding the way to acquire a rune	Fulfillment

Figure 9: The final thesis level artifact's ludonarrative analysis table

Prototyping the ludonarrative loops in isolation began to show the interactions between mechanics that would create the ludonarrative loops in the next phase.

2) Phase Two: Interactions

The Interactions phase is the second phase of testing ludonarratively harmonious mechanics as they interact with each other in game loops. Games have a core game loop that defines the second-to-second as well as the moment-to-moment gameplay player's experience [26]. The designer wanted the gameplay of centered around exploring a tomb-like environment, and being awed, and wondering, in this environment. The interactions between mechanics needed to emphasize these feelings, and mechanics that were associated with those feelings, were prioritized. The designer altered the GDD's core game loop, which was simply walking, casting light, and find runes, to account for the mechanics tested in the Analysis phase. The designer updated all documentation that altered any previous assumptions.

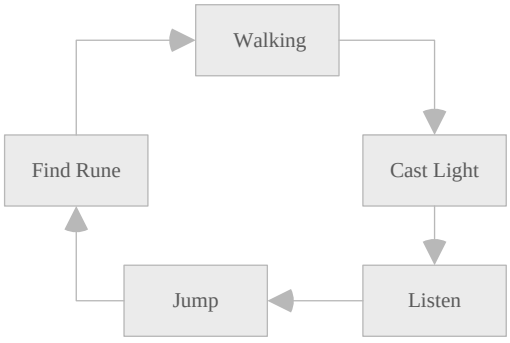


Figure 10: Core game loop for the thesis level artifact

The core game loop touched on the central experience the designer wanted the player to have. The player should walk, need to cast light to see, listen to a Geiger Counter, and then repeat this process until they need to jump. Since the environment included obstacles that would need jump to proceed, and therefore have a strong challenge narrative, the designer included jump into this core game loop. The designer labelled this core game loop the second-to-second game loop, as the player would use this loop on a second-to-second basis. While this game loop created a game experience, it was separated from the narrative. Using the four columns from the Analysis table, the design inserted these into the mechanics of the core game loop.

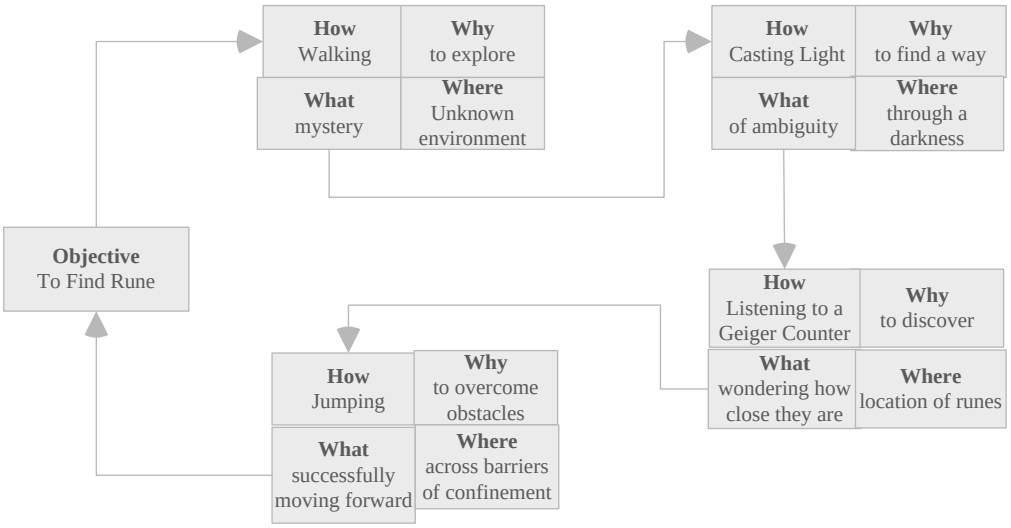


Figure 11: the second-to-second ludonarrative loop, broken into the individual ludonarrative loops

The above ludonarrative loop showed the interactions between each part of the game loop. The last phrase of each mechanic flowed into the next mechanic. This ludonarrative flow would become an emergent gameplay reason for the player to use the next mechanic. For example, listening to the Geiger Counter placed players in a situation where they would have to jump to get closer to a rune. Players successfully moved forward by overcoming the obstacle with jump that previously prevented them from moving forward. Performing those mechanics allowed players to achieve their objective: finding runes. The ludonarrative loop showed how the mechanics interact with each other, and also showed the designer the narrative for each element. This granular ludonarrative loop was then condensed into sentences.

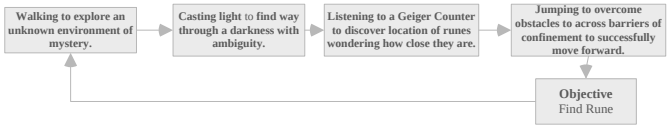


Figure 12. the sentences of the second-to-second ludonarrative loop; these sentences are repeated in the moment-to-moment loop on the following page

The designer identified the interactions necessary once players had found a rune. Once players hit the extract button “e,” the collection process began and would always result in success. Players could not collect a rune twice. Collecting a rune always led to finding another rune until the player found all runes. These loops are the moment-to-moment gameplay that took place over an entire game session.

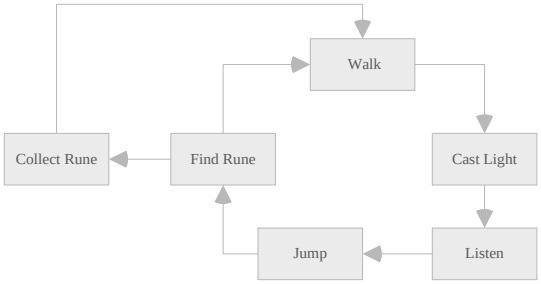


Figure 13: the thesis artifact's moment-to-moment gameplay loop

The designer used the moment-to-moment ludonarrative loop written as a paragraph to create to the central gameplay narrative of the final thesis level artifact. The Interactions ludonarrative loop needed to include each individual ludonarrative loop from the Analysis phase, which meant that some mechanics had different purposes. These purposes varied from moment-to-moment.

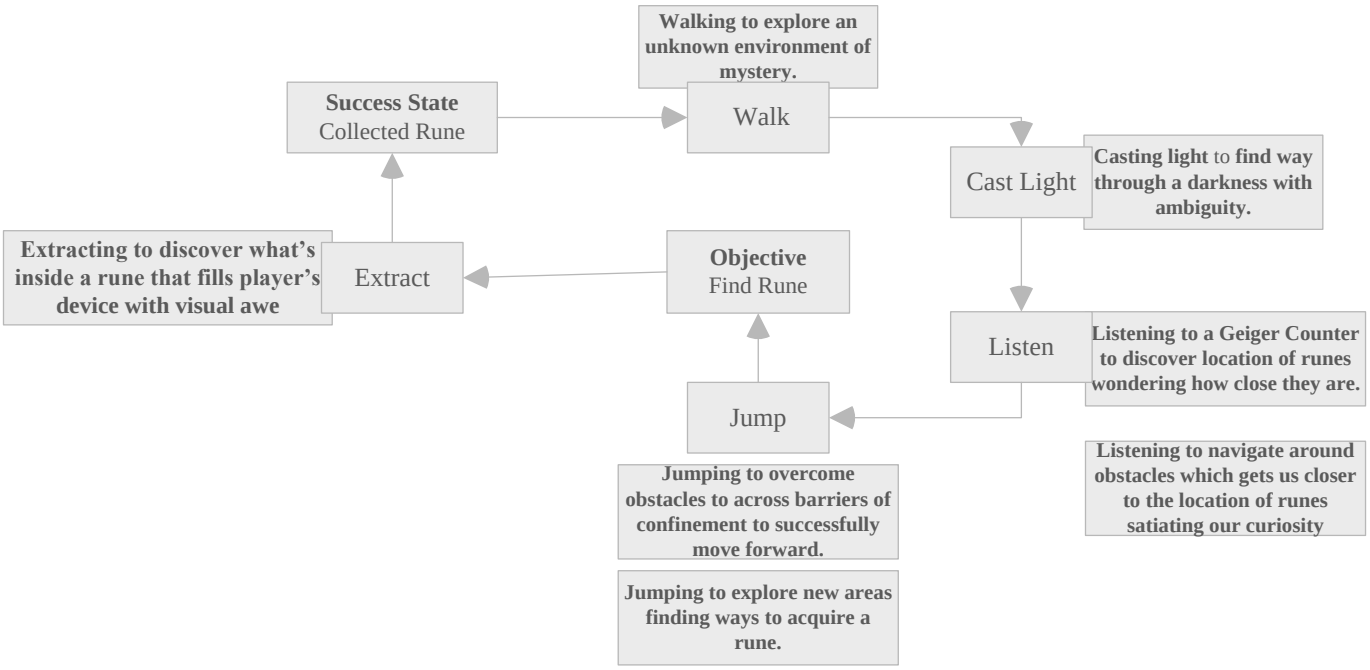


Figure 14: the thesis artifact's moment-to-moment ludonarrative loop

a) Prototyping Interactions

During prototyping the interactions, the designer evaluated how the mechanics worked together to enhance, or detract, from those feelings. The designer also looked at the joint narratives reviewers experienced when playtesting the level. The designer adjusted the interactions based on expert review of the narratives reviewers experienced during play and whether or not those reactions matched the loops made on paper. The phase of prototyping helped identify exactly whether or not the ludonarrative loops create ludonarratively harmonious gameplay.

