# 1 Table of Contents

*"I hope to offer a middle ground position between the ludologists and the narratologists, one that respects the particularity of this emerging medium - examining games less as stories than as spaces ripe with narrative possibility" (Jenkins, 2004)*

*"Gaming and storytelling have always overlapped. They are both being expanded at this moment as authors take advantage of these new affordances, and they have increased opportunities to develop in their areas of overlap." (Murray, 2004)*

*" Good puzzles require insight from the player, the "Aha!" moment that occurs when the player realizes how the puzzle works and how to solve it." (Adams, 2009)*

*"There are lots of ways designers can place story elements throughout their environments to lead their audience to conclusions designed into the game's plot" (Carson, 2000)*

*"not only must a narrative be about a sequence of events over time, structured comprehensibly in terms of cultural canonicality, it must also contain something that endows with exceptionality" (Bruner, 2001)*

"Stories are not empty content that can be ported from one media pipeline to another." (Jenkins, 2004)

*That original stories would emerge from a system given the system is complex enough is an unrealistic take on the issue. Our opinion is that emergence should not be associated with a lack of purpose in the authoring process." (Crawford, 2004)*

# 2 Introduction & Background

Interactive narratives have become increasingly popular both within the academic field and within the design field. A lot of interesting perspectives and academic points of view during the past decade, the environment have become widespread to emphasize in computer games. Examples of game developers that emphasises the environment particularly are games such as Skyrim (Bethesda, 2011), The Witcher 2 (CD Project RED, 2011), Miasmata (IonFX, 2012), Dear Esther (TheChineseRoom, 2012), and Journey (Thatgamecompany, 2012). Though these experiences have been created and published, only a modest amount of research has been done regarding seeing the environment in digital experiences, as an embodiment for telling stories (Nitsche, 2008) (Carson, 2000) (Jenkins, 2004) (Girina, 2013).

Don Carson came up with the term *"environmental storytelling"* [ES[1]] in an article on Gamasutra in 2000 (Carson, 2000). When he wrote this article, he used interdisciplinary knowledge, from his experience with designing real life theme parks, guiding, telling stories or attracting the audience only using paths, buildings and the landscape. This later inspired Henry Jenkins to outline a more detailed derivation of the concept, by presenting four subsidiary items to the narrative potentiality of the environment: *Evoked* (Landscape and details)*, Embedded* (Objects and their staging)*, Emergent* (the stories emerging in the user's mind) *& Enacted Narrative* (Character interaction and dialogue)*.*

Given that there has been very little research in this field, 2½ years back, I and two other students from AAU-CPH took the concept further, since we believed it deserved further research and evaluation as it might hold important aspects of interactive narratives. We designed an alternative computer game experience, Aporia[2], specifically based on Carson and Jenkins' idea of ES. In the next few years, three separate experiences was created under the same concept (Aporia) resulting in wide-ranging expansive studies and results[3]. Two papers were written and accepted at the ICIDS conference 2012 in Spain and published by Springer Link (Bevensee S. H., Boisen, Olsen, Schoenau-Fog, & Bruni, 2012) (Bevensee S. H., Boisen, Olsen, Schoenau-Fog, & Bruni, 2012). During these years of investigation within this particular area, some level of expertise on the subjects was established. This study wishes to use that knowledge together with a large amount of approved research on the area; establish an entire framework on ES experiences.

My intentions with this work is to construct a framework or a "conceptual toolbox" for both analysing existing works that could fall into this category, or be used as actual guidelines in the design of new interactive experiences. In other words, the project aims to function as an indexical work, where designers and researchers can achieve design-oriented guidelines and analytical aspects on different topics of ES.

[1] Environmental Storytelling will be referred to as "ES" throughout the report

[2] Since the reports based on the three Aporia experiences are not published, they will not be referred to as official sources throughout the report, however, when necessary, the papers based on the first report will be added sources. The reader can therefore expect times throughout the report where knowledge of certain subjects is based on one or more of the three Aporia investigations. Some subjects from earlier reports are therefore brought up again, but in a new context, which is how the subjects work in the context of ES experience as design elements.

[3] Later, I created another research project called Memoriam, an ES experience focusing on replay value through productive interactivity between players. A paper based on Memoriam was published and accepted by the ICIDS conference 2013 in Turkey and a workshop was held on the concept (Bevensee & Schoenau-Fog, 2013).

Before establishing the framework, it is essential to review some of the main analytical concepts that can be used as a theoretical foundation and contribution to this work. Then the existing influential contributions, Aporia, together with the notions and ideas of ES will be described.

Having done this, I will include the main components and aspects of ES that a designer should keep in mind, such as how to design objects, analogies, scenery, challenge fantasy etc. to effectively and aesthetically induce user enjoyment.

A central part of the work will be the design of two applications in order to test and validate the framework. A methodology for evaluating narrative engagement in ES and for validating the assumption of having different levels of "environmentalness", that is, what are the minimal requirements of an environment needed, to suscitate the construction of a story in a user's mind.

The results of this project might hold something new and valuable to share within the field of interactive storytelling.

# 3 Initial Problem Statement

It seems prudent to start the preliminary analysis by forming analytical properties that can be used as techniques to design for ES and then go into depth with the practical aspects in the main analysis. It is believed that the ES framework established in this report can contribute with a set of guidelines that can be used by designers of such experiences. We can then form the initial problem statement:

*How is it possible to establish a framework of environmental storytelling in computer games, resulting in a set of guidelines that can be used in the design process of such experiences?*

*"How is it possible to establish a framework of environmental storytelling in computer games, resulting in a set of guidelines that can be used in the design process of such experiences?*

The resulting framework of this work is almost equivalent to the overview of the chapters in the preliminary analysis and the main analysis. Thus, it seems prudent to refer to the framework, giving the reader or the designer a small encyclopaedia of the different perspectives and a full overview of the structure of the report, if desired (see Figure 15). It is significant to mention that the framework itself is the overview of ES and the actual guidelines will be established afterwards.

# 4 Preliminary Analysis

Before diving into the creation of the framework, it seems prudent to discuss the two most elementary terms in this project: Environment and narrative. What is a "story" in the context of the environment and what functions, components, and techniques does it entail? What exactly does "environment" include when talking about computer games? To answer this questions I describe in what way the environment can convey a story theme and how one can use different narrative techniques in ES experiences.

Throughout this work, I present vast academic areas, in which, a multitude of work have been put into investigating and clarifying each subject by researchers around the world. To narrow my work and keep focus, I will mostly focus on how the research aspects can be converted into design guidelines and applied to ES experiences. I will elaborate on how others have used some of the methods and discuss their shortcomings/potentials. All the academic aspects in this report are not just described or reviewed, but should intentionally serve to provoke new thoughts and theoretical models on how interactive narrative theory can be used in practise.

The analysis will investigate definitions, theories, structures, and understanding of narrative in ES experiences. It will touch upon the notion of agency, immersion, and emotions with focus on design choices that evoke these cognitive aspects. However, initially, a presentation of Aporia is deemed prudent.

## 4.1 State of the Art

Since a good part of this project is based on existing knowledge of creating ES experience, it seems prudent to introduce the background of the three Aporia experiences by briefly describing their focus, purpose, and their use of ES. A state of the art description of Memoriam, Dear Esther, Myst and Journey has been chosen to include in appendix section A & B (some are derived from the first Aporia report), since these games is particularly relevant as state of the art and/or as inspirational sources for the creation of Aporia. All three Aporia experiences were created in Cryengine SDK. All three games have mystical and eerie atmosphere, with no characters or dialogue and often, the story is very enigmatic and abstract (see Figure 1).

*Figure 1 - A screenshot from the first experience. This particular shot conveys the mystical atmosphere of Aporia well.*

### 4.1.1 Aporia

- *Aporia: Uncover the Mystery:* The focus of the initial Aporia game was to convey a prewritten story embedded with the environment and told through the staging of objects, cave paintings, photographs, and symbols. Stranded on a mystical island the player has to uncover the truth of what he/she is doing there and who they are. The player must gather a series of orbs with each

their own power, in order to return to the real world. The results indicated that the majority did not perceive the prewritten story, but indeed had story experiences, making a narrative emergently generated in the users mind.

- *Aporia: Darkmist* Forest: From the results of the first Aporia, it became interesting to purposefully design for emergent narratives. Darkmist Forest had the focus of guiding the user in a fully open world, by providing sensory stimuli cues such as light, sounds, and movement embedded in the environment. We also implanted in-game metrics, such as a diary in which the user could write and tracking of the user's position and navigational tendencies. The user starts out in a dark forest that is not necessarily safe and has to discover their own darker personalities, which are represented through a ghost, symbols, and cave paintings. The results from the study indicated that player did not take a specific path through the environment, but when they got close to a location with a cue; they found it much faster than without cues.

- *Aporia: Still Lake Valley:* In Still Lake Valley, the idea was to provide a full-blown story in the Tunguska crater in Russia, using notes, doodles, and pictures. Normally, including notes exceeds the unwritten rule of not having any text. However, the notes were used to test the concept of merging story and gameplay[4]. We tried to solve this, by letting two players collaboratively communicate the story to each other[5]. By placing them in each, their own end of the map and letting a player receive story information about the area where the other player was situated and vice versa. In this way, they had to tell each other stories about what happened at the crater, making this collaborative aspect the main gameplay element in the experience. The results of the study indicate that there is potentiality for sharing stories. People considered the collaborative sharing of the story as being one of the main game elements, but reading the notes appeared as a somewhat tedious process.

## 4.2 Interactive Narrative Theory

Before I am able to create and validate the framework, I need to look into form, plot, structure, interactivity, and drama management regarding digital narratives. Based on these features, I can establish as set of general rules that should be regarding when creating ES experiences.

### 4.2.1 Narrative interaction and defining narrative

*"Interactivity is about freedom. Interactivity is about giving your player things to do and letting your player do them. The whole point of interactive media is letting the player do something on her own."* (Adams, 1999).

I will first briefly clarify the means of interacting with the story in ES experiences. Interacting is a broad term, with many different interesting approaches and attempts to dissect it in the video game genre[6]. I will

[4] Often receiving story in computer games is a passive process where the player rarely "plays" but waits until the character dialogue or cutscenes is done.
[5] We noted the system Collaborative Interactive Storytelling System (CISS)
[6] For instance, Marie-Laure Ryan outlines eight forms of which way the user can interact with the system an arrangement between *ergodic/nonergodic*, *electronic/nonelectronic*, and *interactive/noninteractive* (Ryan, 2001), however, since her dissection is supposed to fit multiple platforms such as electronic databases and books, the

not spend time on giving a collective review on these approaches, but rather do a quick elaboration on how the user is interactive with the story in ES experiences.

The way that ES differs from the classic notion of interactive storytelling in computer games, is its way the user interacts with the story. The type of interaction is not selective in the classical way as provided by Ryan (Ryan, 2001), where the user is presented with a selection of multiple choices that will affect the course of the story. The selectivity of the narrative, here, is offered by allowing the users complete freedom through navigation in the environment and letting them seek out locations in different orders to attain narrative material. Selective interactivity can also be used in picking up and using objects, relevant to the story. The designer can furthermore choose to introduce productive interaction, such that the users can create or contribute story material to the world by, for instance, placing objects, drawing, or writing.

It seems prudent to present how the term "narrative" has been defined by other researchers, since some are more specific than other is:

| ***Author*** | ***Definition*** | ***Source*** |
|---|---|---|
| Onega & Landa | *"narrative is a semiotic representation of a series of events"* | (Onega & Landa, 1996) |
| Bordwell & Thompson | *"A chain of cause-effect relationship occurring in time and space"* | (Bordwell, Thompson, & Ashton, 1997) |
| Jerome Bruner | *"A narrative is composed of a unique sequence of events, metal states, happenings involving human beings as characters or actors"* | (Bruner, 1990) |
| Chris Crawford | *"A story is a collection of facts in a time-sequenced order that suggest a cause and effect relationship"* | (Crawford, 1984) |

Definitions such as the ones Bordwell & Thompson and Onega & Landa's are created considering the fact that the user does *not* have any influence or interaction with the story. They are vague in the sense that they are simply too obvious and not specific enough, which might have been more suitable if I were dealing with general studies of literature, but not in the context of a computer game.

classification of interaction in computer games are mostly both *interactive, ergodic & electronic*. Because, often, that is exactly the affordances that a computer games offers.

Based on the definitions combined and knowledge of analysis of state of the art computer game experiences[7], I suggest a more suitable definition of the term narrative in ES experiences:

> *"A selection of staged objects, events, and environmental setting, suggesting a cause-effect relationship or a semiotic relationship from a story theme in non-linear time and space"*

The purpose of the definition is not to outmatch existing definitions, but rather present a set of guidelines of how the narrative works (or could work) in ES experiences. Let us briefly dissect the definition – The terms *staged objects, events* and *environmental setting* is an attempt to present the *embedded, enacted,* and *evoked* narrative aspects as discussed earlier. As described, the narrative material from these three aspects can either result in different perceived *semiotic relations* or evoke some sort of *cause-effect relationship*. The narrative is embedded in an open world and can be experienced in various ways depending on the user navigation, which does not ensure a linear presentation or understanding of the story[8], making both time and space non-linear regarding the narrative.

### 4.2.2 Defining Narrative as a Scalar Property

One view I find particularly interesting, is Ryan's (2006) conception of seeing narrative as *"[…] a scalar property rather than as a rigidly binary feature that divides mental representations into stories and nonstories."* (Ryan, 2006). This is not about dissecting narrative as components and functions but presenting its macrostructure on different levels in four different dimensions – the *spatial*, *temporal*, *mental*, and the *formal & pragmatic dimension*. A nice but unusual approach Ryan uses to elaborate on each level is to mention (non-desired) narrative aspects that the author eliminates by including the given levels:

[7] Presented later in the preliminary analysis

[8] However, the narrative might be interpreted linearly inside the users' minds – Like Ryan's structure "The hidden story" where a non-linear presentation of the narrative might have a linear cause-effect relationship. Additionally, some elements are allowed to be linear, for instance in narrow areas where the designer controls the navigation.

| ***Spatial dimension*** | ***By including this dimension, we eliminate*** |
|---|---|
| 1. Narrative must be about a world populated by individuated existents. | Eliminates representations of abstract entities and entire classes of concrete objects, scenarios involving "the human race," "reason," the State," "atoms," "the brain," etc. |
| ***Temporal dimension*** | |
| 2. This world must be situated in time and undergo significant transformations. | Eliminates static descriptions. |
| 3. The transformations must be caused by nonhabitual physical events. | Eliminates enumerations of repetitive events and changes caused by natural evolution (such as aging). |
| ***Mental dimension*** | |
| 4. Some of the participants in the events must be intelligent agents who have a mental life and react emotionally to the states of the world. | Eliminates one-of-a-kind scenarios involving only natural forces and nonintelligent participants (weather reports, accounts of cosmic events). |
| 5. Some of the events must be purposeful actions by these agents, motivated by identifiable goals and plans. | (Together with 3) Eliminates representations consisting exclusively of mental events (interior monologue fiction). |
| ***Formal & Pragmatic dimension*** | |
| 6. The sequence of events must form a unified causal chain and lead to closure. | Eliminates lists of causally unconnected events such as chronicles and diaries as well as reports of problem-solving actions that stop before an outcome is reached. |
| 7. The occurrence of at least some of the events must be asserted as a fact for the story world. | Eliminates instructions, advice, hypotheses, and counterfactual statements. |
| 8. The story must communicate something meaningful to the recipient. | Eliminates bad stories[9] |

Ryan clarifies that some might be satisfied in defining narrative as including steps 1 through 3, where others will imply that step 4 and 5 is obligatory. Some insists on including 6 as required, too which I disagree, since a narrative indeed are allowed to have "loose ends" with no closure and still be defined as a narrative. I believe that it would be possible for the majority to experience a story only by using the first two levels, given that the levels are embedded in an interactive computer game. Brilliant or not, Ryan's

[9] Ryan elaborates on this (the footnote continues on next page) – *"This is the most controversial condition in the list, because it straddles the borderline between definition and poetics, and because it needs to be complemented by a full theory of the different ways in which narrative can achieve significance. If we accept 8 as part of the definition, then narrativity is not an intrinsic property of the text, but rather a dimension relative to the context and to the interest of the participants. A sequence of events like "Mary was poor, the Mary won the lottery, the Mary was rich" would not make the grade as the content - of fictional story, but it becomes very tellable if it is presented as true fact and concerns an acquaintance of the listener."* (Ryan, 2006)

levels does not take interactivity from an actor into perspective, making the scale more related to linguistic semantics.

It is of interest, though, to investigate how the scale can be converted into degrees of semiotic narrative components (Game design elements) in an ES computer game. The scale will therefore be used as a basis for evaluating levels of the framework, by dividing it onto constructional semiotic levels of narrative, each corresponding to Ryan's degrees of narrativity.

### 4.2.3 Cause-effect Relationship

One major component or "rule" of narrative is the causality between events throughout the story. As we saw in the above sections, it is often involved in the definition of narrative Crawford, on the other hand, defines cause-effect relationship well suitable for interactive experiences, since he implies that the story facts *suggest* a cause-effect relationship. This is what happens in ES experiences; the designer does not always provide a specific cause-effect relationship since the experience often is non-linear and the story cannot be linearly presented by the author, since the responsibility of the sequence of events lies discovery of the player (depending on which order the narrative elements are discovered in).

By saying that the designer does not always provide cause-effect relationship I mean that one can provide different facts ("effects") through the narrative design, to which the player is given the responsibility to interpret these facts to be caused by *something*. This is an example of an *INUS condition*[10] (Belnap, 2005). In the context of ES experiences, the facilitation of INUS conditions is often created through the *embedded* storytelling. A good example of this can be found in The Last of Us (Naugty Dog, 2013), a post-apocalyptic survival game, set out in United States in 2033. During the game experience, players traverse through ruined city environments, giving strong impressions of past events through their mise-en-scene. In several locations, the objects tell a story of some past event, but the appurtenant causal conditions are not always provided. On Figure 2 a bridge has collapsed, but one does not know *how* or *why* that bridge has collapsed. It could be the fact that a jet plane that crashed into it or maybe the bridge held too many cars on that specific point or it could be many other things. I would note this example as an embedded example of INUS conditions, where players are able to interpret their own

*Figure 2 - Artwork from The Last of Us. The image can evoke many story associations - a city overgrown by nature, a collapsed bridge, and terrible accidents.*

[10] An event (a) that is sufficient but not necessary for another event (b) to happen as a cause-effect relationship. This can for example be a list of materials (INUS conditions), that might cause a house to burn.

interconnection (causality) of events. This is a good technique to use when designing for emergence in game experiences, since it evokes multiple interpretive versions of the story.

It is my belief that INUS conditions are an important part of designing for emergent storytelling and the more INUS conditions an event has, the greater the emergence will be, as the player can conjure own explanations as being the cause of the event.

### 4.2.4 Form & plot

Taking the cause-effect relationship a bit further, let us have a look at how the major narrative components can be structured in ES experiences. In order to achieve drama in an experience where the user is interactive and in control of the experience, the designer can create a certain narrative structure or form, to be able to better control the user experience. However, in open world environments where no chronology of narrative events is designer-controlled, it is extremely difficult to control the drama level. This is mainly because the environment tells the story and the form of the narrative are thus, almost equivalent to the form of the landscape.