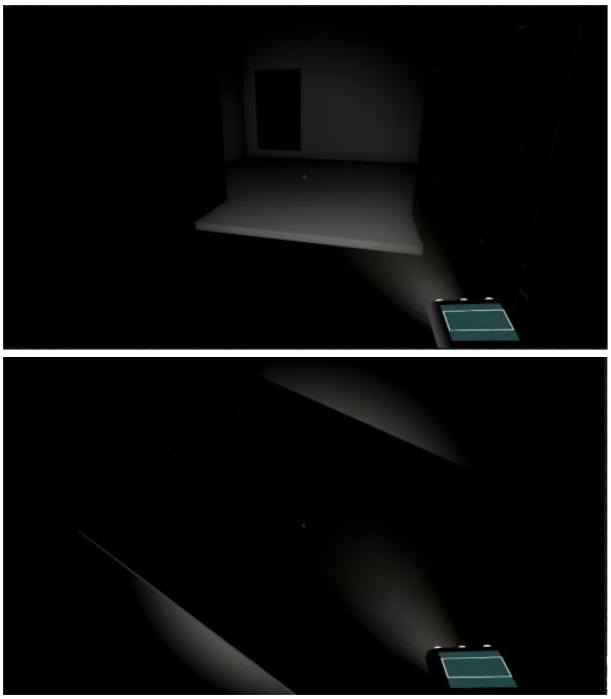


Figure 15: the light shows the platform to jump to while not illuminating the chasm, TOP; players can see either side of the chasm, but not how far it goes down, BELOW

These images show how casting light and jumping worked together to create a ludonarrative harmonious experience. The narrative of "overcoming obstacles" with jumping was enhanced by casting light's inability to penetrate the darkness of the chasm. The chasm represented a dark and confining environment, which jumping overcame. Casting light illuminated the dark confinement of the playspace, but hazards could not be illuminated. This reinforced the context of using jump to break free, because unlike casting light, jumping could

overcome the obstacle of a chasm. Casting light in the level enhanced exploration, by revealing the areas where players could and could not explore. This enhanced the context of known and unknown to players. Known areas were safe to explore, but unknown environments presented more risk.

The interactions prototype also revealed the initial synergy between mechanics at the localized level. The joint narrative presented by casting light and jumping was a "discovery" of "overcoming obstacles." Casting light indicated safe areas by shining light on the side the player was on, safe, and the side they needed to get to, also safe. Jumping was necessary to overcome that barrier to navigation, and reach the safety. The chasm presented a narrative threat—something that was unsafe. In order to get across, players had to experience a narrative of discovering how to get across and successfully crossing. The joint narrative of the two mechanics became casting light to discover a safe way to jump across a chasm. The context between the interactions became more specific: a dark environment shows a chasm that confines the player to one side, creating a barrier to navigation. After jumping over a chasm, players felt a sense of *fiero* for having personally triumphed over a dark, confining space.

This prototype phase connected the ludonarrative loop of collection to a tangible goal: finding runes. At first, runes were pickup items only and did not have functional use. While this encouraged players to explore areas outside the main path, players questioned the narrative context. They wanted to know what they were and why they wanted them. The collection mechanic needed something else in the world to validate its narrative context in order to have ludonarrative harmony. This introduced the listening mechanic as a Geiger Counter system. The designer notes that although this phase does not require systems, sometimes systems are necessary to test a mechanic. The designer implemented the Geiger Counter and the rune collection systems for this phase.

The designer chose to represent the Geiger Counter system as a physical object in the playspace as a diegetic user-interface (UI). Unlike a Head's Up Display (HUD), the diegetic UI would conceptualize listening to the player's device. Since the designer had established a science fiction genre for the level, the device was technological. With a diegetic UI, the designer also needed to establish a separation between the environment and the player. Since the narrative of the environment stated it was unknown, the designer encouraged this perception by giving the environment harsher angles and muted colors. The player's device contrasted this with rounded edges and a bright LED display. This contextualized listening to a specific device, rather than an ambient noise. The Geiger Counter system was automatically activated so players started with the expectation of a constant light and constant click as long as they need to explore. As the player explored, their device started clicking faster and louder to indicate they were getting closer to a rune. The player's device was a visualization of this system for the player that created the context needed to use the listening mechanic. This device also told players which button to press. This UI enhanced the ludonarrative harmony of the level by keeping the player's attention in-game.

The Interactions phase and prototyping localized interactions between the individual ludonarrative loops. After this prototyping, the designer reiterated these interactions at the final phase—Synergy—to expand these local interactions into global ones.

3) Phase Three. Synergy

The Synergy phase incorporates all the ludonarrative loops on an individual and collective basis from the previous phases and adds the necessary systems and level design to support pre-them. After developing and testing the ludonarrative loops, the designer then looked at what each mechanic needed to create synergy through the game's systems.

The mechanics and narrative elements are solidified with minor adjustments left for the designer to make. The Synergy phase required constant iteration in-game to check for ludonarrative dissonance. The designer referenced back to the analysis table and game loops to ensure that the level design scenarios consistently matched with the ludonarrative experience. The designer took the same table and added the systems underneath, which identified where in the ludonarrative structure they were needed.

The designer identified the major gameplay elements from the core game loop and looked at the systems that were already being used, such as first-person movement, and systems that needed to be done, such as the rune collection system. In Synergy, the designer identified how the systems would sustain the ludonarrative interactions. Implementing systems within existing ludonarrative harmonious mechanics and narratives was the most challenging part of development. If a systems did not encourage the intended type of interaction as discovered from the ludonarrative loop, even if the game loop was the same, the reviewer experienced ludonarrative dissonance. This created a central ludonarrative thread that held the experience together: collecting runes.

When the player enters the playspace, the ruin looked ancient compared to the player's device, but the technology felt more advanced than the player's device. Collecting runes was the primary objective for the player. Listening and casting light had narratives central to the discovery of the environment and the runes. The Geiger Counter system directly supported the mechanic of listening. This system got the location of runes in the environment within a certain distance of the player's device. Players listened to the device to find how close they were to a rune, then used that same device to find the way to get there. The designer chose that the visualization of the runes would reinforce an ancient symbol of power. The designer modelled runes as physical crystals, because they were naturally occurring. In this harsh environment, these naturally occurring crystals were specifically placed inside large columns that had emissive to symbolize that the rune had power. Designing the runes as crystals inside a technological conduit was a direct result of the established fiction from the GDD and NDD. The designer largely used the fiction to make decisions that would symbolized the underlying fiction, not explicitly state it. The chose symbolism as a direct result of the player-directed game design approach. This fiction also centralized how the designer conveyed the rune collection system.

The rune collection system was necessary to convey to the player the runes had power the player did not originally have. The runes primary function in the level was to encourage exploration. From the previous phase, reviewers felt the runes did not convey awe and discovery, because reviewers did not

know what they were or why they needed to collect them. In this phase, the designer implemented visual effects. The player pressed a key and the rune's power was sucked into the player's device. The rune had power and needed to convey that fiction. The designer chose a bright fuchsia color that matched the cool color palate of the environment, but still stood out from it. The rune's power was represented as visual particle effects floating around the rune. These runes also represented something that was not a part of the player. The bright blue color of the player device's display and the matte case highlighted that the player came from a different place than the shiny, iridescent fuchsia runes. During extraction, when the player pressed the "e" key, the player's device absorbed these particle effects and the rune got smaller. This process conveyed extracting, which was more than collecting. The text on the player device's display read "extracting" to explicitly convey the process. Players weren't just taking something from the environment and putting it in their pocket. Players were draining the power from something in the environment and putting it into something they owned. In this way, the rune collection synergized the extraction process to maintain ludonarrative harmony. On the first rune, players extracted runes to discover what extraction was. On the next rune, players extracted to discover what's inside a rune that fills player's device with visual awe, and take that power inside for themselves. Visual conveyance created the context for the collection system that supported the narrative of finding runes.