It is not carved in stone that an ES experience has to be completely open world. There are multiple ways in which the narrative form, can be worked into the environment and still be able to give the player a high level of freedom, by using a set of well-considered navigational constraints.

In her profound work, Marie Laure-Ryan *"Narrative as Virtual Reality",* amongst other subjects, brings light upon interaction with the narrative and a variety of structures for interactive narratives. Two types of interaction with the narrative can be carried out by the user, *selective* and *productive* interaction. The terms are as straightforward as they are clever – selective interactivity is the task of choosing between ranges of choices regarding the story, e.g. "do you want to save the princess or do you want to slay the dragon". Productive interactivity is a more diverse process, since it can be carried out in multiple ways. For instance, the diary example from Aporia and placing objects in Memoriam are good examples of productive interactivity. Interaction such as drawing is also a possibility.

Before going into depth with the structures, Ryan offers two manners of constructing the story from the narrator's perspective. These are causal and dramatic narratives. Causal narratives are best interesting to use in ES experiences. It is a sort of backwards logic where the narrator decides on an event and then establishes a chain of cause-effect relationships that leads to this event. On this, she notes: *"The system gives a very specific task to the user— rescue a princess, find the missing page of a book, or simply move along an initiatory path to reach higher status—and the user progresses toward this goal by solving a series of problems."* (Ryan, 2001), to which she states that causal narratives are particularly well functioning in adventure games. If the user takes a wrong turns or fails a challenge, it does not break narrative coherence, since the story form allows both stories of success and stories of failure while chasing "The thrill of the quest" (Ryan, 2001). Dramatic narrative often suggests a structure where the narrator is in complete control of the user's progression in the story because it aims to evoke certain emotions and reactions with the user. This contradicts one of the desires of ES, which is to let the user be in control and explore the

world. Therefore, dramatic narratives are not appropriate for ES experiences and, if ever used, it should be used with caution[11].

Ryan offers an array of nine suggestions of how narrative can be structured, which potentially all could include in ES experiences (see Figure 3).

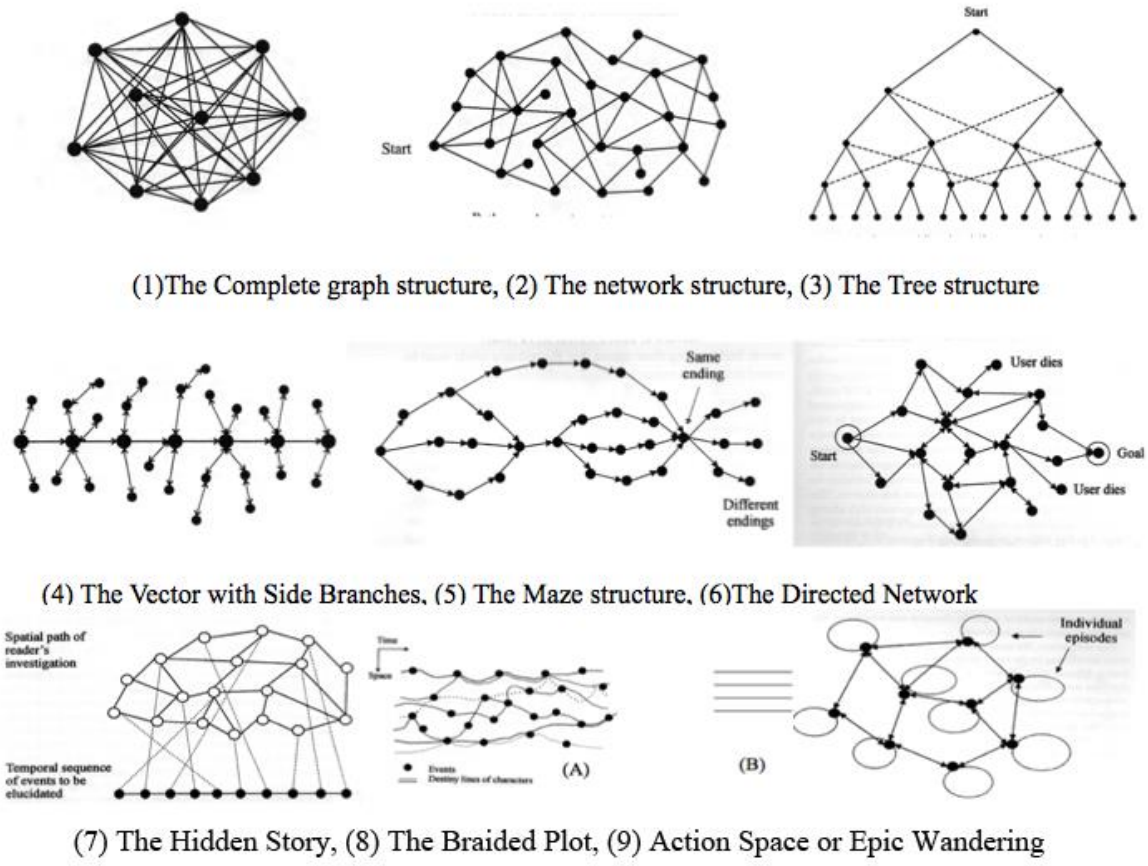


*Figure 3 – Ryan's nine models of interactive narrative structures.*

Some are definitely more applicable in ES experiences, than others are. For example, The Tree Structure, The Directed Network, and The Vector with Side Branches are not highly suitable as standalone models for ES, since they rely heavily on selective interactivity with prewritten plotlines. However, having side branches for each node and multiple endings is something that holds potential in ES experiences, so if one wants to use one these three structures, they should provide more freedom to the user, by being either expanded or combined with one or more of the other structures.

*The maze* structure is very well suited for ES, since it has a beginning and an end, which in between gives a high level of user freedom and provides different narrative nodes that can be interconnected in some ways. However, the nodes in this structure do not infer complete freedom, since there are still some fixed cause-

[11] Dear Esther (TheChineseRoom, 2012) uses a mix of the two narrative types, by letting the player set their own goals to explorative in the virtual world (causal narrative), while at the same time tightly controlling the chronology of the voice-over narrative parts (dramatic narrative). However, no goal in the virtual world is provided by the author as a causal narrative element so whether the virtual exploration is in fact a causal narrative is arguable.

effect relationships suggesting some need for linear design in the diegetic world and the plot. *The Complete Graph* also has some potential, in the sense that it provides very high freedom, but as Ryan notes *"[…] Almost impossible to guarantee narrative coherence"* (Ryan, 2001). *The hidden story* works in ES experiences if the author intends to convey a specific story, but this is somewhat paradoxical since conveying a specific linear story has proven extremely difficult, using ES elements only (Bevensee S. H., Boisen, Olsen, Schoenau-Fog, & Bruni, 2012). *The Action Space* shows potential in its structure, but not regarding the narrative, rather as a navigational map of the world, since it can be viewed as containing small multiple open environments – a method to maintain some degree of freedom and still be able to control the general story. *The Braided Plot* is uncommon to use, since it also suggest some sort of linearity. It could however, work if one wanted to incorporate more than one player at a time.

As I see it, these narrative structures can be slightly too specific and since ES experiences can take many forms regarding the narrative structure, I would like to present a more broad model, giving the author a greater possibility of being creative. I reached at the idea of using inspiration from multiple of Ryan's models into a highly suitable and applicable model for designers of ES experiences. *The Network* is the one of Ryan's models that fits the open world element of ES best; however, I want to discard the drawn lines, putting the connections of the nodes (the plot) in the hands of the user. As mentioned before, *The Maze* holds potential, since in ES experiences, fixed start and ending nodes provides the player with introduction and initial objectives, while giving the user a sense of coherence. The author should be allowed to design several endings from a fixed node, giving the user even more agency in the end of the experience, which is what *The Directed Network* suggests.

From these guidelines, I present *The Environmental Exploration* (see Figure 4). The blue circle in the beginning is the introduction to the story (or story theme), often providing the user with a narrative introduction and/or narrative goal. The idea with this area is also to give users an idea of the purpose of the game as well as being presented with the general mechanics in the game, before they are offered full control in the open world. The yellow square in the middle represents a creative open world space, in which authors (or users) can connect the nodes in any form they like. Here, the designer can also choose to divide the navigational space of the world, into smaller parts if necessary, to offer the user some chronological understanding of the story, or give each sub-area a thematic coherence. The "ending space" can vary, depending on whether the author want to give the user a specific uniform ending, or create a system that produces multiple endings; either randomly or based on the user's choices throughout the experience. Furthermore, the model is based on the canonical Aristotelian narrative model, containing a beginning, middle, and end with rising and falling action (Halliwell, 1987). As the user progress in the "open world", more and more narrative information is received, intentionally giving an increased level of drama (rising action) until the "same ending" node is uncovered, representing the climax. Here the author can choose to end the experience here or give resolution (falling action) to the user, with different outcomes. The author can also choose to skip the "same ending" node and go directly to different endings, caused by the final nodes discovered in the "open world".

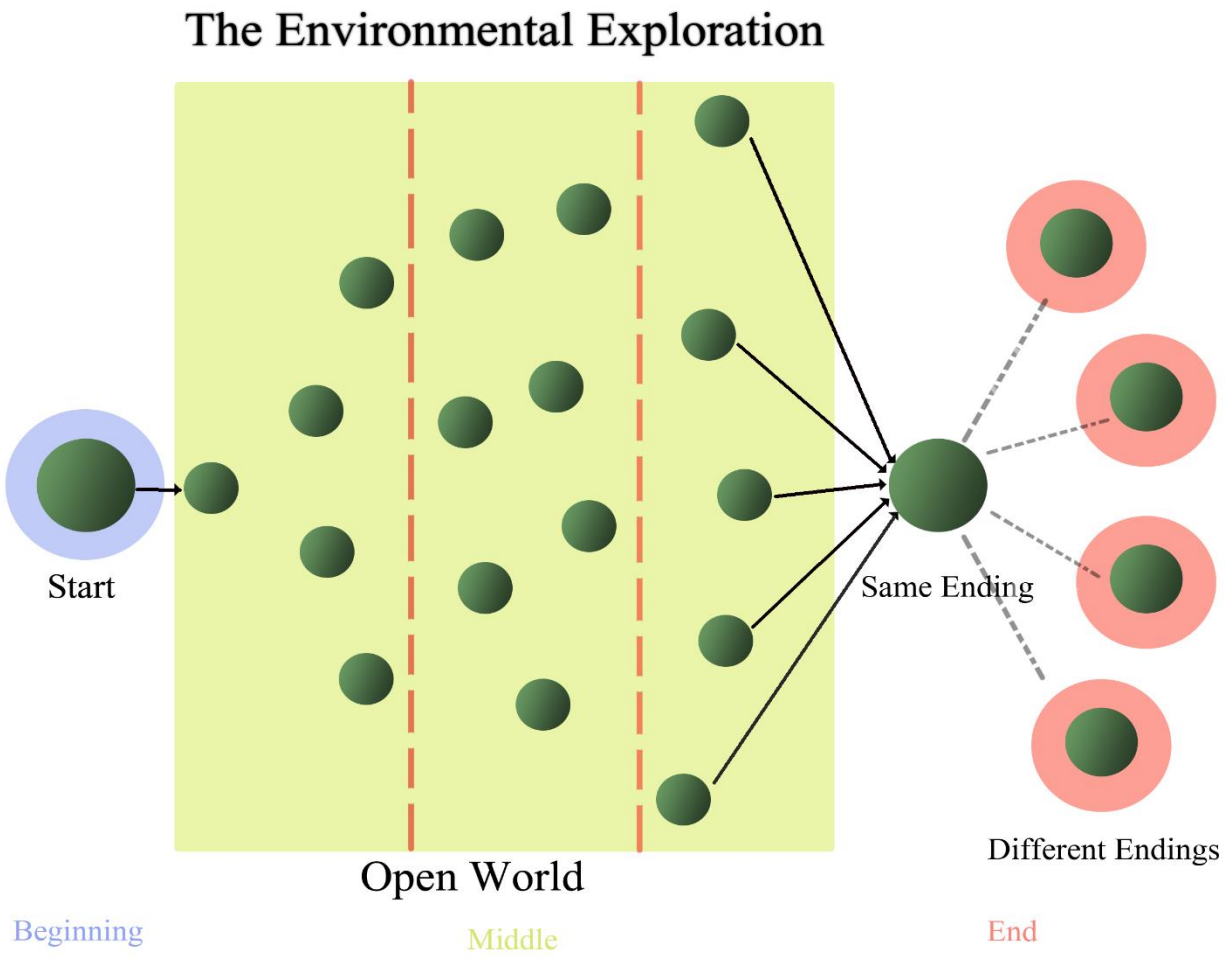


*Figure 4 - The Environmental Exploration serves as a broad model of how the narrative structure of an environmental storytelling experience could look like. The idea is to let authors of such experiences, modify the model corresponding to their own story theme. The stippled lines represent possible choices that the author can choose to use.*

The reader should note the fact that it is environmental elements that conveys the story, which means that the model itself is also an indication of the structure of the virtual world. That being said, it is still on a somewhat analogous level, such that the structure of the world should obviously not be round or square shaped, but rather contain elements from the model in the respective areas. The designer should of course be allowed to sculpt the virtual world in any form they like, as long as its underlying basis is rooted in the model.

When talking about the structure of a narrative conveyed be the environment, one also talk about the player's freedom of navigating and influencing the story through his or hers actions. In interactive narrative experiences, this is referred to as the notion of agency.

### 4.2.5 Agency

Let me initiate this section with a classical definition of Agency, provided by Janet Murray (1997) in her comprehensive work *"Hamlet on the Holodeck"* where she defines agency as*: "the satisfying power to take meaningful action and see the results of our decisions and choices*." (Murray, 1997). From this definition, agency can be all sorts of actions performed by the player, however this section will deal with the type of agency affects the plot and story outcome.

Agency has been a quiet discussed aspect within the area of interactive storytelling and a number of types have been notated, such as *Global & Local* agency and *True, Unrestricted & Limited* agency (Mateas & Stern, 2005) (Tanenbaum & Tanenbaum, 2010). It is not my intention to build further on the discussion; however, there are few interesting clarifications in the work "*Agency Reconsidered"* by Noah et. Al, (Wardrip-Fruin, Mateas, Dow, & Sali, 2009) which I would like to note before elaborating on agency. In the piece, Mateas reconsiders Murray and Laurel's concepts of agency and redefines the process of when players are experiencing agency, by making use of two Laurel's causality forms (formal and material):

*"Players will experience agency when there is a balance between the material and formal constraints. When the actions motivated by the formal constraints (affordances) via dramatic probability in the plot are commensurate with the material constraints (affordances) made available from the levels of spectacle, pattern, language and thought, then players will experience agency. An imbalance results in a decrease in agency."* (Wardrip-Fruin, Mateas, Dow, & Sali, 2009).

The definition is specifically interesting in the context of viewing agency in ES experiences, because of ES' similarity to the adventure game genre. Here Mateas highlights an important view:

*"In the adventure genre, there are typically many more material affordances than formal affordances — so there are many things to do, but no clear sense of why one action would be preferable to another."* (Wardrip-Fruin, Mateas, Dow, & Sali, 2009)

I agree with this statement, however, even though the player is not presented with an idea of which type of action is most preferable or has a higher dramatic probability (formal constraints), does not mean it will result in decreased sense of agency. However, I will agree that the agency might be *perceived* as being low, since players cannot necessarily see an outcome or a meaning behind an action.

So in a game experience, there is clearly a number of facts that plays a role regarding agency, such as the *Intended* agency (formed by the designer), the *perceived* agency (interpreted by the player), the player's motivations for taking action and whether the agency regards interaction with the plot or general interaction with things in the environment. This can be confirmed in a study in which the illusion of agency is achieved, by making the same plot event as result of two different choices, where players believed that their choice affected the story, but actually did not (Wardrip-Fruin, Mateas, Dow, & Sali, 2009). That being said, it is the designer's job to make players aware of their agency in the game experience.

So how does one make players aware that their choice affects the story, given an open world, which they can traverse in which they are not presented with an array of choices regarding the plot like, for instance, in Heavy Rain (Quantic Dream, 2010)? One can create indications of several endings of the experience, or discrete signals through the design of the environment. This can be done by, for instance, making

seemingly inaccessible and hidden areas or create a world large enough to make the players feel that they might have missed something interesting.

The notion of agency in ES experiences refers to the player *freedom* rather than player *choice*[12]. This is because ES are emergent narrative experiences set in an open world and because we are not dealing with canonical selective interactivity in a branching structure. The type and amount of agency is dependent on how the story is written into the game and therefore we considered how agency suited each experience, throughout the development of the three Aporia games. In the latest Aporia (Still Lake Valley), we formed three types of agency that relates more to the player actions instead of the amount of agency:

- *Navigational Agency* (Defines the experience depending on the player freedom to traverse around the game environment. The amount of agency is then defined by the structure of the environment and the placement of the locations. Example: The Stanley Parable (Wreden & Pugh, 2011).)
- *Conversational Agency* (The freedom experienced when enabling the player to select pre-defined text sentences as responds to NPC characters or write their own text in an input field. This can also be cooperatively used between players, sharing story information. Example: Mass Effect (Bioware, 2007).)
- *Skill-based Agency* (The players' possibility to perform actions based on their skill level in the game, such as shooting enemies or solving puzzles. E.g. if you are not quick enough to perform a certain combination of action on the joystick in Heavy Rain, it can influence the story. Example (Grand Theft Auto IV (Rockstar Games, 2008).)

I believe that these types provides something new to the creation of agency in computer games, since they are more design-oriented because they can be converted into game elements and they relate to interactions performed by the player. Furthermore, the three agency types are applicable to all games and are not genre-specific. The use of *Navigational Agency* should be the most used agency type ES experiences, since navigation is the mean through which the player explorers the environment and thus receives the story. *Conversational Agency* should be used in the cooperative sense or through an entirely new method, since an array of written text choices are often used through character interaction, which is uncommon in ES experiences. The *Skill-Based Agency* is something that ought to be disregarded when designing for ES. Simply because the focus of ES does not lie in stimulating players' physical interaction skills but rather stimulating their cognitive "skills" regarding the story (These two skill types relates to the challenge-based and imaginative immersion types, discussed later in the report in).

### 4.2.6 Drama Management in emergent narratives

Even though I believe that ES is a step towards solving the paradoxical fact that users should have a dramatic experience and simultaneously be in full control of their choices (the narrative paradox), but there is still a chronological issue that the designer cannot control.

[12] As Tanenbaum & Tanenbaum emphasises in their research *"Agency as commitment to meaning: Communicative competence in games"* – That the advancement of computer games has given players expectations to behave more freely and emergent: *"Today, not only is it possible for unanticipated and emergent player actions to occur, in many games it is expected. These expectations have given rise to a shift in the notion of agency, away from choice and toward freedom.* (Tanenbaum & Tanenbaum, 2010)

How is it possible to provide an increasingly dramatic experience in an open world? How does one make sure that users experience one thing before another? The questions were partially answered in the previous section where the *Environmental Exploration* model is presented, by adding the specific limitations to the model, such that there is a beginning and an end[13]. The questions can also partially be answered by looking at how to design for emergent narratives.

The essential questions is then "Do we, as designers, *want* a high level of control in ES experiences?" In many cases, I would say no. I believe it is about designing the narrative elements such that there is minimum need for controlling the plot and cause-effect relationship.

That being said, discrete[14] drama management can be used in ES experience. If the designers want some control in the progression of the story and the level of drama, there are a number of things that can they can do. Below, I list techniques that can be used as a part of drama management most of them are already used, in existing game experiences:

- *Subdivide the world* (This was done in *Memoriam* where the world expanded, as the player progressed. In this way, the designer can limit the number of narrative elements discovered at a time. The downside to this method, is the fact that the player will not have full navigational agency/freedom)
- *Guide the user with cues* (We did this in *Aporia Darkmist Forest*, where discrete and subtle cues in audio/visual form, stimulated the player to get directional attention and guide the player around in a full open world. The disadvantage is that the designer should not rely that this works for all players.)
- *Delimit the world with natural boundaries* (An element drawn from Journey. The great desert in Journey consists of natural boundaries by making wind blow players back, if they get too much off track. In this way, the player does not feel limited the same way they would if they were blocked by the terrain itself, such as a cliff wall or an impenetrable forest. On the other hand, this is creating an illusion of accessible areas that are in fact not accessible, which might not always be the best solution)
- *Create events based on user position* (An idea could be to generate a set of events that could take place close to the user, such that the drama becomes independent of the user's freedom to navigate. However, this would require the events not to involve static objects placed in the world such as buildings or characteristic environmental locations.)

These are just a few out of many ways in which drama management can be carried out. The drama manager should always suit the narrative structure, since it manages the narrative nodes from the structure of the story. The designer should also consider what narrative model is the most fitting, whether it is Aristotle's triangle or The Hollywood Model. It seems prudent to present some different ways of using drama management in other storytelling experiences.

[13] But the chronological order of the presentation of the narrative material in the open world (middle) can be hard to control

[14] It is not the intention to make the users aware of the drama management, such that they feel too restricted by the designer. This might also ruin the agency and even break the user's immersion.

In the dramatic learning-based game, First Person Victim, you are set in a war-related situation in your hometown, where your choices influence the narrative path through the environment (Schoenau-Fog, Bruni, Khalil, & Faizi, 2010). However, the narrative structure is not a classical branching structure, but a creative approach to Laurel's flying wedge, where each scene is a possibility to begin with, and the narrowed down to a "necessary" ending (see Figure 5). This approach to drama management is relevant because, despite the fact that characters are a main element of the story, the model is also based on locations and scenes. The same could be done in ES experiences, by viewing all the nodes as narratively interesting locations in the environment. Consequently, the downside is that the final stage of the user path might feel too restricted and linear for the user.

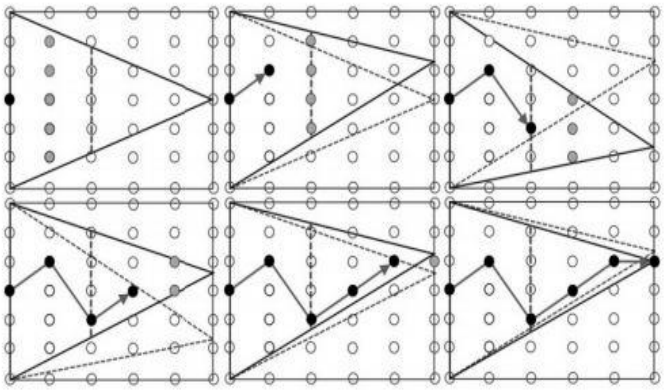

*Figure 5 - Laurel's flying wedge was cleverly converted into a drama manager, ensuring that the drama management suited the narrative structure perfectly.*

One model I am especially intrigued by is Louchart et al's attempt to model an "emergent landscape" as an analogy of how narrative emergence can be perceived (Louchart, Swartjes, Kriegel, & Aylett, 2008). The user can have various interpretation of the story, depending on what kind narrative elements are experienced and more importantly, how they are perceived. The advantage of the model is the fact that it can be applicable to almost any type of emergent narrative. However, the model remains on an abstract level, giving little to no affordances for the designer to incorporate into the experience.

I believe that the emergent landscape can be converted into a more design-oriented tool in ES experiences since it is the landscape, which contains the narrative elements. In this way, the designer can directly apply the location of the narrative nodes and their intended drama level, to the model that now, no longer, is a perceptual model[15] but a map of the world and how the narrative is embedded within it. The designer would then be able manage the drama by drawing the user's attention towards a narrative node, if nothing interesting has been experienced for some time.

[15] The model might still be both a design template for drama management and perceptual at the same time, but ensuring this would require a comprehensive narrative cognitive understanding of the experience. Another reason why it would be hard to compare these two aspects, is the fact that users might process and connect the narrative coherence in between the narrative nodes and in that way have a dramatic experience, in a place where no drama is actually intended.

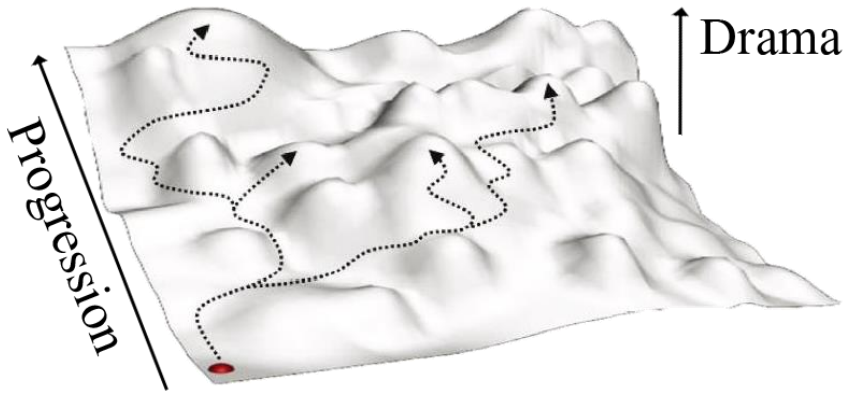


*Figure 6 - Louchart & Aylett's attempt to model the perceived story of an emergent narrative experience. The landscape varies each time, depending on the user's actions and choices*

The drawbacks of this way of managing the drama are the lack of controlling the user's path through the environment. Nevertheless, combining this model with a suitable narrative structure, for instance, the environmental exploration as previously presented, could result in many different and well-functioning design approaches to achieve the intended degree of drama management.

## 4.3 Introspection & Narrative Construction

To look at how a narrative is understood, it is essential to clarify how narrative differs from other forms of discourse. Narrative understanding is an extensive research field and this section will only present the tip of the iceberg to get a brief overview and idea of how narrative distinguish itself.

Jerome Bruner notes an interesting feature of narrative as being either "real" or "imaginary" without these two factors influencing the discourse of the story – *"In other words, the sequence of its sentences, rather than the truth or falsity of any of its sentences, is what determines its overall configuration or plot* (Bruner, 1990). Bruner also implies that a narrative must have a point, as we also see Ryan mention in her eighth degree of narrativity – the story must infer some level of meaning, else it is simply a "bad" story. Bruner's work on autobiographical interviews can inspire the creation of an introspective theme, making the story revolve around the player/main character. Often, when being interviewed with questions regarding oneself, one's past events, doings, and reflections are often conveyed in a narrative form (Bruner, 2001).

Thompson presented the classical film terms *Fabula* & *Syuzhet* in 1988 (Thompson, 1988, pp. 39-40). Even though there might be a plot with cause-effect relationship (*Syuzhet*) embedded in the environment, ES experiences put more effort into designing for *Fabula,* which is the user's mental construction of the chronological events. However, all the inclinations of *fabula* and *Syuzhet* have been incongruent during the years, which makes the terms hard to work with (Nitsche, 2008).

There can be several ways, in which, a narrative is understood depending on what media it is conveyed. However, we are not dealing with classical storytelling with clear text, dialogue, or characters like most functional works (In which, most theory of narrative understanding is based on). We are dealing with ES and introspective stories. We are utilising the fact, that the only character in the story is yourself (the user), which makes the story introspective (something that will be elaborated in the section describing enacted narratives and the section describing introspection).

Busselle & Bilandzic (2008) makes an interesting notion regarding the mental construction of narrative, as being mental models that is constructed in the user's mind based on the events in the story and the presuppositions and pre-existing knowledge of the user (cognitive representation of events) (Busselle & Bilandzic, 2008). Often, the narrative is unsuccessful in providing all the details that is necessary to perceive an entire story, the audience make use of pre-existing schemas based on the knowledge from previous story experiences to "fill out the gaps". More elaborately - *"Thus, a viewer or reader uses preexisting, generic schemas of, for example, people and events to construct specific mental models that represent a specific story."* (Busselle & Bilandzic, 2008). In ES experience, the story interpretations rely heavily on these mental models and schemas, since there is little-to-no text or dialogue to clarify the narrative. It is important to take into perspective when analysing test results regarding narrative understanding or the level of emergence.

### 4.3.1 Immersion

Many researchers have during the past decade tried to clarify and dissect the aspect of immersion in interactive digital experiences. Some researches regard immersion as the notion of "presence" (McMahan, 2003), but I am more into the idea of viewing immersion as being continuous, something that can include different levels of the "degree of involvement" with a game (Brown & Cairns, 2004).

Brown and Cairns divides this involvement degree into three levels, engagement, engrossment, and total immersion. The levels of immersion are controlled by barriers that need to be removed by either the player or the designer, for instances the level of concentration with the player and the designer removing of interruptive elements in the game.

Engagement is mainly achieved by player effort, investing time, attention and showing interest in the game.

Engrossment can only reached if the player is on the stage of engagement and becomes emotionally involved with the game. Engrossment is reached if the designer is able to make the experience detailed and well-constructed, and trigger emotions on such levels that the player will be affected.

Total immersion can be attained through high levels of attention, both visual, auditory and mental and are highly related to the sense of presence, i.e. "being there". As discussed earlier, we want the player to pay full attention to the narrative in the environment and due to this; it is highly recommendable to design for reaching the stage of engrossment or total immersion when designing for ES experiences.

Another conceivable and game-oriented study of immersion, by Ermi & Mäyrä (2005), presents three types of immersion as different experiences the player has with the game, relating to several existing components of game design (Ermi & Mäyrä, 2005):

- *Challenge-Based Immersion* (Related to csikszentmihalyi's flow theory (Csikszentmihalyi, 1990), which regards the concept of experiencing a satisfying balance between challenges and abilities.)

- *Imaginative Immersion* (Being absorbed in the characters, the fantasy, and the story of the experience.)
- *Sensory Immersion* (The sensation of presence, evoked through auditory and visual stimuli, intercepted by the human senses)

View appendix C for the full elaborative model of these three immersion aspects. The model is presented as being dynamic in which the player can achieve different modes of immersion depending on the activity in the game.

As suggested in previous sections, designing for challenge is not within the scope of ES. However, the environment provides both auditory and visual stimuli, suggesting that that the sensory immersion aspect is the most central aspect. When the player is in this mode, it might lead to imaginative immersion. As such, if there is no sensory immersion in ES installations, it is difficult to achieve imaginary immersion since the players attention will not be directed towards the environment (and thus not the story).

I believe that immersion is highly correlated with the suspension of disbelief, especially the sensory aspect, since it is important (In ES experiences) that the presentation of the diegetic game world have a certain degree of realism before this kind of immersion is reached[16].

In Figure 7, I give two examples of existing games. One, Amnesia: A Machine for Pigs is designed to evoke a high level of immersion and the other, World of Warcraft, cares more about the gameplay mechanics and social aspects.


*Figure 7 – 7A: World of Warcraft's (Blizzard, 2004) overwhelming and confusing interface, along with the use of a cartoonish look, lowering chance of sensory immersion. 7B: Amnesia: A Machine for Pigs (The Chinese Room, 2013) uses a much more realistic graphical style and has little-to-no HUD, increasing chance of sensory immersion.*

[16] This is not to say that fantasy elements should be discarded, but rather the visual style and look of the game should be more realistic. For instance, games such as World of Warcraft (Blizzard, 2004) and Borderlands 2 (2K Games, 2012) has a style of cartoonish graphic and caricatured elements that constantly reminds the player that the world is not real, making it more difficult to suspend disbelief.

From previous experiences and the abovementioned aspects, it seems prudent to form a number of design choices that can be used to increase the desired suspension of disbelief in ES experiences:

- *Limit the size of the HUD[17] (Or remove it completely)*
- *Choose a realistic graphical style*
- *Provide very few navigational boundaries to have a high level of freedom(To mirror reality[18])*
- *Have a well-balanced amount of fantasy-elements (if any), proportional to the amount of realistic elements - based on the previously mentioned balance*
- *Create a realistic soundscape and suitable music*
- *Avoid interruptions of user testing, during the experience and/or embed the test inside the game experience as non-intrusive methods or data mining.*
- *Choose to execute the experience on hardware that is qualified enough to make the experience run fluently on a high graphical level*
- *Avoid bugs as much as possible*

The presentation of the guidelines is not written in priority, since it is not a rigid set of guidelines, but suggestions of how to increase suspension of disbelief that can be selectively followed by designers of ES experiences. In addition, they do not include in the final set of guidelines and should instead be considered as general unwritten rules, to keep in mind when designing for ES.

#### 4.3.1.1 Emotions

As mentioned before, reaching the stage of "engrossment", the player needs some degree of emotional involvement with the game. Emotions are a wide psychological and cognitive academic aspect and because of this, the amount of designing to evoke emotions in ES experiences is somewhat limited and most of the studies of designing for emotions in computer games are character-based (Freeman, 2004), which contradicts the guideline of not have intelligent agents in ES experiences. This is somewhat obvious, since players easily empathise with the emotional state of the fictional characters (Freeman, 2004). Nevertheless it might be possible to portray the player (through pictorial storytelling), in a situation that is able to evoke emotional response from the players.

It is not the focus to evoke so-called primary emotions such as sadness or happiness, when dealing with ES, (even though some types of music may help evoking these emotions), but rather deal with a wider subset of emotions. Such emotions are defined in Klaus R. Scherer's "Geneva Emotion Wheel[19]" "enjoyment/pleasure" "irritation" or "involvement/interest) giving a broad array of emotional states by

[17] HUD stands for head-up display and can be described as the meta-game elements such as minimaps, healthbars, and the player's current score, which is constantly shown on the display while play.

[18] A good point on this, was done well by Adrian Chmielarz in Gamasutra, where he talks about game designers trying to mirror reality as much as possible, but contractively don't, because they use unrealistic navigational boundaries to control and guide the player. He suggests that we remove these boundaries because it is how the real world works: *"[…] it is weird that we model and texture our game objects so they perfectly mirror reality, but we're not creating worlds that do. We nailed the details, but the big picture is still not quite there. Of course, 1:1 copy is hard and possibly unnecessary, but the core elements could remain: the odd structural mix of chaos and harmony of the real world, its indifference towards the inhabitants, etc."* (Chmielarz, 2014)

[19] The Geneva Emotion Wheel was later modified into a more comprehensive version, by using two emotional labels at each subsection. This modified wheel was also used to measure the emotional experience in the first version of Aporia (Bevensee, Boisen, Olsen, Schoenau-Fog, & Bruni, 2012). See appendix D for the full modified model

subdividing different emotion families (Scherer, 2005). Previous studies of Aporia, using the emotion wheel for testing purposes, indicated that many of the participants chose “involvement”, “enjoyment” or “worry”. A discussion could be whether these terms are regarded as being a part of emotions or if they are more state of minds emerging from the activities in the experience. The Emotion Wheel proves very valuable when it comes to planning and testing of certain emotional types regarding ES experiences, since it gives a fresh input and a wider selection of emotional families.

## 4.4 Defining Environmental Storytelling

This chapter will go through a clarification on environmental storytelling, presenting and providing many examples from the thoughts and works of Henry Jenkins (2004) and Don Carson (2000).

### 4.4.1 Evoked Narratives

Evoked narrative refers to the contested space[20] in which the user progress in the game. Evoked narratives play a larger part in the immersion aspect when playing computer games. Often evocative spaces tell a story of where the user is and when, for example in Alice in Wonderland, she is “trapped” in a dreamscape in which easy-recognizable objects are placed. Using the user’s prior knowledge of different worlds or spaces, evoked narrative excels in conveying memorable contributions to the story. Also in the latest Aporia game, Still Lake Valley, we use the evocative space, a vast snow landscape in Siberia with a huge crater that is directly connected with one of the main story events (The Tunguska event from 1908). Jenkins gives some insight on how games a better at creating spaces than other media – *“In such a system, what games do best will almost certainly center around their ability to give concrete shape to our memories and imaginings of the storyworld, creating an immersive environment we can wander through and interact with.”* (Jenkins, 2004)

I believe evoked narratives needs a small amount of significant objects (manmade or not) as a facilitation to create stories. Nevertheless, testing whether nature elements such as landscape and terrain alone, would convey a story to the user, would be useful.

Based on my own experience with evoked narrative, the level of details is extremely important, not only to increase the aforementioned sensory immersion, but particularly to direct the user’s attention towards the environment. From this, one could hypothesise that users will become more immersed, spend more time, and show a higher interest in a detailed environment, than in a non-detail environment.

### 4.4.2 Embedded Narratives

To me, this is the most profound, useful and essential part of ES. Carson offers a well-formulated example of embedded narrative and how objects, can create cause and effect relationships:

*“These are staged areas that lead the game player to come to their own conclusions about a previous event or to suggest a potential danger just up ahead. Some examples of "cause and effect" elements include doors that have been broken open, traces of a recent explosion, a crashed vehicle, a piano dropped from a great height, charred remains of a fire... etc. These "cause and effect" bits of storytelling can help the game player better understand where they are and what they might expect to experience further on.”* (Carson, 2000).

[20] The virtual space in which the user traverse – or “the virtual world”.

The best relation to embedded narratives is "the detective story". This is one of the reasons why mystery almost always is a part of ES experience, since most of them is a detective story in each their own way, where users have to figure out what happened and where they are (like in Aporia) or solve an abstract narrative mystery (like Dear Esther). Here Jenkins adds *"Read in this light, a story is less a temporal structure than a body of information"* (Jenkins, 2004, p. 126). He also emphasizes the importance of placing embedded material with narrative information in more than one way, since designers cannot predict the user's reaction to it:

*"Within an open-ended and exploratory narrative structure like a game, essential narrative information must be presented redundantly across a range of spaces and artefacts because one cannot assume the player will necessarily locate or recognize the significance of any given element"* (Jenkins, 2004, p. 126)

One of the reasons why Aporia works well with its storytelling through the environment is its high relation to the adventure genre. The adventure genre does not need other characters to tell a story and often the users is solving a mystery since they have no idea where they are and what they need to gather. When designing the game in this manner, it is easier to convey a story, since the designer can use objects that related to past events, which the main character cannot remember. Ernest Adams also elaborates on this:

*"When you play an adventure game, you have no idea what is going on. You have amnesia. Even if start the game in your own home, you have to explore it. You don't know what's going to happen to you, so for safety's sake, you pick up everything you see […]"* (Adams, 1999).

As Adams mentions, there are often no meaningful relations between the, objects you carry how you use them or what you should use them for. This is where ES is different. You might need to pick up a few objects, but the focus is to solve the story, unlike in Myst (Cyan, 1993), where there is much focus on puzzle-solving involving coincidental objects.