Originally, an environmental obstacle of the level to further increase challenge was breaking glass. Breaking glass was a system that reacted to players not successfully execute jump. Jump was used to avoid falling through breaking glass. If players fell, they would drop to a lower level and experience tougher navigation without jumping. In this way, the breaking glass system encouraged never giving up; because even if players failed, they had the ability to continue onward. Breaking glass ended up breaking ludonarrative harmony across the table. Mechanically, breaking glass was hard to see during prototypes. The light did not reflect well off of the glass material. This created dissonance when using jump, because reviewers fell through without realizing it was glass. This resulted in reviewers landing in a more confined space that did not always require jumping to get out. When the designer changed the material, reviewers so easily saw glass they found the walkable path, and experienced no challenge. Without challenge, the narrative of overcoming obstacles for jumping was not experience. Breaking glass did not represent an obstacle to overcome. Contextually, breaking glass also did not support the ludonarrative. Jumping had a context of "overcoming obstacles *to escape confine*ment." If using jump resulted in greater confinement, then the use of jump no longer had that context. Failing a mechanic is not a mechanic; so even though breaking glass created a fail state that would encourage never giving up. The breaking glass system did not support the context for jumping. Therefore, the designer cut breaking glass and kept one hazard: chasms. Not only did reviewers feel responsible when they fell into a chasm, but they also acted more carefully and continued to explore areas with chasms. This process led the designer to look at other ways to establish a central theme for the level.

Other than quitting the game, the artifact's design had nothing that supported giving up. This made the designer look at the existing synergy and determine how to create a fiction that encapsulated the entire player experience from start to finish. The designer categorized two central narratives based on observed gameplay: exploring and searching. Searching mode was characterized by the challenge of finding the rune. The designer made a distinction between exploring and searching to test a system's interaction with the mechanics when exploring an environment versus when searching that same environment. This meant that the supporting system had to functionally hold each narrative of gameplay, and work with each context. Players are immediately introduced to runes and collection, start the level in searching mode, and play the majority of the game in searching mode. Once players collected the final rune, they switched into exploration mode since there is nothing left to search for. The gameplay experience centered around two things: exploring and searching. This gameplay indicated that players needed one, a place to explore, and second, a situation that would require them to search. The designer decided to trap players in the level, and then require runes to escape. This context created a situation where players had to explore to find runes. Creating this situation encapsulated the game experience as a complete experience from start to finish. The designer used this context to structure the level design towards creating scenarios that achieved and maintained the themes of escape and ascension.

Light in the level led to discovering the player's way forward. The environmental hazard of chasms and the casting light's range synergized to reinforce the ludonarrative that the way forward was up. Darkness limited visibility for players, which increased the challenge of jumping. The designer used chasms to create risky situations for jumping. The checkpoint system was implemented so that players would feel free to take riskier jumps and get the reward of collecting a harder to reach rune. When there was no checkpoint system, the game would end as soon as the player had failed one jump. This directly contradicted the narrative of overcoming obstacles. Players needed the ability to fail to have the chance to succeed. Only scenarios that allowed players to succeed against a challenge would encourage the emotion of *fiero*. The checkpoint system helped players take more risks throughout the level.

The distinction between exploring and searching also helped systems uphold ludonarrative harmony, even when players got lost in the level. Minimal lighting in the level meant players may get lost without runes. The light mechanic limited visibility for players, which encouraged feelings of mystery. Since players could not see long-distance, they had to rely on the Geiger Counter system to identify where they were in relation to a rune. The player's actions in game cannot disconnect with the player's interpretation of a scene [11]. If players got lost while searching for runes, they no longer were searching for runes, they were exploring for a way out of being lost. While the systems supported finding runes, the designer used a looping level design that all led to a central intersection to ensure players never felt lost for too long. When they did get lost, each branching path of the level flowed into a central path. These central paths always led forward and up towards the exit. The level layout of the space maintained the ludonarrative harmony established within the mechanics and grounded by systems. Synergy is represented in the ludonarrative model as forming a basis for the ludonarrative loop with systems.

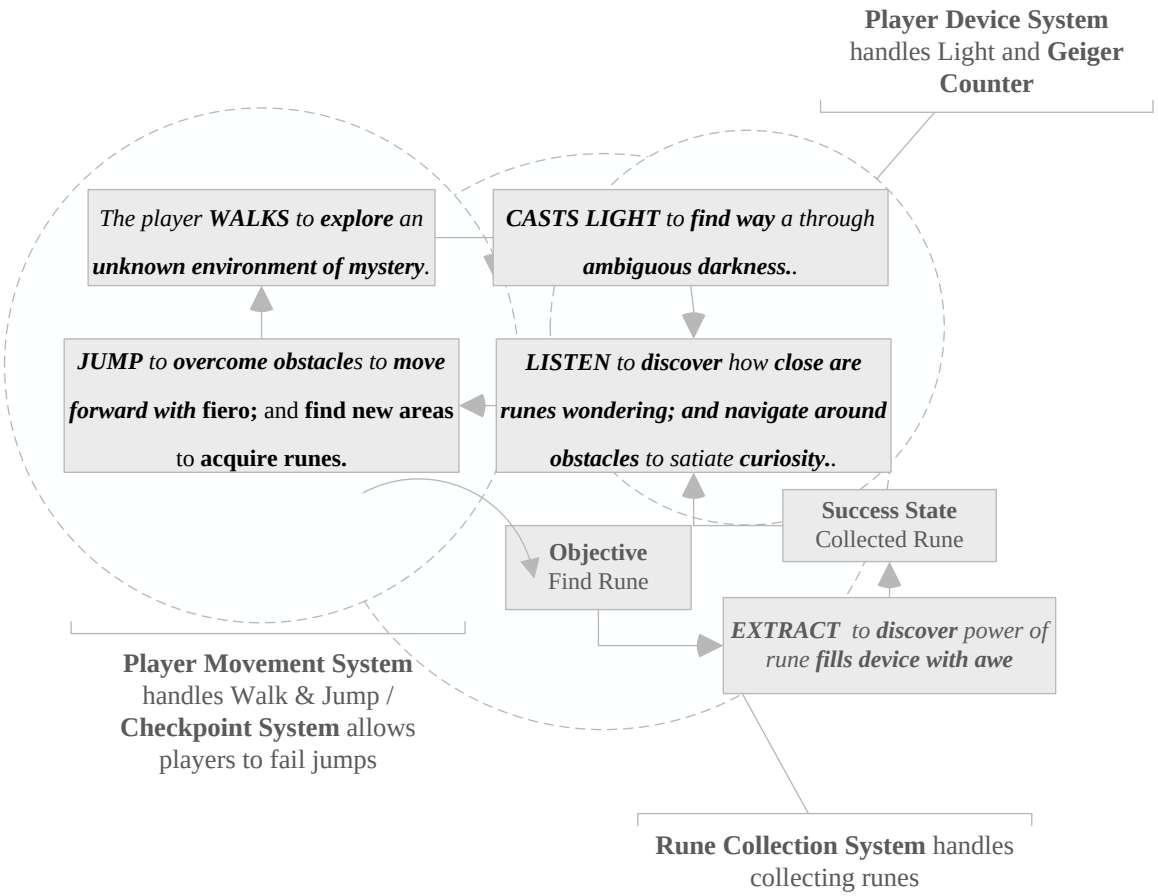


Figure 16: The Synergy phase is a constant prototype to ensure the systems support ludonarrative harmonious gameplay

Even though the mechanics were designed with a player-directed approach, the level design needed a more designer-directed approach to make sure players eventually reached the top of the tower. The level design directed the player towards the top of the tower, even though the player chose how to get there. The designer also used the designer-directed approach to create an overarching level goal for players during the level.

The context of trapping players in the level became the level's goal and central story for playing the game. Players started in confined space that limited their movement. They looked up and saw a small hole, making a connection they must have fallen down into the level. Then, the level forced players to fall down again, into the introduction section. The player saw the first rune, and extracted it. Upon extraction, the floor fell down from beneath them and the player fell down with it. The level begins with falling, because falling is the opposite of exploring. Exploring is purposeful movement towards a goal; falling is uncontrolled movement towards an uncertain end, or certain "death." In this level, falling was the exact opposite of what players want to do. It took control away from the player. The level began this way to facilitate the ludonarrative themes and contexts of confinement and overcoming obstacles. Players only want to escape confinement if they have been purposefully confined.

Players achieved escape by exploring the environment to find runes. This gameplay existed, but the goal changed the experience. Players weren't exploring and collecting just to explore and collect; they were exploring to get out, to climb up, and to get back outside. If the level design allowed players to reach the top of the tower without collecting any runes, this negated the overall exploration of the level, which meant the level did not have ludonarrative harmony. Likewise, if the game's systems did not account for players running through the level, then the systems also negated the exploration narrative. The designer placed a locked door at the exit of the level. Players could only open this door by having collected three or more runes. This became a central goal: find a way out. While players started in highly confined environment, as players progressed through the level, areas became more open. There were more areas to jump, and staircases led up. While the player started the game falling, the rest of the game was climbing back up. This decision to centralize around trapping a player in a level came directly from the ludonarratively harmonious gameplay established in the previous phases. The designer used the same flow of the Analysis phase to establish the central game flow: in order to escape, one had to explore.