### 4.4.3 Emergent Narratives

So far, Jenkins terms have been quite straightforward and they have presented and emphasized components of computer games. However, I believe that his interpretation of emergent narrative is a bit unclear or maybe deliberately narrow, since the term has been existing for a long time in the field outside interactive storytelling. He uses *The Sims* as example, which is *designed* for emergent narrative but emergent narrative is not a *component* of a game. As such, Jenkins view of emergent narratives in ES experiences seems as a design suggestion/example of how it has been done in relation to the environment, rather than a discussion of how to design for it.

For environmental storytelling, I give a new definition on what emergent narrative is:

> *"A mental process of putting objects, world, events, characters, text, dialogue etc., into a meaningful cause-effect relation that can be put in the context of any given story imagined by the user".*

Specifically for ES, one can remove the *Characters* and *dialogue* from the definition if desired, such that we are left behind with *objects, world,* and *events*.

One of the major discoveries we did with the first version of Aporia, was the fact that we combined the design of evoked and embedded narratives, but it revealed that these two aspects leads to emergent stories. This was a newfound and somewhat surprising result, since Jenkins does not infer any such thing in his works, that two of his terms combined, actually results in one of his other term (see Figure 8). Another discussion would be to distinguish between multi-interpretation of abstract objects and emergent narratives. Additionally, how these two things correlate with each other. This is however, deemed beyond the scope of this work.

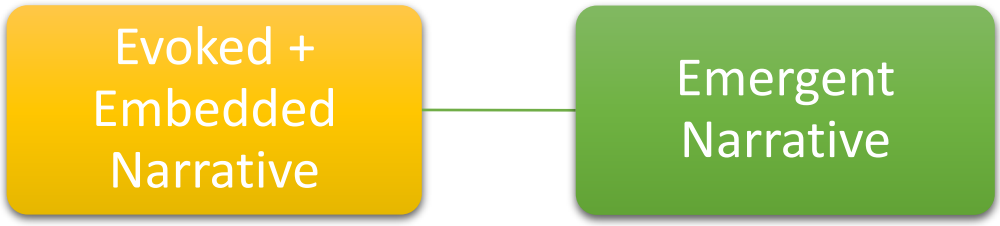


*Figure 8 - We discovered that once the designer chooses to incorporate evoked and embedded narrative in the environment, it will lead to emergent storytelling, since there will be multiple interpretations often resulting in completely different stories*

This might indicate, that designing for emergence in ES experiences, needs a new framework set, or at least some new guidelines. In earlier projects, we suggested how to design for emergence in interactive storytelling, by creating a new set of design-oriented guidelines, where some was derived from Louchart and Aylett (Louchart, Swartjes, Kriegel, & Aylett, 2008). However, one should note that this research is character-based emergence and not environmental-based emergence. Therefore, it slightly decreases the validity of the derived guidelines, but to me, they appear quite solid. The list of derived guidelines turns out as follows:

*Envision the story landscape* – Get an established overview of how your story will develop as the user progresses, without being too specific on a concrete storyline. This process could be creating a narrative structure, or trying to map the possibility space of the user, regarding both the structure of the story and the structure of the diegetic world.

*Be more than one author* – Being more than one person, writing the story, ensures diversity and aids the fact that the author do not get stuck or get to eager during the process in conveying one specific plot through the story, since the goal is not to make one single linear plotline, but multiple plots that can or cannot interconnect. Aylett & Louchart elaborates – "*Once the author tries imagining the outcome of the Narrative as the sole inspiration for modelling, there is a risk of "thinking in terms of plot" and the temptation to take a top-down view on things. The result is that the author starts following a narrow story path and creates just those elements that will produce this path, which has a negative effect on the density of the story landscape."* (Louchart, Swartjes, Kriegel, & Aylett, 2008).

*Boundaries* – there should be a clear contextual congruence in the story world, that helps define the atmosphere and style. This also includes the locations with story elements as well as how to limit the interaction with the world.

*Critical Mass* – Critical mass is the authored content (objects) in the world. Here, quality should be weighted over quantity, because well-authored content can expand the story world and the choices within it.

*Dead Ends* – Points in the experience where there is no emergence in the narrative or choices to follow. In ES experiences, this could be a large area where no story material is presented, which should be avoided.

A critique could be that these guidelines are very rigid and does not seem to offer a middle way. I would say that they should vary depending on the type of experience being made. A question from the designer could be whether they should design for emergence or not. The answer is that ES experiences would most likely be emergent narratives no matter what. This is because the use of embedded and evoked narrative will result in this, as presented in the model above. However, the designer can follow the above-mentioned guidelines to increase the level of enjoyment and consistence in emergent experiences.

### 4.4.4 Enacted Narratives

The virtual world in gaming environments is not functional without actors to explorer, interact, and modify the world, that (in this case) being the player. Often, it is the characters that drive the story, but ES work around this, by making the experience more puzzle oriented and use the main character, i.e. the player, as a protagonist of the story. Bates (1997) explains that - "*If the backbone of good fiction is character, the backbone of good interactive fiction is puzzles that involve those characters."* (Bates, 1997). I will look more intro introspection later in the report.

Jenkins' own thoughts of enacted narratives appear slightly uncertain, since he does not define it as a design element, but as interaction between the world and the user. He infers that enacted narratives can be interaction between the user and the embedded mise-en-scene of the world. It can also be the interaction between the user and NPC's or antagonists – *"We may have to battle our way past antagonists, navigate through mazes, or figure out how to pick locks in order to move through the narratively impregnated mise-en-scene. Such a mixture of enacted and embedded narrative elements can allow for a balance between the flexibility of interactivity and the coherence of a pre-authored narrative."* (Jenkins, 2004).

In addition to the narrative that is built on characters, I also observe enacted narrative as events in the game that does not use characters other than the user. The events that occur when the user's actions coincide with the embedded elements of the world, for instance, using an object or just the simplicity of navigating around in the world. Whether these enacted actions relates to the story or contributes to the interpretation of the story is another matter. To make the user's action relate to the narrative, the designer has to consider if the action itself has a cause-effect relationship (A subject I will go in depth with in a later section) with a meaningful outcome[21] on the course of the story. For instance, getting access to a cave by using a key to a door, can give access to narrative material within that cave or a light source that you carry can reveal cave paintings.

[21] In this context, meaningful outcome refers to Salen & Zimmerman's (2004) term "meaningful play" that regards the notion of the outcome having a meaningful relation to the action performed by the user. (Salen & Zimmerman, 2004)

# 5 Delimitation & Final Problem Statement

I have now provided analytical tools, and basic guidelines that form general dos and don'ts when designing ES experiences. The state of the art has covered the origin and definitions of ES have furthermore provided a solid ground for what the concept in general. I can now go into the practical part of the framework that gives actual design guidelines for implementation in the main analysis.

It is not known whether the guidelines will actually provide the intentional contributions to the narrative experience, seen from the user's perspective. As such, I would need to dissect the design guidelines into different levels, adding more and more profound elements, to investigate if the narrative engagement[22] increases along with the number of supplemented design features.

This will be done by dividing the guidelines in several levels of "environmentalness" based Ryan's aforementioned narrative scale, assuming an increased narrative engagement across each level. The exact methodology will be presented in the section with the established framework and guidelines after the main analysis.

*"To what extend is it possible to increase the user's narrative engagement across distinct experiences with different levels of narrativity, designed by using the established framework of environmental storytelling, as a set of design guidelines?"*

The final problem statement will be confirmed by creating two installations, testing the two first levels of the narrative scale. Hypotheses for each of these two tests will be established in the section describing the methodological approach. The hypotheses will ultimately confirm or reject the final problem statement.

Before it is possible to create the two experiences, a review and discussion of how to design for ES experiences needs to investigated to ultimately lead to the framework the design guidelines. I also presented some guidelines in the preliminary analysis, but they will not include in the final set of guidelines, since all of them is general unwritten rules that will be considered in all levels of the narrative scale.

[22] The term "narrative engagement" will be presented and further elaborated in the methodology section

# 6 Analysis

In the preliminary analysis, I looked into cognitive aspects, such as definitions, structure, and understanding of narrative, immersion, agency, and emotions. In this main analysis, I will deal with aspects and discussions of game design and theory of environmental storytelling. More elaborately, I explain how and what ES elements to use, on basis of Jenkins' four items. I will additionally, point out seven points of user enjoyment in ES experiences describe how to design for each, separately.

## 6.1 Using Environmental Storytelling in a Computer Game experience

It is essential to mention that this project mostly views ES as a computer game concept, but ES can also simply be a narrative experience in a virtual world, with no interaction, rules, or goals. Designers can indeed choose to write a specific story for an ES experience, but they should never hope to achieve a high level of intelligibility with the audience. This is because using the environment as a narrative embodiment, in itself, results in many different interpretations and many different versions of the story. However, this is not necessarily believed to be a negative feature. Writing a specific story can lead to a clearer story interpretation[23]if the means of conveying it, is done with more than evoked and embedded elements.

Most of the project will deal with how to design for environmental storytelling, so let us first have a look at in which way the environment can convey a story or a story theme. Most of the subsequent sections will base their knowledge on examples from Aporia, Memoriam, Dear Esther, and a range of other games. The design guidelines will primarily refer to Jenkins' and Carson's ideas and notations of the subject. Using Aporia and Memoriam as a scientific source throughout the project may seem to decrease the validity since two of the four games do not have an official paper publication; however, it will mainly be used to give design examples and/or use statements that can be backed up from the test result of the given experience.

### 6.1.1 Objects & Scenery

This is also known as *The Memory Palace,* which is based on Jenkin's notation of *Embedded Narratives* that he refers to as the staging of objects and sceneries – which one also could signify as the *Mise-En-Scene* of the game (I will go a bit more in depth with mise-en-scene later in the report). Imagine a room in a small cabin in the forest. The room has a bag full of money, a gun, rope, and stains of blood next to it. This scene could give indications of several past events, such as bank robbery, kidnapping or laundering. In ES experiences, the memory palace should be filled with objects that have a number of such *INUS conditions,* which are not necessarily answered by the designer (Belnap, 2005). As such, the cause-effect relationship is emerging in the user's mind, allowing the story to become emergent instead of the objects having a fixed chronological relation.

### 6.1.2 Analogies & metaphors

This is often conveyed using cave-paintings, photographs, drawings, or symbols. Often, they are a representation of something else or hold a deeper and more profound meaning. For example, Journey makes use of metaphors and analogies as well, by portraying the main character as paintings on the wall together with different symbols, telling a story about the civilisation and rituals of the people (Figure 9B). In

[23] We experienced this fact, when testing on the first Aporia (Uncover the Mystery) and the second Aporia (Darkmist Forest). The first Aporia had an intended story and the second had a story theme – the results indicated that even though, players had difficulties in getting the "true" story in the first Aporia their interpretation of the story was still clearer than their interpretation of the theme in the second Aporia.

addition, *The Eye of Providence* was used in Darkmist Forest (Figure 9A) together with a drawn image of the main character (the player) and his/hers unknown personality or counter-ego.

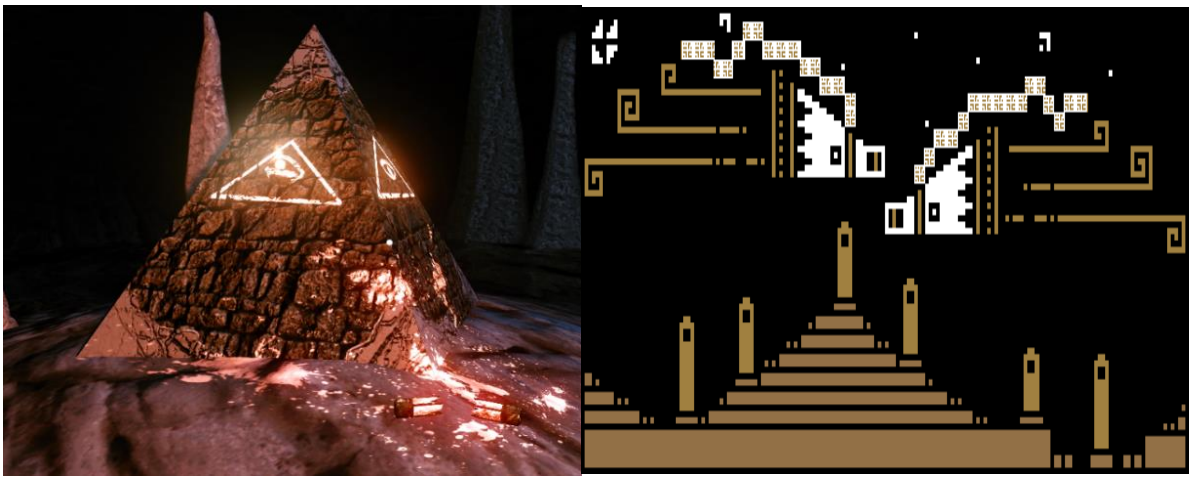

*Figure 9 – 7A: In Aporia: Darkmist Forest, we included "The Eye of Providence" to symbolise enlightenment towards one's own personality, as a part of the introspective theme of the game. 9B: Journey's remarkable and characteristic way of telling a story, by creating a common visual language through glyphs on walls.*

Not surprisingly, analogies and metaphors are more abstract and are often more efficient in conveying a story *theme* rather than a structured story.

### 6.1.3 Terrain & Landscape

The terrain and landscape is often seen as a container of which stories and events can take place and it relates to Jenkins notion of *evoked narratives*. The potential of the landscape should not be underestimated. For instance, in Aporia Darkmist Forest, we introduced a glade representing a hideout for

*Figure 10 – 10A: The Scottish landscape, rendered in Cryengine 3. 10B: The glade from Darkmist Forest, which may or may not tell a story on its own. However, adding a simple object or two, such as gnawed off bones or wolves pelt, we get indications about a hideout for wolves.*

Wolves (see Figure 10B) solely using properties of nature, such as a rocks, vegetation, and terrain height. It is not certain that the area alone will hold story potential, but it can be used in connection with the staging of objects and scenery to combine narrative values from each element. The landscape may also tell about the whereabouts of the game. It can give indications of which period the game takes place in and

sometimes it can inform the user of the geographical location. As an example, Martin Teichmann (Ex-member of Crytek – the team behind the Cryengine) made a Scottish landscape as a part of Polycount challenge over 3 months. The landscape provides indications that we are in Scotland (or a similar country) and the embedded objects within it, questions the user what could have happened in the scene (see Figure 10B).

### 6.1.4 Textual Elements

I will make no secret of the fact that we, with Aporia, somewhat broke the unwritten rules of ES of not using written text. Written text can indeed be used in ES experiences, but should be used in small dozes and with caution, since we do not want the main story to be conveyed through text, but through the other above-mentioned ES elements. Rather, they should be support the main story and remain on a somewhat abstract or metaphorical level, such that they yield multiple interpretations.

In Darkmist Forest, we introduced a diary system; in which pre-written sentences was introduced to implicitly convey story information. The player then had to finish the sentences, to be productive and give a sense of their interpretation of the narrative[24]. One could say that the diary is not a part of the environment, so in Still Lake Valley, we wanted the textual content more embedded into the environment – which gave us the idea of having notes scattered around the level, left behind by past characters. The diary and notes are only examples of a couple of solution - designers can come up with other creative approaches, such as doing a visual language of their own creation.

### 6.1.5 Video Game Mise en Scène

Other researchers than Jenkins & Carson, has indeed looked into the concept of using the environment to create stories. Girina argues that there are two main common tendencies between cinema and games, which he describes as *scripted staging* and *expressive lighting* as tools to analyse video game aesthetics (Girina, 2013). He argues that the difference between cinema and games roots in the classic narratology vs. ludology discussion, a widely discussed and cited phenomenon in the field of interactive storytelling.

Whereas Jenkins defines the environment as the center of the story, Girina describes game design and architecture to exist in parallel, and thus separating narrative and video games as two different elements. He states that Jenkins only lists two typologies of environmental storytelling (embedded and emergent), which is not true, since Jenkins also introduce evoked and enacted storytelling. Girina's interpretation of these two elements, furthermore, appears narrow and unclear: *"while in the first case the narrative elements are inscribed within the environment to be spatially or temporally triggered by the player, in the second case the narrative is generated on the fly by the interaction of the player with the procedural system"* (Girina, 2013). I would agree to the extent that, the embedded narrative elements are inscribed in the environment, but they do not necessarily need any interactive input from the player to function as well-produced emergent narrative elements in the environment. On this part, it seems that Girina fails to involve relevant research on emergent narratives and ES.

Girina's *scripted staging* is a virtual staging that allows for the compromise of between player freedom and the control guaranteed to the narrative instance. My problem with this definition is the "scripted" part, which is definitely, what, is done in movies and seen in many games, but something, which I believe, will

[24] I also introduced the diary in Memoriam, as a productive element that was forwarded to the next player as story material

not fit in the design for environmental storytelling. It simply forces the player to observe the environment in a specific controlled chronological order and robs the player from any form of navigational freedom, other than running forward. Another wry statement worth pointing out is *"The ultimate goal of staging is to believably convey the illusion of free will while channelling the player's activity on a predetermined route."* (Girina, 2013) This may count for scripted staging, but should not count for staging of objects in general, especially not when designing for environmental storytelling.

"Expressive lighting" is a more reasonable denotation to use as a common factor between cinema and video games and something that could prove interesting to use in this report. It is about using light as a tool of expression, indicating the player's physical or mental state, e.g. health or emotional states. It can also contribute in the narrative theme, which is the case in Alan Wake (Remedy Entertainment, 2010), where the light is a major part of the story theme and the mental state of the main character (see Figure 11).

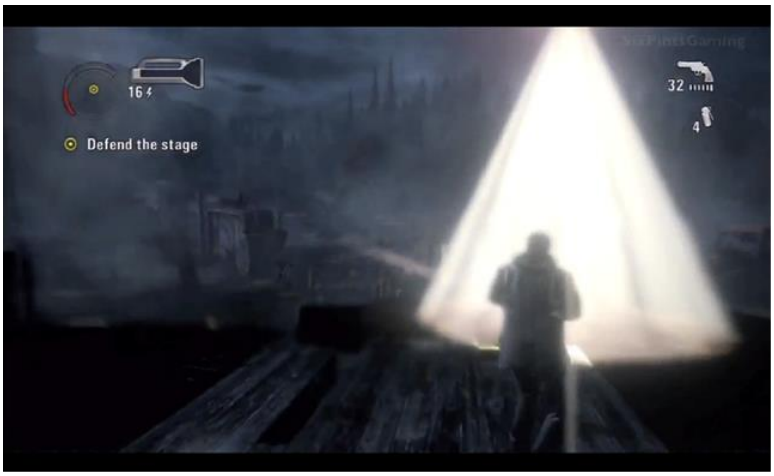


*Figure 11 - A screenshot from Alan Wake, (Remedy Entertainment, 2010) where lighting is used both as guiding the player, but also to receive health and hold back enemies*

## 6.2 Satisfying User Enjoyment

An important aspect of game design that I have not covered yet, is designing for the enjoyment of the user. A game should be entertaining in one way or another, so it is significant to look into what and how designers can satisfy the user needs when it comes to enjoyment and "having fun" while playing. Don Carson give a qualified notion on this in his work on ES: *"Needless to say, there is a fine line between fulfilling the desires of creating a beautiful game, and creating a game that people will want to play. No matter how stunning your environments might be, if it's no fun, no one will buy it."* (Carson, 2000).

### 6.2.1 Mechanics, Dynamics & Aesthetics

In the article *"MDA: A Formal Approach to Game design and game Research"*, Hunicke et. al. establishes a formal framework to outline the process of game design and game research on a more abstract meta-level, which is specifically useful for iterative game design (Hunicke, LeBlanc, & Zubek, 2004). Here they take three classic game features, *Rules System* and *Fun* and establish a set of design-oriented counterparts:

- *Mechanics* (Data representation and algorithms, defining the rules)
- *Dynamics* (the behaviour of the mechanics, defining how the system works)
- *Aesthetics* (the sensory and emotional features evoked in the player, defining the level of enjoyment)

They emphasize that the player and the designer sees these particular aspects from two opposed angles, where the design often starts out with the mechanics, dynamics and aesthetics, the player will probably

experience the aesthetics and then the dynamics behind them and eventually maybe the mechanics (see Figure 12).

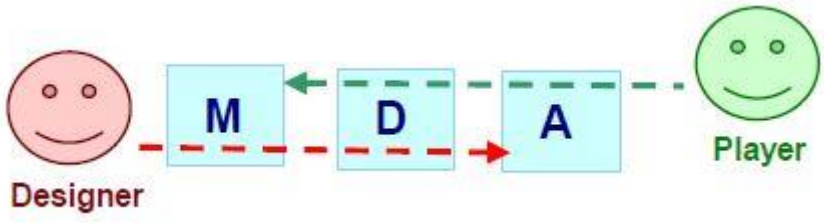


*Figure 12 - The process of MDA, the designers often starts out with mechanics and work their way towards giving the player a certain experience, whereas the player sees the process the opposite way*

The most interesting part of the article is the attempt to dissect *aesthetics* into different components in which the player can be stimulated or experience "fun". Here they propose the following taxonomy of eight aesthetic components, for identifying different types of affects:

- *Sensation (Game as sense-pleasure)*
- *Fantasy (Game as make-believe)*
- *Narrative (Game as drama)*
- *Challenge (Game as obstacle course)*
- *Fellowship (Game as social framework)*
- *Discovery (Game as uncharted territory)*
- *Expression (Game as self-discovery)*
- *Submission (Game as pastime)*

In this use, the term "aesthetic" does not seem to fit as a parallel to "fun" in my opinion. Nevertheless, the dissection itself and each category appears trustworthy and interesting to include as a part of the ES framework, but will not be categorised as "aesthetics" but as "enjoyment".

A critique could be the fact that most of the aesthetic components are something that the game can *contain*, but I find the last three components a bit indefinite. D*iscovery* and *submission* appears more as player *conditions* rather than components of a game and are therefore not fully designer-controlled. *Expression* appears either as a player *condition* or as a *style* of the game. It is of course still possible to design a game for these three components, but not on the same level as the other five.

It is prudent to mention that each of the subsequent descriptions I provide, only works with how each component is relevant in the context of ES. If we were dealing with a strategy game or a sport game, each of the components would probably work entirely different. This way, we can already now leave out a component that is irrelevant to include in the design process of ES, namely *Submission*. Submission is simply considered for smaller and less academic and profound game experiences such as mini-games on the mobile platform.

### 6.2.2 Seven components of enjoyment

In the forthcoming section, I go into depth with each component, of which for each, I elaborate on the notion of the term, discuss how to design for each component within the scope of ES and finally which player type each component might appeal to the most.

#### 6.2.2.1 Sensation

This is an important aspect of ES, since the environment needs to be designed to stimulate senses and emotions, because most of the story lies in environment itself. As such, sensory stimulus should be provided by the surroundings to give the player increased attention towards the environment. As mentioned in the Aporia chapter, we earlier investigated how stimuli for different sensory modalities (audio/visual) worked in getting the player's attention towards interesting locations. Once the player enters a detailed nature environment, with no enemies or concrete goals to distract him, the level of immersion increases and therefore it is expected that the senses become sharpened. Sensory stimuli cannot only be used to guide the player but also plays an important part in providing an increased level of sensory immersion.

#### 6.2.2.2 Fantasy

The term can be considered very differently and are often connected with the Dungeons & Dragons universe or similar worlds that include heroes, magic, and monsters. Yet, let us have a look on the Oxford definition: *"the faculty or activity of imagining impossible or improbable things"*, which is much more broad term and does not specify anything about *what* the product is, of any given imagined thing. Looking at this broad definition of the term fantasy, it is indeed relevant in ES to design for the user's fantasy, since some of the story is perceptually generated in the player's imagination.

I see the fantasy aspect from two different angles. One is the fantasy that is perceptually generated in the user's mind. The other is concrete designer controlled elements inside the game, such as unrealistic objects or events that gives rein to the perceptual aspect, i.e. the fantasy arising from the imagination, which leads me to believe that fantasy is strongly connected with the aforementioned Mäyrä & Ermi's concept of "imaginative immersion". I should also mark that the perceptual fantasy could surely be caused be purely realistic and credible objects provided by the designer. Maybe even in some occasions, fantasy objects can be perceived quite realistically or clear, depending on how the user sees them.

The user-perceived amount of fantasy is very subjective and hard for the designer to control. However, one can see the designer's control of providing realistic or unrealistic objects as an analogy for cooking a strong stew. The more chili you put in the stew, the stronger it gets, but if you make it too strong, it will be hard to digest or even inedible. The same goes for fantasy elements in ES. If you provide too much fantasy, the user can become confused regarding the story, or will not even get a story. This is simply because it is hard for unrealistic objects to hold valuable story information[25]. I would not estimate a limit of the amount of fantasy objects in ES, but in order to maintain a reasonable narrative understanding, one should not overload the world with fantasy elements.

In order to evoke the fantasy aspect in ES experiences, the designer should incorporate one or more elements that is not realistic, or elements that the user has not seen before. If the designer want to keep the story theme clear or attain some degree of narrative closure (Bruni & Baceviciute, 2013), it is limited

[25] The section about introspection and narrative construction, also touches upon this, mentioning MOPs. Having never seen an object before lowers its narrative potentiality because there is will be no MOP containing that specific object.

how many fantasy elements the experience should contain. If the world is filled with elements that are not recognizable for the user MOPs (Worth, 2004), the narrative can become more abstract, and a great deal of questions (that can be hard for the designer to answer through the environment can arise in the user's mind, resulting in no closure whatsoever (Caroll, 2000). On the other hand, if the designer wishes to incorporate a mystical theme, having few but strong fantasy elements, is very powerful in evoking strong questions that may or may not be answered later in the experience. For example, in the first version of Aporia, we used "Orbs" as a mystical or magical fantasy element, in which the player could gather and use for different supernatural purposes, such as changing the time of the day or making rocks float. We were, however, a bit careful with how many other fantasy elements we implemented, such that we maintained some clearness to the story. Designing for fantasy can appeal to every player type, since fantasy can be embedded in multiple ways through visual game elements and player actions, but it will probably not appeal to every type of person.

*Figure 13 - The Green Orb. A fantasy element from the first Aporia game. This was used to change the time of day*

#### 6.2.2.3 Narrative

Evidently, this is the most important component in ES experiences, which is also reflected in major parts of the preliminary analysis of the report, through the embedded, evoked, emergent, and enacted narrative theory of ES. The primary purpose of designing for ES should always be to provide the user with a specific story or a story theme, embedded in the environment. To use the term "Narrative" or "Game as Drama" is indeed valid, but simply too wide to define as an aesthetic component of user enjoyment. Furthermore, it is my belief that narrative can conflate with or be the cause of many of the other components, for instance, *Sensation* or *fantasy* can be induced through the narrative experience, because a dramatic experience can stimulate senses and the story theme can contain fantasy elements. Games designed with the narrative in focus, is most appealing to Boeckman *Narrativist* player type, playing for pursuing the storyline. (Boeckman, 2003).

#### 6.2.2.4 Challenge

The term "challenge" is a broad term in the context of computer games. When thinking about challenge, the first thing that strikes me is Csikszentmihalyi's flow theory, which he came up with in the early 90ies (Csikszentmihalyi, 1990). By increasing, the challenge over time (as players progresses and assumable increases their skills) designers can achieve a situation where the players are in the so-called "flow channel", where the difficulty of the game matches the player's skills perfectly. If the game is too easy, players will become bored. If the game is too difficult, players will become angry or worried. Designing for flow is easiest if the designer can somewhat control the chronology of events during the game. However, this is often not the case in open world environments, since players can roam freely around and experience things in a different order each time. Therefore, sometimes it can be useful to either guide the player or slightly limit the world by breaking it up in different areas, which will give a better chance of designing for flow in ES experiences.

Generally, for all games, I would state that the challenge depends on the type of interaction and engagement in any given moment during gameplay, since it is possible for the user to experience challenge

in various ways. When viewing the different types of engagement provided by Bjørner & Schønau-Fog (intellectual, physical, sensory, social, narrative, and emotional engagement) as causes for the desire to continue, it is my opinion that different types of challenge can be set in context with some of these engagement types (Schønau-Fog & Bjørner, 2012). For instance, the user can be physically challenged by mastering the controls, narratively challenged by understanding the story or intellectually challenged through puzzles or general strategy.

Raph Koster notes the challenges in games as "patterns" and once the player has mastered a pattern, the game simply becomes boring (Koster, 2004). This is a good point and might be valid for extremely many games, but not necessarily for ES experiences. For instance, Dear Esther (TheChineseRoom, 2012) does not have any challenges other than understanding the story, which is exactly the type of challenge that ES experiences evokes. In other words, the challenge in ES is not to *receive* the story in the game, however, the main challenge of ES lies in the *sense making* of the story. To increase the diversity of challenges and add more elements related to gameplay, the designer can choose to incorporate other types of challenges, than the ones regarding the construction of the narrative. Let us discuss three types of challenges used in ES:

- *Physical challenges* (The type of challenge seen in the majority of all computer games. In ES experiences, it should be on a micro-level and not take the focus away from the narrative goal in the experience. What I mean by micro level is, the fact that the entire experience should not focus on being physically challenging for the player, such as precision of controls, timing, aiming etc. Instead, the physical challenges (if any) should be small obstacles during the game, like jumping puzzles, balancing on a fallen log or finding your way through the world, while uncovering the story. Making these small obstacles increasingly more difficult to achieve flow, can also be done, but is not necessary to achieve an enjoyable experience[26])
- *Intellectual Challenges* (Designing for intellectual challenges in ES, often involves designing puzzles or riddles that the user has to solve, which makes this type of challenge very user-dependent. Intellectual challenge can also coincide with the sense making of the story, for example by deciphering symbols, drawings, or paintings that holds story material.)
- *Narrative Challenges* (Since this type of challenge relates to heavy cognitive theory of narrative understanding, I choose to stay on a shallow level to remain clear about this type of challenge. The challenges simply lie in understanding the story or story theme intended by the designer. This process is about putting the pieces of the story or puzzle together, based on narrative elements uncovered during the game. As such, the designer can provide more and more clear or strong narrative elements to achieve "flow" in the story.

Designing for challenge can appeal to many different player types, depending on the type of challenge, for instance narrative challenges appeal to the narrativist and physical challenges might appeal to Bartle's killer or achiever (Bartle, 1996).

[26] We saw this in the results from Aporia: Darkmist Forest, where only a few physical challenges were incorporated. This also apply for Dear Esther, which is considered a successful game, despite complete lack of physical interactive challenges.

#### 6.2.2.5 Fellowship

Fellowship can be used in rare occasions in ES, but it is not considered, as a standard component of ES, since is an introspective experience, which focus is to let the player explorer the environment revealing a story about themselves. Designing for fellowship together third version of Aporia (Still Lake Valley), where two players collaborated in telling each other stories from the environment. As such, the focus of that experience was less introspective with more focus on previous and historical events, collaboratively uncovered by the two players.

When designing for fellowship in ES experiences, it should be tightly connected with the narrative in order for it to work properly, since sometimes, the two players can lose focus and begin to perform unintended actions or start chitchatting. The fellowship element will probably attain the highest level of enjoyment from Bartle's socialiser player type.

#### 6.2.2.6 Discovery

Exploration is probably the element that ES facilitates the most by having narrative locations and objects that are scattered across the world, giving the satisfactory sensation of discovering hidden or secret narrative elements. In many modern AAA game titles, players are often presented with everything useful or interesting closely around them. Designing for discovery in ES experiences, is about making a landscape and terrain that is large enough, such that the players are *not* presented with everything in front of them, but they have to put some navigational effort in finding the places.

An important fact here is also that the environment is *interesting* enough to make the player *want* to explore it. Making an environment interesting can be done in several ways, for instance by adding many details to it. One should place the wanted locations in more discrete corners of the environment making them less easy to come across by taking the "obvious" path. One can also choose to let players see a remote location from far away, to invite them to explorer and deviate from the main path[27]. As an example of this, Dear Esther uses a huge radio tower blinking in the distance that can be seen from the beginning of the game. This does not only guide players, but also invites them to explorer (see Figure 14). A shipwreck lies in the edge of the island, quiet visible for players

*Figure 14 - A screenshot from Dear Esther, in the first part of the experience. The blinking radio tower in the distance let's the player know where to go from the beginning.*

[27]"Main Path" in this context, is not necessarily a specific designed path in the game, but rather an analogy of the most logical road through the environment.

going on the main road. This is a method to drag the player out of the current course and let them explorer different corners of the world.

It might not only be locations that are enjoyable to discover, it could also be the game mechanics or finding exploits in the game, even though it is off the scope of the designers intentions. For instance, the player could be tempted to answer the questions: *"Can I jump onto this roof, even though I'm not supposed to?"* or *"Will I drown if I stay under water long enough".* These actions and the entire navigational exploration aspect, is what Bartle's *explorer* player type enjoys to do.

#### 6.2.2.7 Expression

An important part of ES is also fact that players have to learn something about himself or herself, whether it is on a pure practical (direct) or a pure philosophical (metaphorical) level. It is desired to let players explorer themselves or alter versions of their personality, since no other characters are involved. If executed well, this has a strong narrative effect.

A challenge when designing narrative elements that conveys a story directed to the player, is the process of making players understand that it often is about *them* and no other persons. On the other hand, this confusion also supports emergent storytelling, since different players believe other fictional characters are involved. It gives the chance of making the experience more diverse and interpretation-dependent. What usually is done when designing for expression is to one way or another convinces players the world might be fictional or metaphorical.

## 6.3 Requirements & Guidelines

From the all the previous investigations, I am able to make a set of requirements and guidelines that are/can be particularly relevant when designing ES experiences. These guidelines can be followed selectively, depending on what type of experience the design wishes to create. Instead of listing requirements from each chapter, the requirements are embedded into five categories, each presenting a practical aspect. The division of categories serves solely to give the reader an overview. They are inspired by Espen Aarseth's dissection of narrative design in games, which he presented in his article "A Narrative Theory of Games" (Aarseth, 2012) as being *World, Objects, Agents & Events*. In the case of this project all these categories serves facilitation of the story, despite this I will add a fifth category, *Authoring*, where the authoring requirements relevant for the designer can be assigned.

***World***

- *Make a characteristic terrain and landscape that facilitates your embedded elements and backs up your story.*
- *Show attention to details regarding particularities of the terrain, landscape and vegetation*
- *Create sensory cues to aid the user navigation or gain attention towards specific objects or locations*
- *Create a detailed soundscape and suitable music for the experience*
- *Make open or semi-open worlds to facilitate discovery and exploration*
- *Make hidden areas and secret passageways*
- *Place interesting locations and objects in different corners of the world, away from the "obvious" path*

***Agents***

- *If characters should be a part of the story, include non-present characters or have the story center around the main character, making the narrative introspective.*
- *The designer can choose to include characters that represents the main character or different personalities of the main character*
- *Fellowship is not a normal component of ES experiences, but can be included with the intention on making it a feature regarding the narrative, i.e. make the narrative the focal point of cooperating with other players.*

***Objects***

- *Create objects that can suggest cause-effect relationship or INUS conditions of other objects or events.*
- *To achieve higher attention level from the user, make contrast between the embedded objects and the background environment.*
- *Make meaningful relation between the objects that can be picked up and how they are used*
- *Embedded elements can be both passive, selective and productive*
- *Embed symbols, drawings, photographs or rebuses, to convey the story on a metaphorical level*
- *Find a balance of adding unrealistic objects – too many might destroy the needed presuppositions of relating to the narrative material, making the story weaker*
- *Make sure that the fantasy elements you embed, has strong relations to the interaction or story theme*

***Interaction & Events***

- *Make events that center around the story in the experience (Or create harmful events, if the designer wishes to endanger the user with challenge-based gameplay elements)*
- *Provide challenges on a somewhat low level, such that they do not take the desired attention away from the narrative*

**Authoring**

- *Envision the story landscape*
- *Be more than one author*
- *Make contextual congruence in the story world, that helps define the atmosphere and style of the experience*
- *Weight quality over quantity regarding narrative content*
- *Avoid large areas where no narrative material is embedded*
- *If the designer chooses to incorporate textual elements in the game, these should remain on a limited and abstract level to "discretely convey story information" (clear/didascalic textual elements, might ruin story emergence or the mystic atmosphere).*
- *Textual elements can be passive and productive*
- *Create a strong story theme that evokes multiple interpretations and suggests mystery*
- *Let players learn something about themselves, either on a practical or philosophical level*

# 7 Framework & Methodological approach

In the methodology, I will create a set of hypotheses in different levels/thresholds of the narrative scale, based on most of the design-oriented statements throughout the report. To test these levels of ES, I will create an experience for each of the first two levels, testing an appropriate set of hypotheses, regarding that particular level. Before doing so, it seems pertinent to provide the framework, presenting the aspects covered in this work. It can also be viewed as a complete overview of the content of the report.