The designer added a mechanic known as "insert" and branched off the existing rune collection system to create a master rune system. This system would support the central gameplay.

Insert	Discovery	Finally being set free	Awe
Master Rune System			

Figure 17: the added mechanic and system to the ludonarrative analysis table

The designer copied the "extract" mechanic's narrative and emotion, and reversed the functionality for the "insert" mechanic. At the top of the tower, players found a locked door that required a set number of runes to open. This reinforced the idea that runes have an inherent value in the playspace. If they had at least one rune, players would insert that rune into a machine located in front of the door. The master rune system calculated which rune the player had collected, which slot the rune should go into, and which light on the door would show players they were closer to opening it.



Figure 18: the level end door and ancient relic shows two out of the three runes necessary to open the door

The designer created the following game loop that included this process.

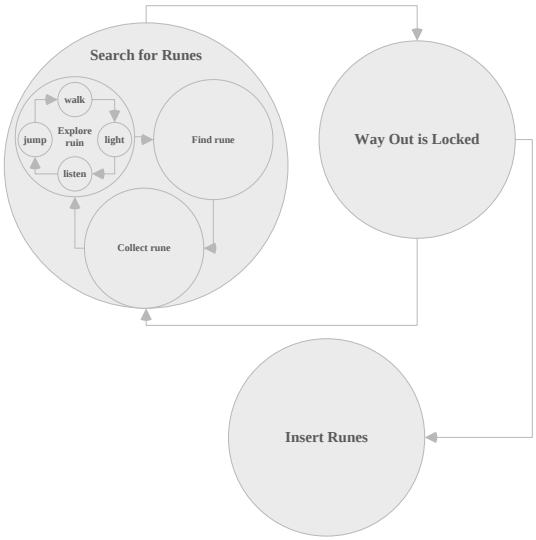


Figure 19: The entire game experience

The master rune system and insert mechanic became the outermost ludonarrative loop for players during the level. Inserting these runes breaks out of the game loop, setting the player free to step outside and end the game experience.

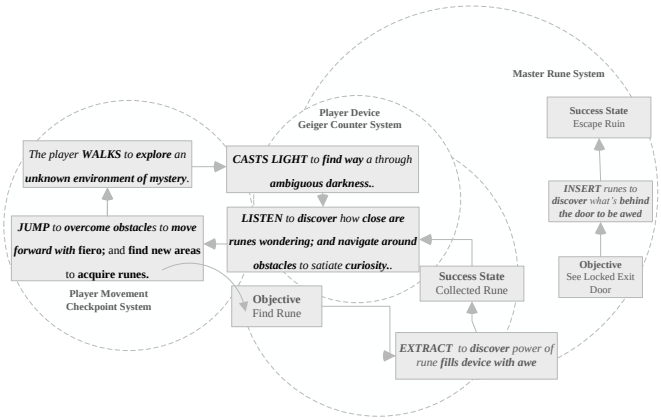


Figure 20: the ludonarrative loop for the entire game including the systems; this image is pictured larger as the final ludonarrative loop at the end of the Methodology section

Players used the same key press for both the extract and insert mechanics. Once the entire systems framework was designed, the designer stepped back and evaluated the experience as a whole from start to finish.

Jenkins referred to the architecture of the space as creating contextualization for how players experience narrative. The level's map layout reinforced why the player needs to use certain mechanics, and mimics problem solving, unlike environmental storytelling, which imposes a story on the player to interpret [15]. The designer chose a brutalist environmental art style to reinforce the environment as an oppressive agent.[9] Brutalism reflected in the architecture of the space the narratives of overcoming obstacles, as the major obstacle to overcome was the environment. The designer created levels based on two existing first-person perspective games: *Half Life 2* and *Deus Ex*. The *Half Life 2* map design is linear and reinforces the goal to the player. Players in the canals section of the game are forced to move in a circular pattern in order to achieve certain sub-goals before moving on [28]. This level artifact took the idea of linear exit/entrance point from *Half Life 2* when designing where to put staircases, which would force players into a different floor of gameplay. *Deus Ex* had tight, enclosed spaces with multiple routes to a singular objective. Pick-ups in *Deus Ex* allowed players different opportunities to find new routes, and to explore alternate options to completing the objective [29]. The level artifact placed runes at the outer edges of the map to create scenarios that required exploration.

Synergizing the ludonarrative loops with the game's systems created a frame for the stories so that risk, reward, and pacing could factor into the different situations for those mechanics. The designer storyboarded the beginning sequences of the gameplay from the first-person perspective. These concepts helped gauge pacing for when players would be introduced to different mechanics and challenges within the level space. This pacing helped determine when mechanics and narrative should be introduced and how. Perspective drawings are located in the narrative design document.[10]

[9] Brutalism is an architectural style used mainly of raw concrete. The style's use of harsh angles and "unfinished" look gives it a cold, totalitarian aesthetic and scientific utilitarianism." For more read, http://www.city-journal.org/html/architect-totalitarian-13246.html.

[10] Perspective drawings are also included in the game design document in the gameplay minute.

The user interface of the level artifact also had to create context for the player during play. The level artifact used a prototype quality diegetic interface through the player's device. The player always had their device out, and could not put it back. The only explicit information given to the player is the text "extracting," when the player activated a rune by pressing "e." This UI element enhanced the Geiger Counter clicks mechanically and made sense narratively, as they were located on the same device that players used to determine the location of runes. At the end of development, reviewers still had trouble identifying the up and down directions of runes based on sound. The designer added an up and down arrow on the player's device to indicate whether runes were above or below the player.

C. Final Ludonarrative Design in the Thesis Level Artifact

The final high concept statement for the level was: players explore a dark, mysterious environment searching for a way out.

1) Game Design Approach

The player-directed and designer-directed approaches to game design demanded different level design scenarios that would impact the embedded and emergent narratives within the thesis level artifact. The designer took a player-directed approach when designing the overall level, and a designer-directed approach when designing interactions between the runes and the player's device. Players experienced emergent narrative when figuring out how to get to a rune's location, but experienced embedded narrative when collecting that rune and interacting with the ancient relic that opened the level end door.

2) Game Theme and Goals

The final themes of the level were escape and ascension. Players started on high ground, but fell down into the level trapped inside. Players had to explore the environment to find runes that would help them escape. The level took place in an ancient spire. Players climbed up from the lower floors that were darker and more confined into areas more open that represented the freedom. Climbing the staircases represented ascension. Players approached the final door and used collected runes to open the door to reveal the outside world.

This theme encapsulated the narratives and contexts from the ludonarrative analysis. Walking in a dark space while casting light emphasized the exploration narrative, encouraging players to discover what's down a hallway they cannot quite see. Listening encouraged movement through a dark space as players could follow the direction of the sound, not necessarily the path before them. The thematic purpose of the runes was to guide players through the map and symbolize value in an otherwise derelict environment. Light became a literal representation of discovery, as it reveals both safety and danger to the player. The level architecture represented the opposing force against the player.

a) Level Artifact Tech

This thesis used Unreal Engine 4.11. This thesis focused on ludonarrative harmony through game mechanics and did not need a high level of environmental quality to be successful. Immersion for exploration games only needed to give a contextualized environment to invoke emotion [5]. All gameplay elements had Alpha-level quality visual and audio effects to convey the narrative of using those mechanics. In-editor BSP and materials created the post-apocalyptic environment necessary to convey the narrative. A level-end matte painting and 3D environmental assets made by volunteer artists rewarded the player for successfully completing the level.[11]

b) Backstory

The player is a female artifact hunter—someone who goes out of their way to find old technological artifacts. One day, she falls into an ancient technological ruin. As she drops down from above ground, her device begins faintly clicking—alerting this explorer that a power source is near.

3) Ludonarrative Models

The designer combined all the separate ludonarrative models into one complete ludonarrative model at the end of development for reference. The final ludonarrative model combines all of the mechanics, narratives, emotions, and systems into one comprehensive chart. The final thesis artifact's ludonarrative model shows the relationship between individual mechanics, narratives, and the supporting systems as they played out in game.

[11] Yuuki Matsuyama, concept artist, created the level-end matte painting; and Colin Valek, environmental artist, created the forest assets taken from his SMU Guildhall thesis studying photorealistic environment art.

Level Artifact - Final Ludonarrative Model

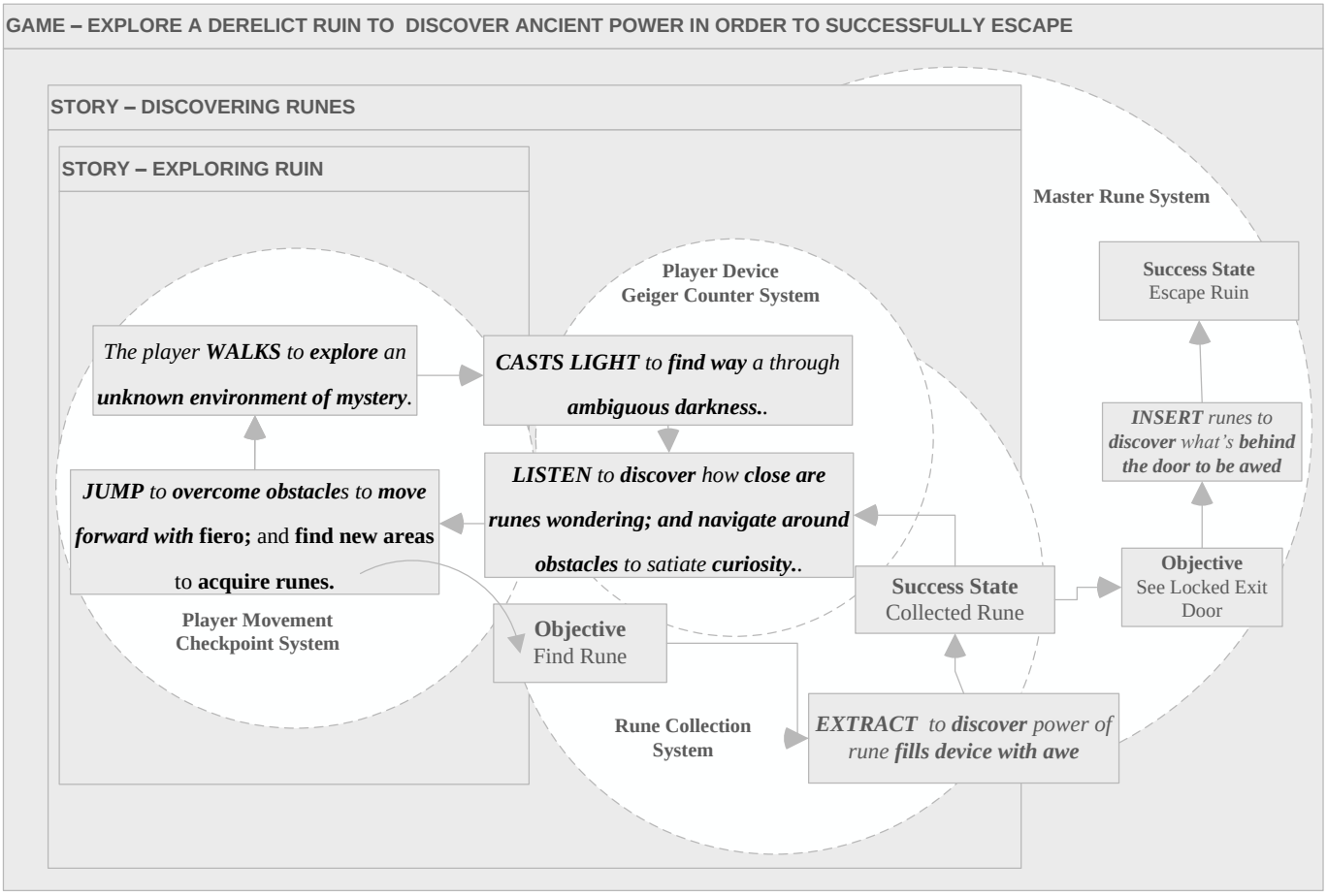


Figure 21: the process complete ludonarrative model

Ludonarrative Analysis and Supporting Systems				
Mechanic	**Narrative**	**Context**	**Emotion**	**System(s)**
Walking	Exploration	traversing an unknown environment	Mystery	First-Person Movement
Casting Light	Discovery	illuminate a dark and confining space	Ambiguity	Player Device Light System
Listening	Discovery	searching for a rune	Wonder	Geiger Counter System Rune Collection System
Listening	Challenge	navigating around obstacles to search	*Fiero*	Geiger Counter System
Extracting	Discovery	acquiring a rune (making an unknown object known)	Awe	Rune Collection System
Jumping	Overcoming Obstacles	cross chasms to escape confinement	*Fiero*	First Person Movement Checkpoint System
Jumping	Exploration	finding the way to acquire a rune	Fulfillment	First Person Movement
Inserting	Discovery	escaping a brutalist environment	Awe	Master Rune System

Figure 22: final ludonarrative analysis table with systems

4) Troubleshooting Additional Features

Troubleshooting required the designer to evaluate new mechanics considered for addition to the existing ludonarrative loops. In general, mechanics should only be added when there is a fundamental part of the game missing from the loop. A designer may not deem a mechanic fundamental, but they should still test that assumption using the ludonarrative process. Troubleshooting does not always require the designer to do both the paper planning portions of the process and the in-engine execution during prototyping. The following is a complete list of mechanics the designer attempted and did or did not include in the final level artifact.

Mechanic Attempted	Paper vs. In-Engine Prototype	In Final Game	System Attempted	In Final Game
Walking	*Paper and Engine*	*Yes*	Breaking Glass	*No*
Casting Light	*Paper and Engine*	*Yes*	Resurrection	*No*
Listening	*Paper and Engine*	*No*	Player Device (Light)	*No*
Extracting	*Paper and Engine*	*Yes*	Geiger Counter System	*Yes*
Picking Up	*Paper and Engine*	*No*	Rune System	*Yes*
Jumping	*Paper and Engine*	*Yes*	Checkpoint System	*Yes*
Pushing	*Paper Process*	*No*	First Person Movement	*Yes*
Sonar	*Paper Process*	*No*	Master Rune System	*Yes*
Marking Mechanic	*Paper and Engine*	*No*		
Insert	*Paper and Engine*	*Yes*		

Figure 23: total attempted mechanics and systems

a) Troubleshooting: Sonar Mechanic

The sonar mechanic went through the paper process, and did not have any in-game prototyping. The designer determined that the mechanic did not have ludonarrative harmony from the paper process alone.

To begin troubleshooting, the designer identified a problem: getting lost when looking for a rune. It was not impossible to find a rune, but one reviewer felt that a more visual indication of runes would enhance the experience. This problem corresponds to the solution included in the Synergy phase—putting arrows on the device to indicate if a rune was below or above the player. Before the designer reached that conclusion, the designer brainstormed various mechanical solutions to the issue. The designer started the analysis process with the emotional fulfillment of "revelation." Players wanted something to be revealed to them. Therefore, players would be satisfied when the rune was revealed. Finding way to a rune created the context. Revelation was a form of discovering where the rune was located. The mechanics had to remain within the game's established technologically consistent fiction. The designer identified the mechanic's function as a "sonar pulse." A visual pulse would emit from the player's device to show the outline of the rune in the space.

Emotion	Mechanic	Narrative	Context
Revelation	Sonar Pulse	Discovery	Way to a rune

Figure 24: sonar pulse mechanic in a ludonarrative analysis table, shown in order of analysis

The designer did external research and determined that since the mechanic would need to be executed in less than a week, the designer needed to continue to paper prototype the ludonarrative harmony of interactions.

In the Interactions phase, the designer made the interaction flow chart and realized two things. First, the sonar pulse mechanic's narrative was to discover a path, specifically. This directly contradicted walking for exploration. Known paths are no longer an unknown environment; thus, players no longer use walking for exploration, but instead for navigation. Second, the sonar mechanic directly influenced the relationship between the Geiger Counter's system that determined how close a rune is to the player with the listening to mechanic. Using the sonar mechanic would replace the Geiger Counter.

Visual cues provide more immediate feedback to players [11]. In the game loop, the designer placed the sonar mechanic between casting light and listening. The designer identified that pulsing a sonar would give more immediate and visual feedback in the environment. The designer theorized how a limit on using the sonar mechanic could work, but required time and resources the designer didn't have to ensure it did not completely replace the Geiger Counter.

The ludonarrative loop showed where the sonar pulse mechanic fought against using the Geiger Counter. Players would not need to listen to know where runes were; thus, the sonar mechanic would replace the listening mechanic. This was also reflected in the ludonarrative loops in the Interactions phase.