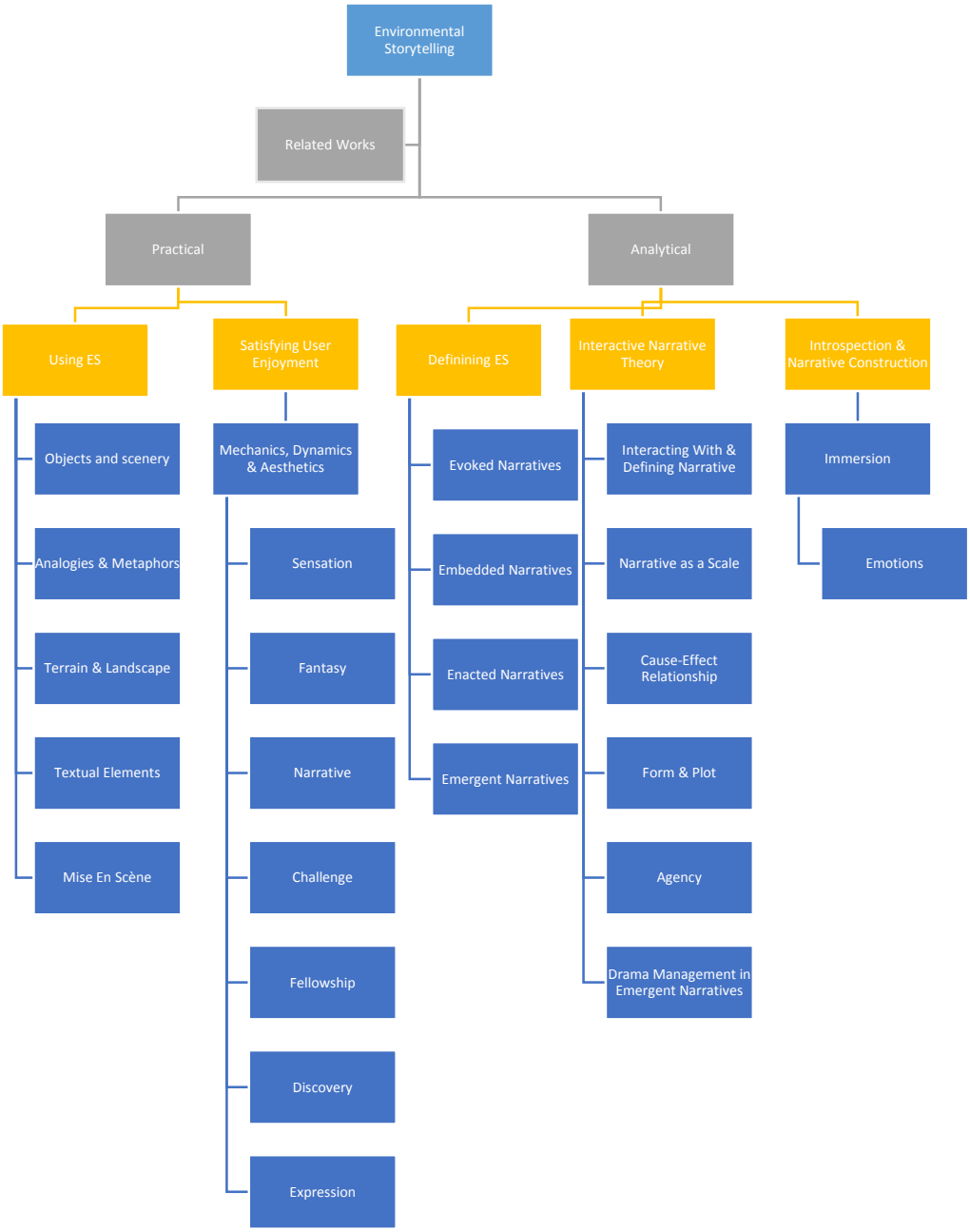


*Figure 15 - The ES framework providing all the significant aspects that this project will cover. At the same time, it works as an overview of the subjects covered in the preliminary analysis and the main analysis*

The methodological approach to measuring the validity of the framework is established by drawing theoretical inspiration from Ryan's (2006) scalar derivation of narrative. It will present the dissection of ES on three distinct levels derived by Ryan's scale. In this way, I dissect the ES framework into three separate layers that can be designed as three distinct experiences for testing purposes (see Figure 16). Each level will be designed based on most of the requirements presented in the section above, except the *authoring* guidelines, which in some sense are considered "obvious" since they are not concrete design choices (but a set of rule of thumb, for the authors) and does not belong to any specific of the three presented levels.

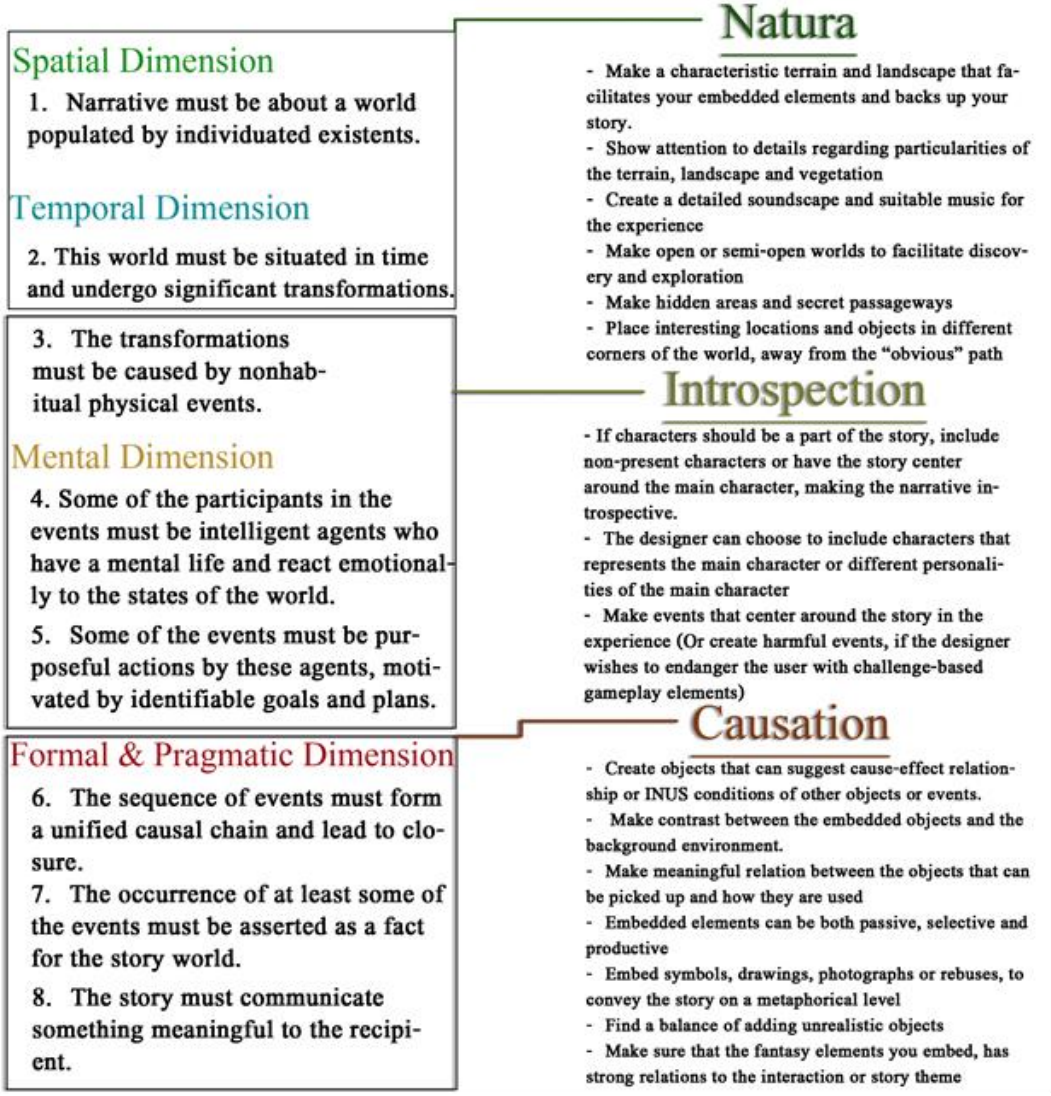


*Figure 16 - A model of how each of the three levels related to Ryan's narrative scale. On the left, we see Ryan's eight points. On the right, we see the three levels of ES with their corresponding design guidelines. Each notation is inspired by Latin, to universalise the distinctions linguistically.*

The model does not only gives an overview, but it works as a design guide for each level that will be implemented and tested throughout the rest of the design and implementation phase of this project. We are thus not dealing with a classical iterative design process, where the analysis of the result from each level, aids the design of the next. We are dealing with three predefined experiences, increasing the level of content regarding narrative elements, goals, and interaction to ultimately increase the narrative engagement.

## 7.1 Resource limitations & Success Criteria

Even though the guidelines for the third level, Causation, are already prepared and the experience is "ready" to be implemented and tested, it seems unrealistic to implement it in this project due to the large workload. Implementing the level would require a team of at least four or five persons working for two months or more, which is beyond the level of resources given to this project. Therefore, the remaining sections of the report will focus strictly on designing, implementing and testing the first two levels, Natura and Introspection.

The final problem statement will be revisited and altered to create a general null hypothesis that will be investigated in this project.

*"To what extend is it possible to increase the user's narrative engagement across three distinct experiences, designed by using the established framework of environmental storytelling, as a set of design guidelines."*

The overall null hypothesis that can be based on the final problem statement should check whether the narrative engagement increases across the three levels and will therefore be:

*$H_o$ – There is no significant difference between the user's narrative engagement levels, across the three different stages of environmental storytelling*

Before measuring the narrative engagement, it must be gathered to what extent respondents experience a story. This is also a part of the success criteria, i.e. to see an increasing in have a story experience. The question confirming this criterion will be presented in the following section.

As mentioned, the third level will not be a part of the test to reject the null hypothesis. The narrative engagement will be measured based on specific items of narrative engagement presented in the following section. These will be quantitatively compared to intentionally reject the null-hypothesis.

### 7.1.1 Test Design

This section will present the data gathering method of how to measure the narrative experience and engagement, which will be based on the quantifiable list of items, provided by Schønau-Fog, Louchart & Soto-Sanfiel (2013). It will present a standard questionnaire that contains questions used during the two levels[28]. However, in addition to the standard questionnaire, each of the levels will contain an additional suitable quantitative or qualitative measurement method to provide specific results within the given level.

Each level will be measured using a between-group method since the questionnaire will bias participants the second time being used (Lazar, Feng, & Hochheiser, 2010). This section will thus describe the standard questionnaire used over the three levels. Each additional measurement method will be described after the design and implementation of the given level. The full standard questionnaire can be seen in appendix E.

#### 7.1.1.1 Demographics & Player typology

Demographics are the initial focus point of the design of the questionnaire. It is highly important for validation of the results, since it might clarify specific patterns in the data or explain odd results or irregular behaviour in the virtual world (Lazar, Feng, & Hochheiser, 2010, pp. 103-107). The demographics for this

[28] The reader can assume that this standard questionnaire will be used in both levels and are thus not repeatedly presented in the method section of the given level, but only in this section. However, the supplementary method of each level will be presented before the relevant level.

project will include a few basic questions such as age and gender. It will also look into gaming habits, to see how much time participants spend, playing computer games.

During the development of Aporia, several attempts to identify the types of players demographically, has been carried out. In the latest Aporia study (Still Lake Valley) a 40-point questionnaire was developed, which attempted to classify the players into Gamists (interested in interaction), Narrativists (interested in the story) and Simulationists (interested in the world); however, the results were quite unclear and inconclusive, since many of the respondents were interested in all three categories. In this project, classifying players will be done, including a different set of player types.

In 2008, Yee et al. came up with a set of second-order factors based on Bartle's motivational factors (Bartle, 1996) (Yee, Williams, & Caplan., 2008). These factors resulted in three main structures with 10 motivational items:

**Achievement**

1. *Advancement (Progressing in the game)*
2. *Analysing game mechanics (Experimenting and playing with different mechanics)*
3. *Competition (Competing with others or oneself)*

**Social**

1. *Chatting and casual interactions (Social interaction with other players)*
2. *Developing supportive relationships (Establishing relations to other players)*
3. *Teamwork (Cooperation with other players)*

**Immersion**

1. *Geographical exploration (Discovering new and interesting areas)*
2. *Role-Playing (Playing different roles)*
3. *Avatar Customization (Creating your character)*
4. *Escapism (Being in another reality)*

Based on these factors, achiever, socialiser, and immersionist, I will covert each of these points to be used to categorise player motivation within these three factors. The question will be presented before the experience along with the other demographic questions. The three player types appears quite valid, but one could argue that more types are needed giving more versatile results, for instance a player type such as the "narrativist" from the world of LARPs[29] (Boeckman, 2003) could be essential to use. In the questionnaire, participants will also be given the chance to answer "other" in this question and the answer will then be categorised in the most fitting player type. For instance, if the answer is "I am mostly motivated by the story" the player will be categorised as an immersionist.

The method used is inspired by a list of items established by Schønau-Fog, Louchart & Soto-Sanfiel (2013) which is based on the narrative comprehension and engagement model provided by Busselle and Bilandzic (2008). The list of items provides the opportunity to construct a more in-depth investigation of the level of engagement on the narrative level.

[29] "Live Action Role-Playing Game"

Based in each item and dimension of narrative engagement, I establish one or more questions (see Table 1 for the existing list and the established questions). Each question will take basis in a labelled semantic 10-point scale question, to make it easier to compare the items and to give results that are more concrete than binary yes/no questions. Some of the items are slightly tautological and a few items does simply not make sense to include in ES experiences, for instance, the story world in this case *is* the virtual world (as mentioned in the chapter regarding form) are a excluded as being a basis of a question (crossed out).

*Table 1 - The table as created by Schønau-Fog et al. together with the "question focus area" which is questions used to include in the questionnaire for the test of this project.*

| **Dimension** | **Items** | **Question focus area** |
|---|---|---|
| *Attention Focus* | • Wandering mind<br>• Thinking about other things<br>• Keeping mind on story | • "During the experience, my attention was on: *Exploring the world, The story in the experience, things outside the experience (personal issues, surroundings)"* |
| *Narrative Presence* | • ~~The mind is inside the storyworld~~<br>• Storyworld cease to exist at the end of the experience (closure)<br>• ~~Storyworld closer than the real world~~ | • "At the end of the experience, the story was: finished – unfinished.<br>• The storyworld items, are implicitly answered in the question in the category above" |
| *Comprehension of Narrative* | • Making sense of the story<br>• Understanding Characters<br>• Recognizing story thread | • "The story experience, I had, was: Abstract – clear (intelligibility)"<br>• "In case you felt other beings or humans were a part of the experience, did they have a goal or a plan?"<br>• "If you answered yes above, please briefly describe what goals or purposes the beings/characters had"<br>• "The happenings throughout the story[30]: Was completely unstructured – Had a clear common thread" |
| *Emotional Engagement and Character Identification* | • Emotionally affected by the story<br>• Feeling happy when a main character<br>is succeeding and sad when it is failing | • "The story experience I had, affected me emotionally: not at all – very much"<br>• "I was emotionally affected by the actions I performed in the experience: not at all – very much" |

[30] This question also regards cause-effect relationship throughout the story

| | | |
|---|---|---|
| | • ~~Feeling sorry for some characters~~ | |
| *Experimentation* | • Changing the outcome of the story<br>• Playing different roles<br>• Trying different possibilities | • "During the experience, I experimented with: Changing the outcome of the story(Checking if my choices influenced the story experience), Playing different roles (Taking different identities for myself), Trying different possibilities (attempting to interact with things), Navigating through different paths in the environment" |
| *Disengagement Causes* | • Narrative Situation<br>• Character<br>• Story world<br>• Game world | "At the end of the experience, you stopped playing[31]. Please lists the main reasons for disengaging with the experience: The narrative situation (A specific situation in the story), The character(s) (for instance if the characters are dull or if you are "out of character"), The story world (The entire story), The virtual environment (The game world itself), Other (list whatever number and write below)" |

The set of narrative engagement items will be the main elements rejecting the null-hypothesis.

The narrative engagement seems irrelevant to measure if no story experience is felt. In this case, the questionnaire should split into another section, investigating why they did not have story experience and what was required in order for them to experience a story (see Figure 17 for structure of the questionnaire). In addition, it is interesting to see if the users still have an emotional experience.

[31] The "stopped playing" might change across the different tests, since some experience might have an ending

***No story experience***

- *Why did you not have a story experience?* (Briefly describe why you believe, you did not have a story experience)
- *Please select one element, that was not present in the experience, but could aid you in having a story experience* (Character interaction & dialogue, Written text, Staged objects & buildings, Symbols & drawings, General interaction, Events, Other)
- *The experience affected me emotionally*

To this set of questions, a few other investigation categories and matching questions are added. These include a few additions to the narrative-oriented investigation such as closure and intelligibility and investigation areas related to game theory:

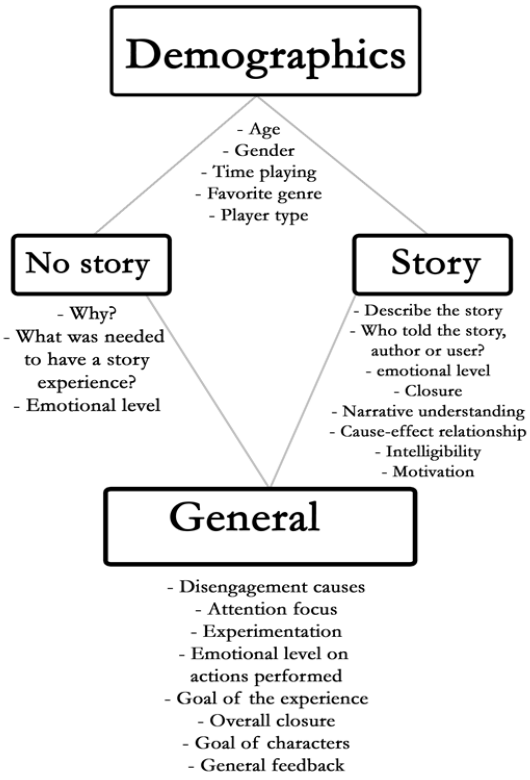


*Figure 17 - Overview of the structure of the questionnaire. Respondents will have different questions depending on if they had a story experience or not.*

***General questions***

- *Closure* (The experience was: complete – incomplete, *10-point semantic scale*)
- *Man-made objects* (In the experience: I was alone (there was only me), Other humans were present at the same time as me, Other beings (non-human) were present at the same time as me, Other humans was there before I was, Other beings (non-human) was there before I was, other)
- *Intelligibility (*Other participants will roughly have the same story experience as me, *7-point likert*)
- *Player goals* (What was your goal in the experience? - *qualitative*)
- *Motivation* (During the experience, my motivation was to: Navigate/Interact/Explore - Uncovering story elements/Imagine my own stories, *10-point semantic scale*)
- *General feedback* (Aesthetics, Sound/Music, Interaction, Mechanics, Bugs, Duration etc., Qualitative question)

As mentioned before, this outlines the main questionnaire used throughout the two levels, which means that it will not be repeated in other sections. Other additional hypotheses and methods will be mentioned under the test section of each level.

With the established testing framework in place, I am ready to move into the creation phase of the first level, Natura.

# 8 Natura

Natura is solely based on evoked narrative and Ryan's first two items. It is interesting to see if participants will have a story experience or not, given an exceptionally low level of narrative content.