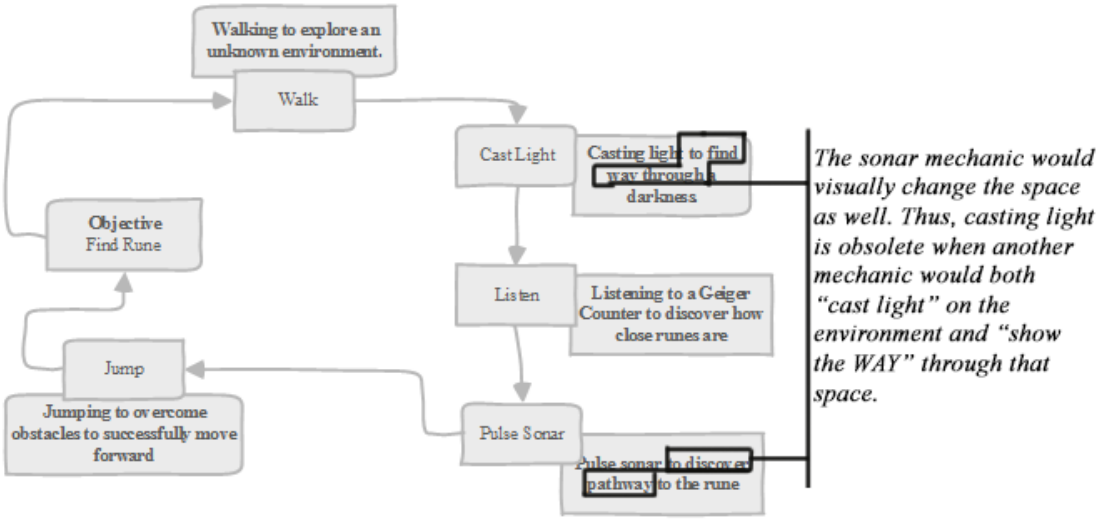


Figure 25: the sonar mechanic's visual change rendered the casting light mechanic needless

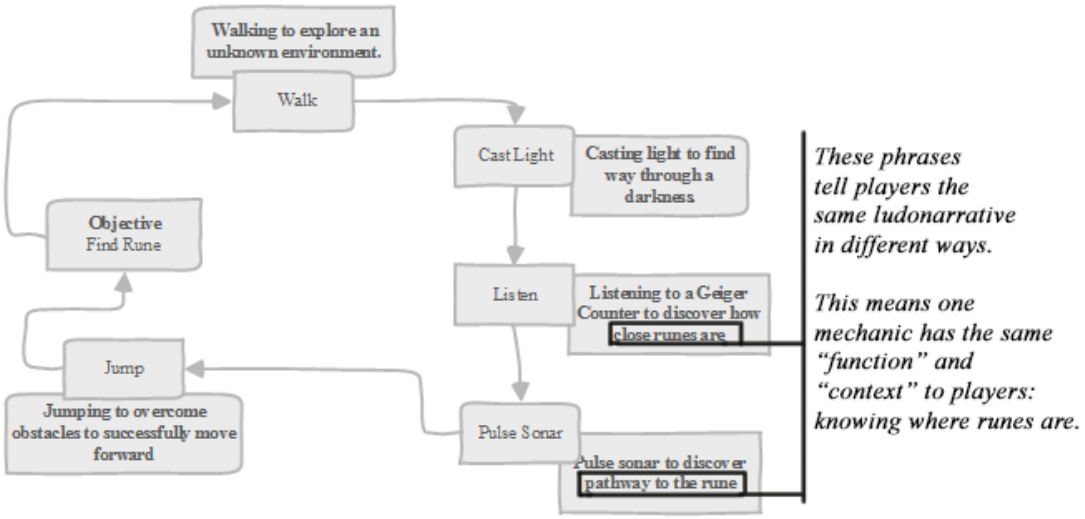


Figure 26: the sonar evaluation showed (without going in-editor) that the addition of this mechanic would create ludonarrative dissonance

The sonar mechanic worked against both the Geiger Counter and the Casting Light mechanics. The sonar mechanic would completely change how the player interacted with the rune collection system. Players would no longer need to use casting light or listen, which would translate to not receiving those narratives in the game. Players would have a conflict of context, as the narratives of casting light, listen, and sonar all represented the same situational use. This conflict created a disjointed story that would be dissonant. The designer did not add it to the level artifact.

b) Troubleshooting: Marking Mechanic

After implementing the arrows on the display device, reviewers presented another issue: they did not know where they had already explored. Since the designer made a conscious choice for a brutalist environment, reviewers wanted to escape and found that the level design encouraged escape. When exploring, reviewers felt that the ludonarrative experience would be enhanced if they had known where they had already explored. Unlike the sonar mechanic which started with a problem that needed solving, the marking mechanic started with something that could enhance the ludonarrative experience. Although the thesis references this section as the marking mechanic, the designer started with the contextual analysis of "knowing previous locations."

Context	**Emotion**	**Mechanic**	**Narrative**
Know previous locations	Assurance	Mark	Knowledge

Figure 27: adding marking mechanic to table

Players would know where they had already explored; thus, players would want to explore more. This knowledge would

give them the confidence to explore, but confidence was not indicative of knowing where to go. The player would have constant assurance of where they had been; thus, the designer chose assurance as the emotion. This assurance meant players had to do something to the previous area. When they looked back, it would be visually distinct from unexplored areas. The mechanic had to leave something behind or visually change the environment. Since the designer had less than a week for implementation, the designer chose that players would leave something behind. The designer decided the mechanic would act as a literal trail of breadcrumbs. These breadcrumbs would lead back to the beginning of the level, the opposite of where players would want to go. In order for players to see the breadcrumb in a dark environment, the designer gave this breadcrumb a light. Then, because the majority of gameplay was spent in tight, enclosed walled areas, the designer chose the mechanic as a "mark" on the wall. The marking mechanic was represented as a 2D arrow on the wall. This mark showed the player where they had already explored and which direction they came from. Placing a mark would increase the player's knowledge of the playspace. The casting light mechanic meant they had already discovered the area they were in; players just needed to *know* they had been there. The narrative of placing a mark was knowledge.

The marking mechanic went through both the paper process and in-engine prototyping and testing. It was in engine testing that the designer decided to cut the mechanic. Unlike the sonar mechanic, the marking mechanic had a unique function and ludonarrative loop from analysis. Moving to the Iteration phase the designer placed the marking mechanic's interaction between casting light and listening. The designer created the ludonarrative loop and the core game loop.

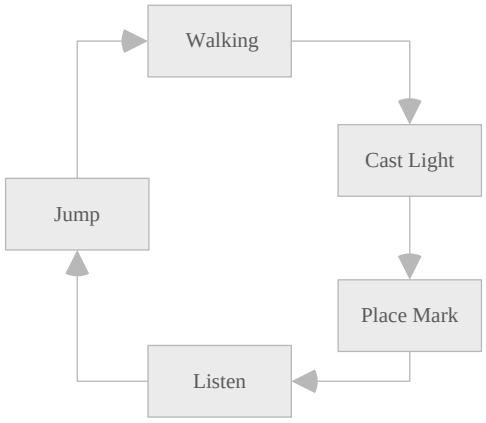


Figure 28: marking mechanic incorporated in the core game loop

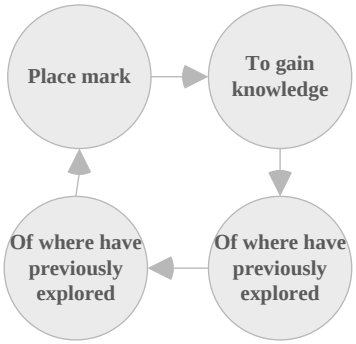


Figure 29: initial interaction analysis shows the first phase of the ludonarrative model

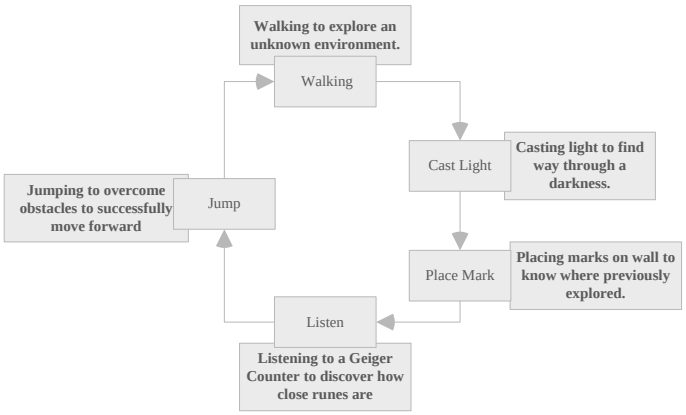


Figure 30: marking mechanic core as it fits in the core game and ludonarrative loops

In Interactions, the designer noted the mechanic had a unique narrative and emotional context. The marking mechanic had an associated emotion of assurance. This assurance completed the mystery of walking. The marking mechanic would provide more concrete knowledge, where casting light would only reveal the environment ambiguously. The marking mechanic supported the Geiger Counter, because players would know when they left an area without runes. Going back would not get them closer to runes. The marking mechanic's unique individual ludonarrative loop and unique interactions in the larger ludonarrative loop meant players would not try to replace an existing mechanic with the marking mechanic.

The marking mechanic went out of paper-prototyping and into in-editor prototyping during the Synergy phase. When the designer implemented this mechanic, reviewers felt that they no longer got lost and knew where they should explore next.

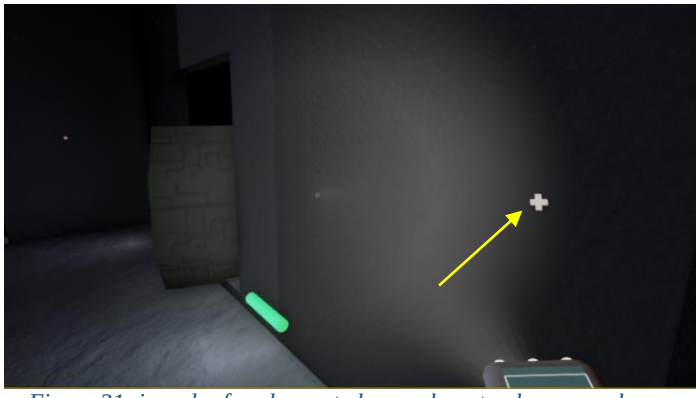


Figure 31: in order for players to know where to place a mark, a small "x" was placed that they could easily see

An indent in the wall would show players where they could mark the wall. The player's device would show the button to press when they got close to this indent. In the first implementation, the indents too closely resembled the environment; players did not use the new mechanic. In the second implementation, the indents became "x's" and gameplay improved. However, reviewers felt the mechanic was arbitrary placed and did not have a visual consistency within the environment. Players must see consistent messaging in the environment in order to keep the suspension of disbelief [11] [26]. This inconsistency between the futuristic environment and the "x's" on the walls created ludonarrative dissonance. Although the mechanic enhanced the gameplay experience of exploring, the mechanic's visual implementation did not adhere to the established fiction of the environment. Also, the lack of structural support for the mechanic meant that the designer had not implemented a system for the mechanic.

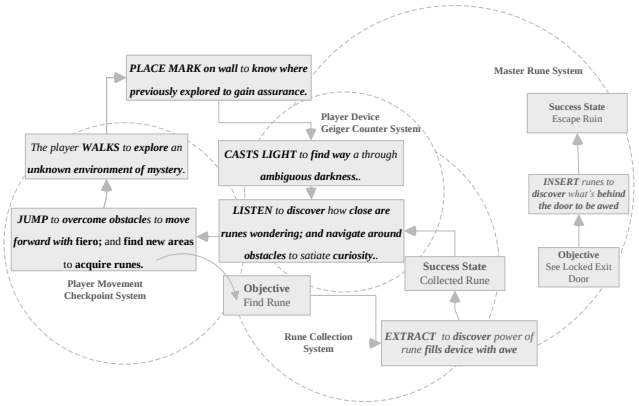


Figure 32: placing mark mechanic unsupported by systems in the ludonarrative harmony model

Lack of a system meant that all visual conveyance would have to fall on an existing system. No existing systems could support the narrative and context of this new mechanic, as both were unique. Since the current systems encouraged different emotional satisfactions in players, trying to overload one system would create conflicting expectations, like with the sonar mechanic. Since time and resources did not allow to visually bring the mechanic to the same visual quality as the rest, the designer cut the marking mechanic from the thesis artifact level. With more time and resources, this mechanic has high potential for ludonarrative harmony.

IV. Results

The designer learned how to tell whether or not mechanics had ludonarrative harmony. The process successfully determined whether new mechanics had ludonarrative harmony and how existing mechanics change existing ludonarrative harmony. The evaluation process successfully determined when to add or subtract mechanics based on their ludonarrative harmony.

The level artifact had both a mix of designer-directed practices and player-directed practices. While the majority of the narrative is emergent through play, the specific level designer encounters were designer-driven encounters (specific paths, entries and exits, and scripted events). The player-directed approach took a bulk of early development time, and switched to a designer-directed approach during scripted sequences for the tutorial section, scripting the player to stand still when extracting a rune, and the creation of the master rune system.

Research into game design approaches solidified the level artifact's design goals with ludonarrative harmony. Knowing the type of narrative presented to players allowed faster iteration and testing the presentation of that narrative. This translated directly into better level design environmental scenarios that stemmed from a designer-driven approach, even though narrative was not explicitly stated to the player.

The designer tested this process from each angle: mechanics-first (ludoloist), narrative-first (narratologist), context-first, and emotional fulfillment first. The designer knew they needed a discovery narrative so players would feel they were figuring something out while exploration, which is an example of narrative-first. A collection mechanic would help promote discovery, as players would physically need to discover the object in the world before they collected it. This ludonarrative model worked regardless of which came first: mechanic or narrative; and also, the context of the actions or the rewards players got for those actions. Each area of analysis was a different starting point when designing for ludonarrative harmony. In future work, the designer intends to use this knowledge when communicating with other game designers, who already have established game design practices and philosophies. The designer also plans to continue to incorporate the ludonarrative flow into the initial design premises and documentation.

The high concept statement and theme were valuable tools to base decisions that would affect the level artifact's overall ludonarrative harmony. The analysis phase relied on the high concept statement to build out different mechanics, narratives, and emotions for prototyping. The high concept statement grounded the level artifact in a verifiable goal that allowed the designer to double-check already established mechanics and narratives for potential dissonance.

The introduction of the mechanics and narrative needs to be in sync to achieve and maintain ludonarrative harmony. The designer discovered that when expert reviewers performed a mechanic and immediately experienced a narrative element, the ludonarrative harmony of the experience increased. Through development, the designer created the tutorial section with emphasis on delivering narrative elements as closely to

mechanical use as possible. Ludonarrative harmony requires the simultaneous introduction of mechanics and narrative.

Overall, the level artifact achieved ludonarrative harmony. The level design architecture provided weight to player choices that increased the level's overall ludonarrative harmony. The level began with an introduction section that taught players the core game loop—walk, listen to the device, cast light, jump, find the rune, collect the rune, and then have that rune "enter" into the player's device. This tutorial room introduced players to the loops, but did not teach the players the core mechanics. This room also had windows to show the outside world players a teaser for the final level's exterior. After successfully collecting a rune, the player fell through the floor and was trapped inside the level. This section was built to enhance the level's overall ludonarrative harmony and establish the themes of never give up. The scripted sequence of this room trapped players in a dark environment, where they now had to find a way through it. This beginning scripted sequence set the stage for a ludonarratively harmonious experience from start to finish not just within the games mechanics. When designing for ludonarrative harmony, the designer learned that when introduction new mechanics it is best to create a situation that has a narrative use for those mechanics.

The level artifact has an ancient relic where players deposit their collected runes an are allowed to escape. This feature also came late at the level artifact's development. The designer concluded that because the ancient relic looked similar to where players collected runes, players initially thought there was nothing to collect there. Upon discovering they could press "e" and then insert a rune, players understood the narrative behind the environmental object. To perform the insert mechanic was not intuitive, but, upon performing the insert mechanic, players still received the designer-directed ludonarratively harmonious experience. In these prototype situations, even where ludonarrative harmony is not immediately intuitive, players can still receive a ludonarratively harmonious experience. When designing the end level experience, the designer learned that environmental objects players could interact with had to be visually distinct.

The level post-tutorial had four floors with one sub-floor passageway between floors two and three. Each floor had two staircases on either side of that floor to get to the level above it. Each staircase was located in a clearly defined choice area. Choosing a staircase up directly impacted the order players would see runes, and thusly, impacted how they navigated towards ruins. This allowed the designer to clearly plan player stories used to test the evaluation process.

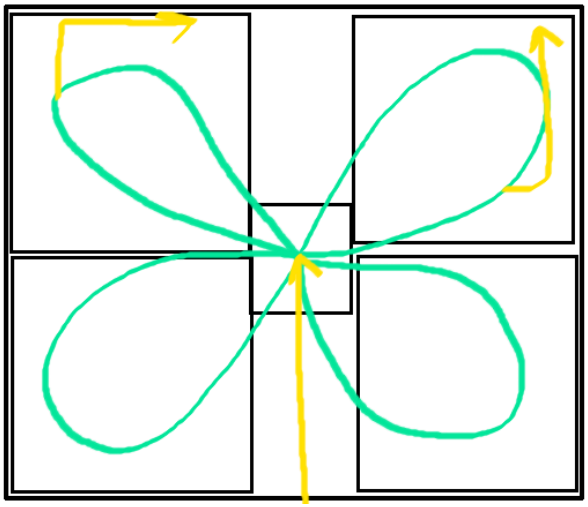


Figure 33: basic design for the infinity loop map layout; YELLOW are entrances/exits; and AQUA is for the loops

Each floor of the level was segmented into four different rooms, or areas. Each floor had two circles that met in the middle to create an infinity loop path. This player path created multiple routes in a single space that allowed players to easily backtrack from one area to another.

The designer connected these loops in the center with intersections. These intersections allowed sightlines to each of the branching paths, and also showed players different staircases that would lead up to the next level. These staircases delineated from the infinity loop to reinforce the theme that staircases—going up—were the way out. The designer placed runes on the outer edges of these pathways to both increase exploration and challenge narratives.