## 8.1 Designing Natura

As mentioned earlier, the focus of the first level is the environment itself. The virtual world based on Ryan's two initial points of the narrative scale; "*Narrative must be about a world populated by individuated existents*" and "*This world must be situated in time and undergo significant transformations*". To get a solid working ground let us refresh the previously mentioned guidelines for this level:

- *Make a characteristic terrain and landscape that facilitates your embedded elements and backs up your story.*
- *Show attention to details regarding particularities of the terrain, landscape, and vegetation*
- *Create a detailed soundscape and suitable music for the experience*
- *Place interesting locations and objects in different corners of the world, away from the "obvious" path*
- *Make open or semi-open worlds to facilitate discovery and exploration*
- *Make hidden areas and secret passageway*

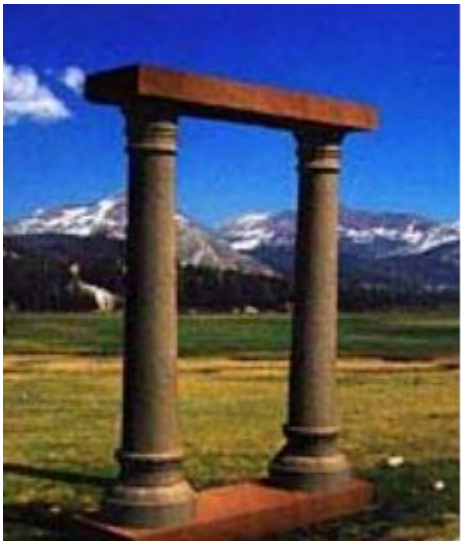

*Figure 18 - Don Carson's example of providing simple mystic content that might evoke story association with the user.*

These guidelines, outlines the main framework in the creation of the first level. As such, there is no goal or strict rules that the player will need to follow. There is no winning condition, manmade objects or other characters. The guidelines do not suggest any story related material either. This is where the first level will be slightly different. In a large nature environment, a number of nature objects will be placed standing alone in slightly odd ways on different locations. This will be done in a way such that it could be manmade but it could also be pure coincidence by nature. This is done to evoke a mystic theme that the player can ponder on while roaming the landscape. It is an attempt to evoke a story theme throughout the experience that can potentially be experienced by users as being a story. The idea originates from Don Carson's second article on ES *"Environmental Storytelling, Part II: Bringing Theme Park Environment Design Techniques to the Virtual World".* Here where he describes how simple it can be to implement story-associated thoughts in the user's mind by adding modest objects (Carson, 2000): *"Imagine you have a pair of columns side by side, like our two trees, and have placed them in an open field. It is easy to predict that any passing hikers would find the sight of the two columns intriguing and potentially walk over to them. In the process of examining them, they might even walk around them several times. Now, imagine that you add a lintel bridging the two columns, making an archway. Now the sight becomes more intriguing, and worthy of further investigation. Add a threshold stone to the base of the archway and you have created an irresistible mystery."* (Carson, 2000).

Carson's example are clearly manmade so in this case, it will not be columns, but trees, flowers, and stones in slightly odd formations, inspired by the one that we see with the columns in Figure 18. Returning to Ryan's second point, the design will not include specific "significant changes", other than the player traversing through the environment. One could implement nature phenomena such as hurricanes, earthquakes, rain; lightning and even time of day changes, but it can take the focus away from the mystic nature objects, and a change in whether. I believe they have vague story potential compared to the odd objects. As such, I believe that the more players discovering the mysterious objects, the more the level is likely to contain a story experience. This hypothesis will be elaborated in the test section.

The form of the level and the narrative can be seen as equal to the "environmental exploration" model presented earlier, both with no endings, divisions of the area or cause-effect relationships between the nodes (The nodes are in this case the odd nature objects). This allows the user full navigational freedom with no subdivision of the environment whatsoever. Regarding the drama management guidelines, established earlier, the boundaries added to the level are not natural and the player is not guided or given any events. This means that the level does not follow any guidelines for drama management. The experience should additionally include a realistic soundscape and suitable music to evoke sensory immersion and emotions.

## 8.2 Implementing Natura

To get the best result, it was decided not to use Cryengine's built-in landscape editor, but Mudbox 2014 and World Machine 2.2 to achieve a more characteristic and detailed result, regarding the terrain. A simple plane model was created in Maya 2014 and imported in Mudbox. From here, the modelling of the terrain could begin. Mudbox serves perfect for creating high polygon meshes, giving the possibility to create a high level of detail (see Figure 19).

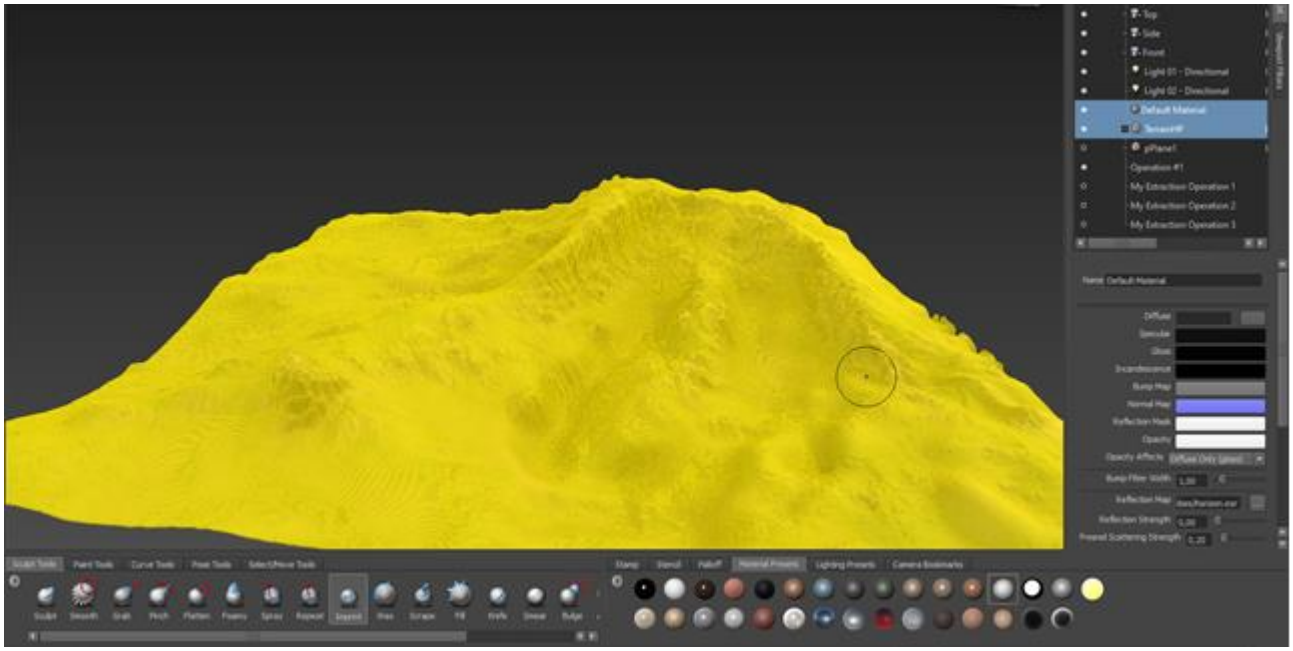

*Figure 19 - Terrain modelled in Mudbox 2014. The terrain was modelled from a simple 2048x2048 plane created in Maya 2014.*

When the terrain started to look interesting, the heightmap was imported into World Machine. World Machine is efficient in creating generative "noise" such as rock terraces; erosions and advanced Perlin noise across the entire terrain (see Figure 20).

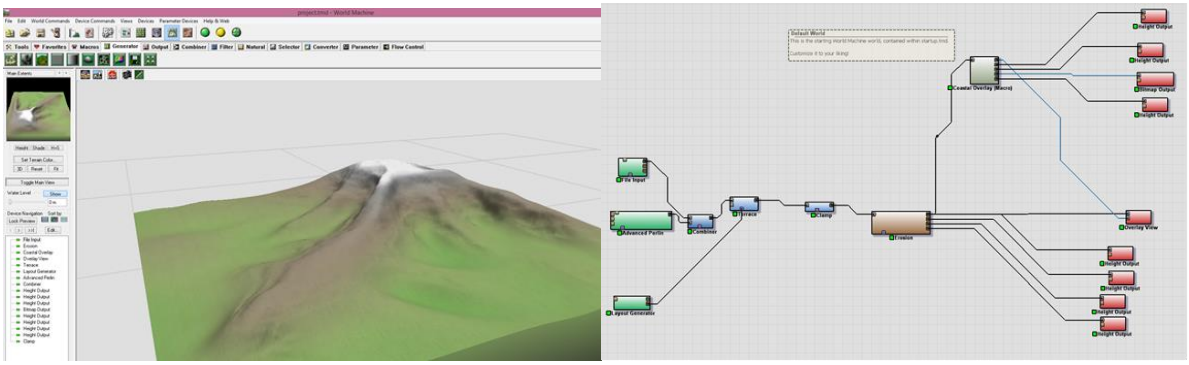

*Figure 20 - Right: A low-resolution preview of the terrain in World Machine. Right: The node system. The red nodes on the far left are output nodes, giving the ability to export different maps such as colour, ambient occlusion, surface normals, height, cavity etc.*

It works in a node-based system where each node provide different options of tweaking generative additions to the terrain. Other than adding details to the terrain, the purpose in World Machine was to render out several images[32], resulting in a very detailed colour map that later is used to import together with the terrain in Cryengine[33]. From these images, a colour map is created in Photoshop CS6, by multiplying the layers together to one colour map image. The terrain heightmap is then imported into Mudbox again together with the colour map and the final sculpting and tweaking is carried out. From this high-level polygonal mesh, a high-resolution ambient occlusion, normal, and cavity map is extracted to blend together with the final colour map in Photoshop. When this was done, the terrain could be imported

[32] The images rendered out are Deposition map, wear mask, flow map, grass/rock colour map, overall colour map, light map and ambient occlusion map.
[33] The Cryengine version used is Cryengine 3.5.8 (released in March 2014)

into Cryengine as a heightmap together with the final colour map to become the final terrain (see Figure 21).

*Figure 21 - Final terrain and colour map imported into Cryengine*

From here, a detailed set of vegetation was added to the terrain, mostly including pines forests, lakes, rocks, paths, cliffs, grass etc. A lot of time was spend making the world detailed, however, having a terrain on 2048x2048, which is 2x2 square kilometres compared to the size of the player, was difficult to make perfectly detailed everywhere. However, the result did not lack any areas that did not have anything interesting to offer when speaking of vegetation. Almost 100.000 pieces of vegetation was planted and two spawn points were added in each end of the map, such that participants would discover different parts of the environment. Additionally, 15 odd objects were added in different locations of the world. Most of these were big stones with a strange shape. All of them had tiny blue flowers growing around them, adding a specific common theme between the objects, to imply narrative significance to the player. Additionally, three music themes were added, playing randomly. The themes were borrowed from *"The Village Original Soundtrack", "The Witcher Original Soundtrack"* and *"Crytek's forest theme[34]"* from the demo level that is included in Cryengine. The music is beautiful and somewhat neutral, but also mystical at times. When the content of the virtual world is on a minimum, the music usually receives more attention from the player and it is thus significant not to have too atmospherically strong themes, which might implant specific purposes or ideas with the players.

[34] The theme used in the existing professional premade level, included with the Cryengine.

*Figure 1 – A mysterious rock formation in a clearing in the forest. Notice the thematic blue flowers*

To see how players will traverse the environment and if there will be more activity around the objects of interest, a simple tracking method was implemented. The tracking system saves the position of player each ½ second and stores it to an XML file. Additionally to this tracking method, another tracking method, regarding the view of the player was implemented. This tracking method shot out a vector ray, from the player's view direction and if an object of interest is looked at, a counter starts saving how many seconds the given object is looked at. In this way, sufficient data telling how much attention each participant has paid to each object in the level.

*Figure 2 - Left: River Lake cutting through the pine forest. Right: Small mystical rock formation with the blue petals surrounding it.*

## 8.3 Testing Natura

Additional to the general narrative engagement questionnaire, two non-intrusive methods are embedded inside the game experience, as in-game metrics. One of the methods used, is tracking the player's position every half second and adds a timestamp. This is done with Cryengine's flowgraph system, saving the player's position as a 3D vector and writing it to an XML file.

### 8.3.1 Results

The test was conducted over two days (April 14th and 15th) at the midterm event (a presentation and feedback event for Medialogy students) at AAU-CPH, A.C. Meyers Vænge 15 in Copenhagen. The test included 21 participants – one was discarded[35] and one (Participant 6) tracking method was not recorded because of a system error, however the participant's response is still valid, but will not include in the tracking result. This leaves us with 20 participants (18 male, 2 female) playing for an average of 13 minutes. Each participant were asked to fill out the demographical questions and then asked to play for as long as they liked. However, a few participants were asked to stop, because of certain time limitations, biasing the disengagement causes. The tracking of time looking at an object, also failed occasionally, since some objects are only looked at for 0.1 seconds, which is close to impossible. This tracking method also caused the game to lag after around 5-8 minutes, which was a bit unfortunate.

As mentioned earlier, the results regarding the narrative engagement will not be the focus in this section. Those results will be compared across all three levels in the result presentation. As touched upon in the design section above, the hypotheses will be that the more objects of interest are discovered, the participants will be more likely to have a story experience. From this, I can set up two hypotheses:

$H_0$ - T*here is no significant difference in whether participants will have a story experience, compared to the amount of objects of interest found during the experience*

$H_0$ - *There is no significant difference in whether participants will have a story experience, compared to the amount of time looking at objects of interest during the experience*

The experience was played on a high graphical desktop with mouse, keyboard, and headphones. Two walls were added to the sides of the table with the computer, to minimise the disturbance level and maximise the chance of immersion. Participants were asked to fill out the demographics of the questionnaire and then asked to play for as long as they desired.-A few technical problems arose during the test

Let us start directly off by looking at the two main hypotheses of Natura, which was the fact that participants would be more likely to have a story experience the more they found or the longer time they looked at objects of interest. This means that the mean of the time and number of objects should be higher at those who had a story experience, than the mean of the ones that did not have a story experience. I measure this by doing a student t-test and comparing the two groups (no story and story experience).

*Table 2 - Table with the given values from a conducted t-test*

| $N = 20$ (No Story $= 5$, Story $= 14$) | $\bar{X}$ | $SD$ | $SE$ | $P$ |
|---|---|---|---|---|
| $Time\ looked\ at\ objects\ (no\ story)$ | 11,45 $Sec$ | 7,59 | 3,39 | 0,392 |
| Time looked at objects (story) | 13,14 $Sec$ | 17,49 | 4,67 | |
| Amount of objects found (no story) | 3,2 | 2,68 | 1,2 | 0,461 |
| Amount of objects found (story) | 2,92 | 1,32 | 0,36 | |

[35] This person was a bit busy (only played for 3 minutes) and inferred himself that he was not into these experiences anyways, but only enjoy high challenge-based games.

As one can see in Table 2, unfortunately the p-values are too high to reject the two null-hypotheses, meaning that there is no correlation between having a story experience and the number of objects found and the time looked at them. In addition, we see a high standard error, especially in the time looked at objects (3,39 and 4,67) meaning that the sample is not representing a population. However, one can look at the emotional level of the participants who had a story experience and those who did not. The fact that only five participants are in the group with no story experienced, can obviously give bias to the results are the. If the group had equal amount of respondents, we would see more clear results.

*Table 3 - The level of emotional involvement on a scale from 1 to 10*

| $N = 20\ (\text{No Story} = 5, \text{Story} = 14)$ | $\bar{X}$ | $SD$ | $SE$ | $P$ |
|---|---|---|---|---|
| $Emotional\ level\ (no\ story)$ | 5,16 | 1,72 | 0,7 | **0,091** |
| $Emotional\ level\ (\text{story})$ | 6,42 | 2,02 | 0,54 | |

In Table 3, it is close in reaching a significant difference in the emotional involvement. This might back up the fact that stories often evoke a certain emotional response. It is interesting to observe this high level of emotional response, even though there are no characters involved, activating empathy. However, one should have in mind that no matter how significant this result is, it can never represent the true level of emotions, since that would require more advanced measurement methods, such as psychophysiological tools, measuring valence and arousal with each participant. Again, the groups are very unequal.

Regarding the story experience, it is considered successful that despite the extremely low amount of narrative material embedded in the world, 70% of the participants were capable of telling a story based on what they experienced.

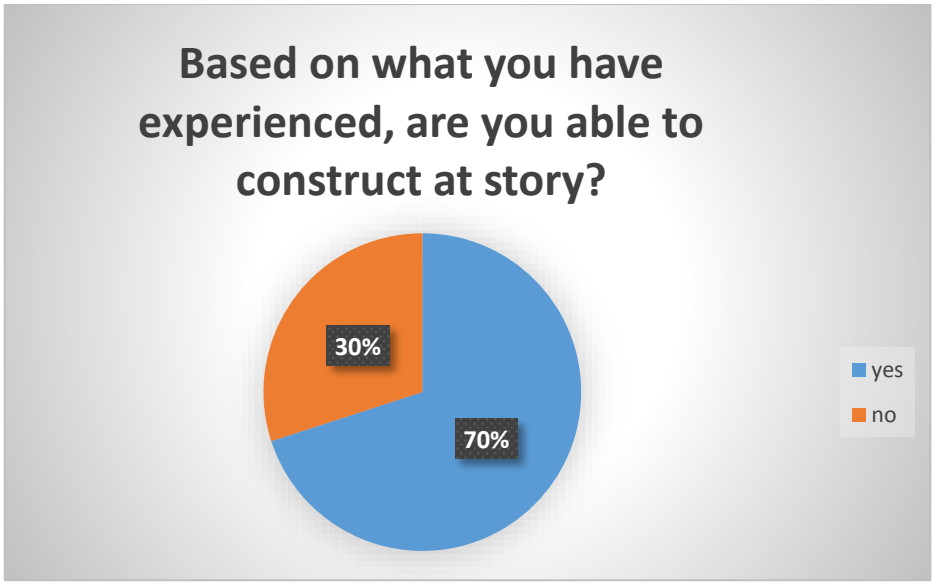


*Figure 22 - This question was the first each participant was asked, right after the experience.*

Despite this, the stories seem to be either very short or slightly vague: *"the character explored the world made by nature and searched for the blue flowers to complete the quest ..." (participant 2, male)*. Others narrative descriptions included more substance and fantasy elements *"Lost in a world of mystery a man*

*tries to understand his place. First with a goal to survive, but later enthralled by the island and its beauty. As he explores the landscapes, he starts to notice clusters of blue flowers luring him towards large, and questionably natural stones, that make him feel off or a little ill when close. Despite this, he keeps seeking them out, as he feels they hold an importance to the island and the question as to why he is here. Everything seems a little too good, while still a bit off, something bad is about to happen sooner or later." (Participant 18, male).* The blue flowers, placed around the objects of interest are mentioned in more than six out of fourteen story descriptions, indicating that they contributed to the perceived story to around half of the participants.

A brief look at disengagement causes (see Table 4), seems to have very low average, which can be considered somewhat positive:

*Table 4 - The average disengagement causes, rated on a scale from 1 to 10*

| ***Disengagement causes*** | $\bar{X}$ |
|---|---|
| *The narrative situation* | 3,2 |
| *The characters* | 3,35 |
| *The story world* | 3,65 |
| *The Virtual environment* | 3,45 |
| *Other* | 5,55 |

One quickly gets the idea that numerous causes that were not labelled were the main reason for disengaging. The main causes listed on "other" were mainly the lack of goal. Some participants also mention downsides such as the aforementioned lag and the lack of interaction.

The overall narrative engagement results will be presented in a later section. At this point, it is natural to look at how to design and implement the next level in the ES framework, to obtain empirical data comparable to the first level.

# 9 Introspection

Even though the process of introspection is occurring for some participants on the first level, this level will be even more focused on setting the main story around the user. This is done by including another character that represents a part of the main character (the user).

In Darkmist Forest, a creature (ghost) was included, to attract attention with the users and guide them to a specific location. It is the intention to include this creature in the design of this experience and use it as a representation of the main character, e.g. the dark side of oneself.