The infinity loop design allowed players to explore one area, and when they moved on, giving clear directional choices gave meaning to why the player chose one way versus another. Since the infinity loop design was initially too subtle, iterations were made to further block out the segmentation on each floor to give players an increased sense of weighted navigation choice. Reviewers felt that the overall scale of the level did not always feel consistent, which translated into players questioning where they were in the space. Visual consistency in level design architecture helped maintain ludonarrative harmony.

The designer learned that the process does work for evaluating mechanics at the localized level. The designer created the marking mechanic as an environmental interaction, players walked up to a spot on the wall and placed a mark. Even though the mechanic functionally worked, it's lack of narrative context in the environment, as well as a system to support it, meant that the mechanic did not have ludonarrative harmony. The designer learned that the underlying fiction represented in the environment directly impacted the overall ludonarrative harmony. The environment does impact player's expectations of what they're allowed to do in the playspace. When creating new mechanics, the designer will make sure to adhere to another project's game fiction to create ludonarratively harmonious gameplay.

The master rune system required an object in the environment that players could interact with. This object called the ancient relic would open the level end door. The visuals of

the ancient relic underwent three revisions. Since players acquired runes from powered on columns in the environment, the designer chose to create a powered off version of a larger, visually similar column for players to place the runes in order to escape. Just like the marking mechanic, the ancient relic blended too well into the environment. Players did not know they needed to interact with this object. Where players placed runes to escape looked too similar to where they collected runes. The designer moved the location of the ancient relic to in front of the final staircase that led to the level end door. Since players did eventually figure it out after exploring the area around it further, the designer kept the final revision of the ancient relic. This result indicated that despite visual discrepancies, ludonarratively harmonious gameplay was still achievable.

Although reviewers requested a character model that would show the player's feet for jumping, a character model is not necessary to achieve ludonarrative harmony, although a character model could enhance ludonarrative harmony according to expert reviewers. Due to time and resources during the development of the project, a third-person character model was not implemented in the level artifact. The diegetic UI grounded players in the playspace, and did not need to be visually perfect to achieve ludonarrative harmony.

V. CONCLUSIONS

This thesis set out to define a process to evaluate mechanics and test that process against the thesis level artifact. Using this process, the designer built a level that achieved ludonarrative harmony. This process also diagnosed whether or not additional features would or would not have ludonarrative harmony. Developing a level for ludonarrative harmony created a more internally consistent world without having to use explicit narrative text to explain narrative. Although ludonarrative harmony focuses largely on game mechanics and their relation to the narrative, the visual representation of those mechanics and environmental art are necessary components to maintain consistent ludonarrative harmony throughout the level.

The designer developed a model for ludonarrative harmony that allows designers to start with the mechanics, the narrative, the context/situation, or the emotional fulfillment and successfully design a level for ludonarrative harmony. This model allowed the designer to start with whatever they were most comfortable with during development, and established a ludonarrative harmonious game flow. This flow created a ludonarrative loop that established ludonarrative harmony. Currently, the model has only been tested in this thesis level; but it has been used from each angle. It's possible to achieve ludonarrative harmony from one of these four approaches: mechanics-first, narrative-first, context-first, or emotional fulfillment-first.

Overall, the design process and ludonarrative model relied heavily on design documentation to ground decisions in pre-established fiction of the game world. What would make sense in the world from a larger, fictional stand point is not covered in this model. Future research would be necessary to expand or alter this model to account for decisions based on the game's underlying fiction. This model currently assumes that a designer uses documentation that encapsulates more of the backstory, the character, the environmental fiction, and any other details the ludonarrative harmony model does not explicitly include. However, the designer recognized the visual conveyances relied on the pre-established fiction from design documentation. As the final ludonarrative harmony model included in this thesis currently does not include the fiction, it has the potential to work with any art style. However, future designers with the intent of recreating this study would need to change fictional naming conventions of certain mechanics to conform to whatever art style or fictional genre they chose for synergy.

Through the correlation between mechanics and narrative, even games that do not have traditional plots, depend on micronarratives—moment to moment experiences—to shape their emotional experience [15]. As stated in Lazarro's research, these moment-to-moment experiences directly correlate with the emotions players' experience [5]. The moment-to-moment interactions within the game must facilitate and progress the narrative for ludonarrative harmony. The consequences of performing mechanics and their context when performing them establishes an intuitive game narrative [21]. The potential for ludonarrative dissonance dramatically decreases when focusing on the present tense of ludonarrative storytelling. When constructing ludonarrative harmonious levels, the spatial design of the space, as well as movement through that space, enables the player to construct their storytelling experience [15]. Mechanics and narrative theme need to match in a consistent, realized whole. Ludonarrative harmony requires the active participation of the player during play.

The practical techniques for achieving ludonarrative harmony require a strong combination of writing and design. Mechanics allow players to co-author the game experience, essential to establishing and maintaining ludonarrative harmony. Games tell the story of the player collaboratively through the player's actions and the designer's creation of scenarios to use those actions [19]. Designers need to create a narrative that synchronizes the player's mechanics, and lack thereof, with the overall narrative of those actions [30]. The designer used the principles of writing and game design to execute on mechanics based on which emotion a mechanic encourages in players. In his own work, Chen continues to look at emotions as a driving factor to create more immersive and impactful experiences [22]. When players did understand *why* they are doing something, they felt a lack of immersion or lack of interest due to a lower (or nonexistent) feeling of ludonarrative harmony. To invoke emotion, designers must understand how mechanics achieve that emotion [5]. Looking at emotions allows designers to provide stronger, more realized ludonarrative experiences.

UI was a vital communication tool when working towards ludonarrative harmony. A diegetic UI was not necessary to achieve ludonarrative harmony, but it enhanced the ludonarrative harmony. In first person games, diegetic UI is seen as part of the environment that reflects the player's identity back onto themselves [11]. Thus, when designing levels and games with ludonarrative harmony in, designers should remember how their choice of UI affects the global ludonarrative harmony. The level design architecture abides by the same ludonarrative harmony as the mechanics and narrative.

Visual consistency in UI elements, as well as in environmental elements, was crucial to maintaining the ludonarrative harmony balance in this first-person level.

This ludonarrative harmony model is only one solution to the solve the problem of ludonarrative dissonance when designing games. The model was designed for the entire design process, but works best when analyzing localized instances of mechanics. Since the designer only designed one level and not an entire game sequence, the model does not capture what the mechanics and narratives would look like over the course of a longer game experience.

VI. Further Research

The ludonarrative model currently is intended to be used alongside existing design documentation that details the fiction of the game world. Since this fiction at times did strongly influence the designer when making decisions about which mechanics to include and why, it would be interesting to expand the model to include which parts of the fiction dictated which areas of the model in a more cohesive way.

This thesis could be modified to start with an existing game, or established game type, and then reverse-engineer that game using the models in this thesis. Future work could start with a game type, such as *Minecraft*, that heavily relies on systems to generate content and see how that affects ludonarrative harmony.

It would be worth exploring both as a single-person study and as a larger, organizational level to test how this ludonarrative process effects entire game experiences, rather than single-level experiences. Currently, the ludonarrative model address the localized concerns of one ludonarrative model. The designer recognizes that some games may have systems that seemingly have nothing connecting them to the overall game experience. For example, a single-player game mode would not have the system that a multiplayer game mode would have. Thus, the designer would like to see someone use multiple ludonarrative models in the same game, as circumstances required.

This thesis' design practices and ludonarrative models could be expanded in the following list to create an interdisciplinary approach to designing for ludonarrative harmony.

- How can designers incorporate more complex emotions into mechanics and systems to achieve ludonarrative harmony?
- Studying the relationship between emotions from Lazzaro's 4 Keys to Fun and immersion in existing games that have ludonarrative harmony
- Ludonarrative harmony and systems, a more detailed study of how systems work with narrative to create ludonarrative harmony
- Areas where dissonance occurs based on Lazzaro's "4 Keys to Fun"
- How serious fun and people fun relate to internal/external motivation
    - How is that relationship conveyed through multiplayer narratives?
    - How does that relationship impact ludonarrative harmony in multiplayer or single player?
- Ludonarrative harmony in multiplayer games
- Ludonarrative harmony in third-person games
- Ludonarrative harmony and identity—how players begin to feel like the character
    - In first person games
    - In third-person games
    - In RTS games
- The designer driven approach versus the player driven approach case study analysis in current games
- Examining and identifying the different instances in existing games where ludonarrative harmony, resonance, and cohesion exist
- Studying the relationship between ludonarrative harmony and experiencing ludonarrative resonance

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VIII. Appendix

The Thesis Artifact also required to include a Game Design Document, the Level Design Document, and the Narrative Design Document. All documentation was used actively during development, with key sections updated at the end of the development process.