## 9.1 Designing Introspection

This time, resources will not be spend on creating the world, but content relevant for the particularities of the Introspection level. Due to this fact, the design and implementation will reuse an existing ES experience, which will be Aporia: Darkmist Forest. As mentioned in the state of the art section, Darkmist Forest was (besides being a game experience) used to guide the player in an open world with cues triggering specific sensory modalities. If the reader wishes to receive more details regarding the creation of this level, in terms of technicalities and design aspects, the relevant section from the original Darkmist Forest report is included in appendix F.

In ES experiences, introspection should be considered equivalent to the notion of Oxford dictionary: *"The examination or observation of one's own mental and emotional processes"*[36], which is a more general definition compared to how comprehensive a term introspection is, in terms of philosophy. Introspection plays a larger role in ES, since no characters are present, and as a result, the users must look inwards, construct meaning based on their own experiences, and eventually involve themselves in the narrative situation. At times, it can be reasonable to clarify[37] that users should consider themselves as the main character in the experience. However, this belongs to the third level, since on the second level I do not have any embedded elements to work with. One solution could be to create a visual event that infers the fact that the creature is a part of the main character.

Like the previous design section, let us list and discuss the guidelines for this level:

- *If characters should be a part of the story, include non-present characters or have the story center around the main character, making the narrative introspective.*
- *The designer can choose to include characters that represents the main character or different personalities of the main character*
- *Make events that center around the story in the experience (Or create harmful events, if the designer wishes to endanger the user with challenge-based gameplay elements)*

Overall, a character needs to be included that represents the main character and it should include in certain events that could potentially harm the player. It is desired to use the creature as an embodiment and a metaphor of the main character's dark personality, without elaborating on this metaphor to the players, but let them have their own interpretation of its purpose. The implementation of this will require animations and cinematics of the creature that should be implemented in a virtual environment.

The structure of the level is similar to Natura, but with a small limited area in the beginning to ensure the first cinematic and the interaction possibilities throughout the experience. After the area, the user is given full navigational agency, with natural boundaries in shape of a layer of mist. The creature will also serve as slightly guiding the player. As such, we achieve all four guidelines for drama management in emergent narrative, as established in the preliminary analysis. The experience should include both eerie soundscapes and mystical music to facilitate the story theme.

[36] http://www.oxforddictionaries.com/definition/english/introspection?q=introspection 12-05-2014
[37] This can be done by embedding elements such as symbolism or drawings and paintings. It can be essential for the experience that the users are aware that the story is about themselves and not a second or third character.

## 9.2 Implementing introspection

Out of the existing design of the level, some mechanisms and design choices are discarded. These include cave paintings, audio cues, voice flashbacks, and the diary. The ones that are purposefully maintained is a series of manmade objects, which includes a cabin in the forest, a treehouse, and an old ruined monastery. It is known from previous tests that manmade objects can give evoke strong story associations since it can refer to present or past characters, increasing the chance of the player attainment a narrative. The treehouse (see Figure 23) is located very high up in a large oak tree. On the way, a jumping puzzle is implemented in shape of a series of ladders and platforms. This is the only challenge-based element in the experience, with the chance of evoking challenge-based immersion (Ermi & Mäyrä, 2005). It is included to investigate whether the challenge will have any influence on the story or if the players will stop after completing it.

*Figure 23 - The treehouse (also known as The Tree of Life). It is a major scaffold leading to a great observation post and a reuniting animation with the creature (also seen in the bottom)*

The first step of the process was to strip away some of the interaction and mechanics that was redundant for the introspection level[38]. However, simple interaction mechanics was maintained. In this game there is a certain glowing vial, which players can pick up to use as a flare and light their way in the forest. It also included a few lamps that can be switched on/off. One should notice that these simple interaction does not cause any narrative related events to happen, but gives the player a slight feeling of being in control of the experience.

The cinematics and animation was the focus of the implementation. Two cinematics and six animations of the creature were applied to the level. The way I distinguish cinematics and animations is that cinematics changes to a non-controllable camera until the end, whereas during animations, the player has full control of the character. All cinematics and animations were done in Cryengine's build-in tool, the "track view". This tool, similar to other animation tools, provided the ability to add objects and cameras to a timeline where key nodes could be added across the sequence. Other functions such as a start/stop sound and music themes could also be added to the timeline, triggering when desired.

[38] Such as collecting specific objects, audio flashbacks, cave paintings and the diary.

*Figure 24 - The ghostly creature in the forest. In this case, when the player got too close, a dramatic string sound would play and the creature would disappear*

The creature (see Figure 24) consisted of a primary light entity. To this light entity, a number of black smoke particles were linked to the light entity with a set of modelled glowing eyes. In this way, the creature became a black cloud with glowing eyes, striding across the terrain. The six animations were primarily made by translating and rotating the light of the creature and adding key nodes at appropriate moments. Each animation was initiated by a trigger box close to the creature. When the player entered the trigger box, the animation would start and the creature would either disappear on the spot or stride in a certain direction away from the player. At times, it was also necessary to track the distance of the player to the creature, pausing the animation if the player did not follow the creature. In these occasions, the creature can also be considered as a visual movement, guiding the player faintly, in a certain direction. However, in this case, it was not intended to guide the player in a specific direction but give the idea that the creature tries to avoid the player.

The cinematics was slightly different from the animations since, the viewpoint of the player should be switched to a controlled camera (see Figure 25). The two cinematics included the creature “leaving the

player's body" in a first person view, in the beginning of the experience. At the top of the treehouse, the creature enters the body of the player once again.

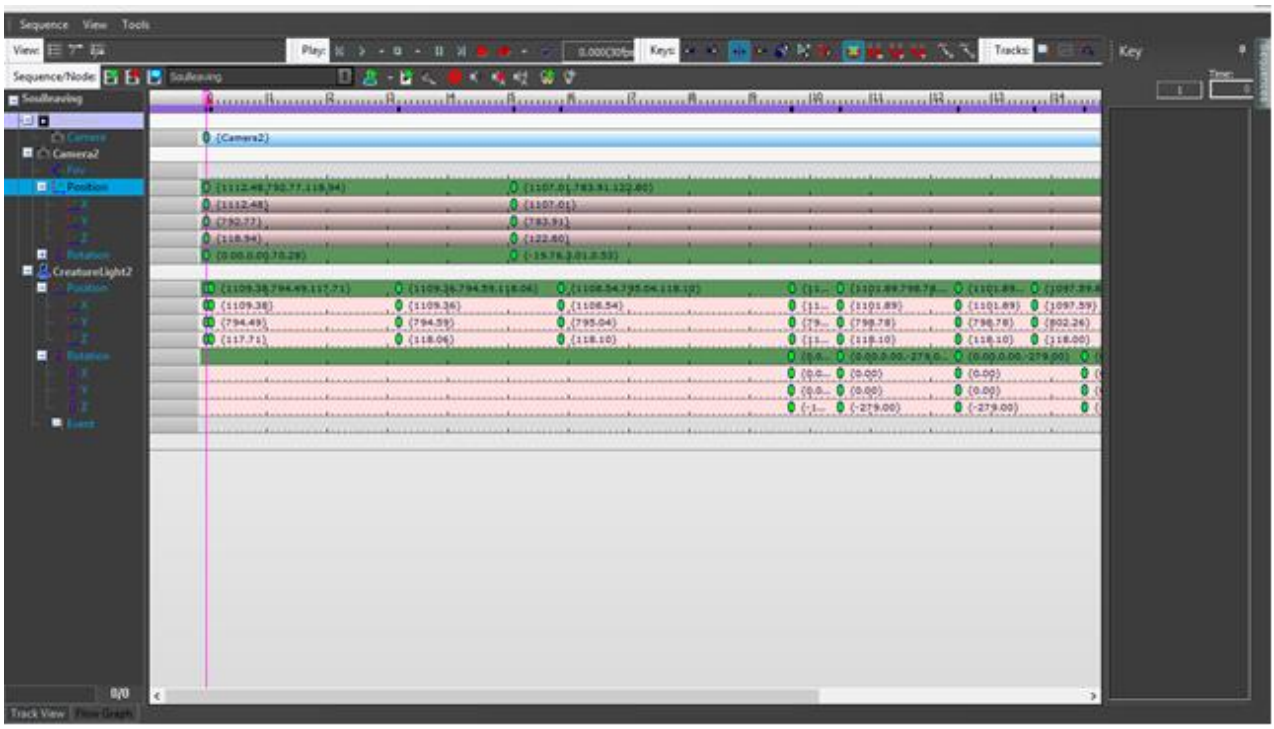

*Figure 25 - The track view program in Cryengine. The position of the camera and the position of the creature can be seen on the left. The key nodes from the position and rotation in 3D space can then be "recorded" over time.*

These cinematics is meant as a beginning and an ending to the concept of the creature leaving the body and entering it again. However, to avoid forcing an ending to the experience, after the second cinematic, the player gains control, allowing to continue exploration if desired. In this way, the concept of allowing the participants freedom to stop whenever they want is maintained.

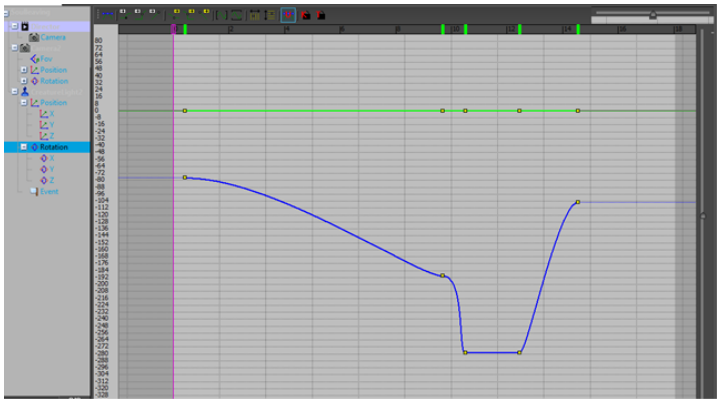

*Figure 26 - A rotation animation curve of two axis from the creature's light entity. Here the rotation could be smoothed out to achieve realistic movement*

At times, the animations needed to be more fluently, which could be corrected by viewing the Bezier splines of the positions across the sequence and using an automated tangent function that smoothed overall motion of the animation (see Figure 26).

As can be seen on some of the screenshots, lighting is used as an expressive tool for getting the players' attention towards locations of interest based on Girina's concept of *expressive lighting* (Girina, 2013).

## 9.3 Testing introspection

At this test, a small non-intrusive method is also included in the test. This method is a simple check that registers which and how many encounter a participant had with the creature. In this way, I can see if more encounters with the creature will result in higher narrative engagement.

### 9.3.1 Results

The second, and final test of this project, was conducted across three days (May 12-15th) at AAU-CPH, Frederikskaj 12 in Copenhagen. The test included 20 participants (16 male, 4 female) playing for an average of 17,5 minutes, which is slightly more females than the first test and 4,5 minutes more in average. No technical problems were encountered during the test and all 20 responses are considered as valid. See appendix H for test setup.

Initially, it is significant to look at how many respondents had a story experience. As can be seen in Figure 27 precisely 90% had a story experience. This is deemed as successful, with only two participants out of 20, not having a story experience. The reasons for not have a story was mainly due to lack of story information provided by the author *"I did experience certain emotions and mystic atmosphere during the game, and I could possibly construct a story if I was given some cues to who I was, etc. But basing a story on the surroundings and the ghost was too little for me."* (Participant 7, female, immersionist). It was also because of the lack of provided goals *"I was just running around and finding objects there were no reason or goal behind it"* (participant 12, male, immersionist).

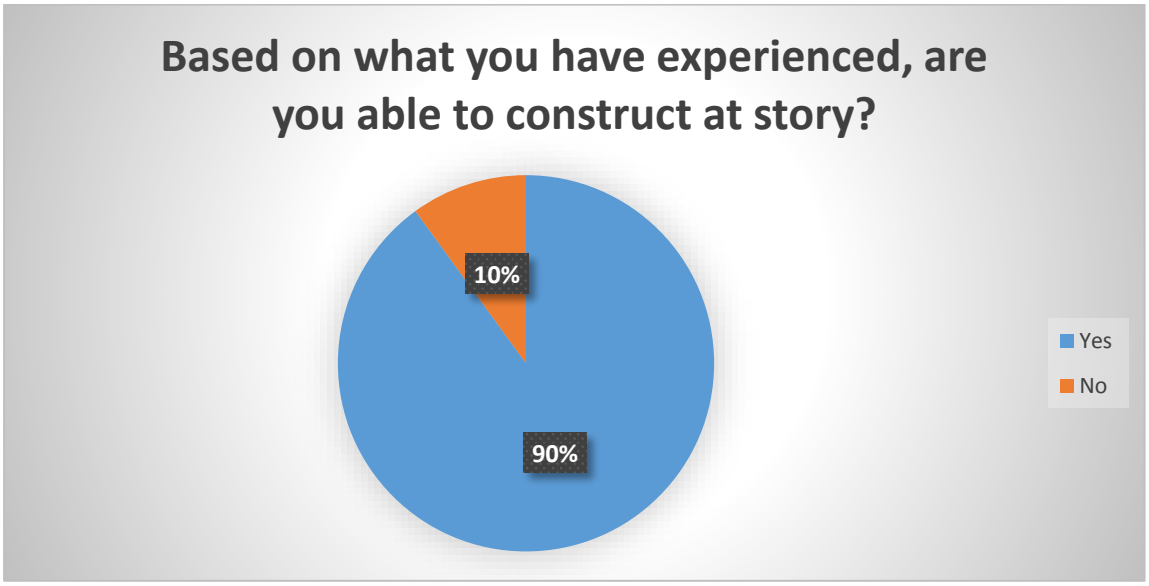


*Figure 27 - A circle diagram indicating how many participants were able to tell a story based on the experience*

Most of the stories experienced were more detailed and elaborate than the stories from Natura. Most of the stories interestingly include imposed goals of the creature *"It occurred to me that this ghostly entity was trying to tell me something - or perhaps trick me! If it were to tell me something, I would say it had something to gain by having me solve an issue for it. On the other hand, it looked a bit evil, so..."* (Participant 1, male, immersionist). Some were more specific and detailed *I had to follow the shadow guide,*

*as it tried to shoe me something hidden in the forest, maybe it wanted to guide me safely out of the forest or maybe it had evil intentions and was luring me into a trap. Either way I had to follow to uncover the secret of the misty forest."* (Participant 14, male, achiever).

From the idea of looking at the number of encounters with the creature, I can set up a small hypothesis:

*$H_0$ – There is no relative increase in the narrative engagement compared to how many encounters each participants had with the creature*

The narrative engagement will be measured without the disengagement causes, since they have a reverse positive/negative scale compared to the other items. In addition, there will be no statistical p-values rejecting this hypothesis, but a chart showing if there is an increase. Let us map the narrative engagement with the number of encounters with the creature.

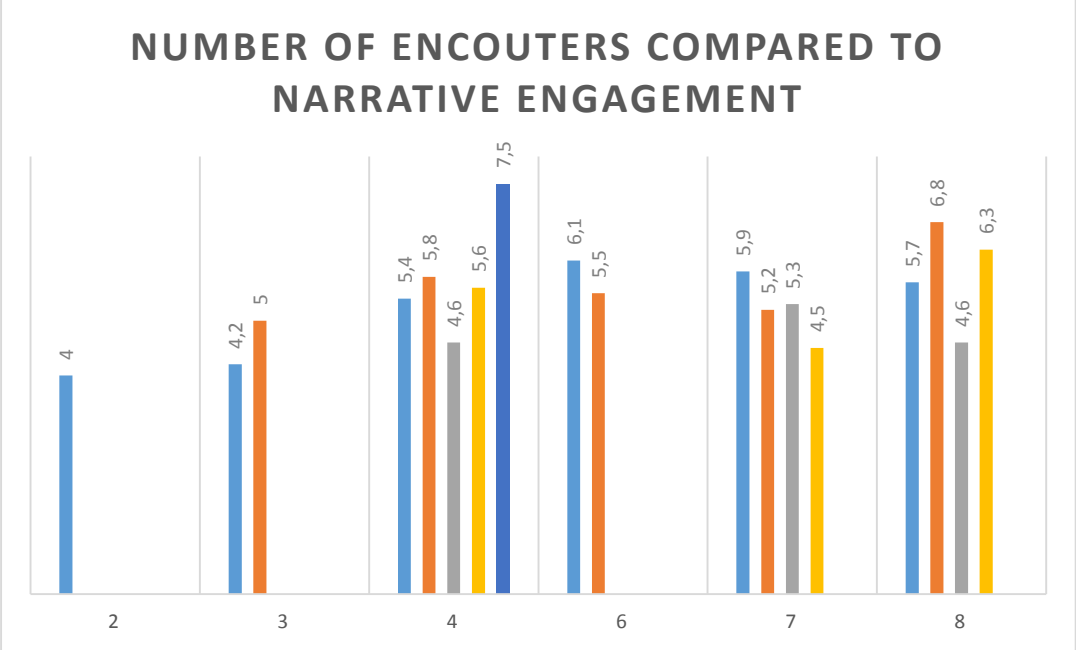


*Figure 28 - The X-axis is the number of encounters (No one had 1 or 5 encounters) and the Y-Axis is the average narrative engagement of each respondent. The colours do not represent any group, but is only there to distinguish between each respondent.*

As can be seen in Figure 28, there is a slight increase but it can be a bit hard to observe because of one standing out on four encounters with a 7,5 average. It might also be, that the more time spend in the experience, the more encounters with the creature, the stronger the story experience will be, meaning that the creature does not necessarily increase the narrative engagement, but the time spent. Let us take the total engagement average on each number of encounter along with the average time spent to see if there is an increase or a relation with the time spent (see Table 5).

*Table 5 - The total average of each encounter with the creature. Overall, we see an increase until six encounters. It then takes a o plunge on seven encounters and goes up again on eight*

| ***Encounters*** | ***Narrative engagement average*** | ***Time spent average*** |
|---|---|---|
| 2 | 4 | 5 $min.$ |
| 3 | 4,6 | 13,5 $min.$ |
| 4 | 5,7 | 10,4 $min.$ |
| 6 | 5,8 | 23,5 $min.$ |
| 7 | 5,2 | 22,6 $min.$ |
| 8 | 5,8 | 24,2 $min.$ |

Indeed, there is a slight increase until six encounters, which, to a certain degree rejects the null hypothesis. However, I would need to know if the result is significant and have more clear result in order to reject it completely. The time spent is also increasing as expected, so one does not know if the encounters with the creature indeed increased the narrative engagement or if it was simply the time spent.

With the relevant results from both Natura and Introspection in place, I can now move into the main results, to investigate if there is an increase in the narrative engagement between Natura and Introspection.

# 10 Main results

This section will present results regarding the narrative engagement across the first two levels, Natura and Introspection. As can be seen in the test design section, most of the narrative engagement items are measured with a ten-point scale, to have precise and comparable quantitative results. Only one item regarding whether other characters had clear and identifiable goals, is a multiple-choice question. It can still be compared, but not yield a p-value from a student's t-test. The player types and favourite genres from the two tests are compared, with no alarmingly difference other than a few differences in player times, for more information on this see appendix G.

Presented below, is a table with the dimension and matching questions with the results from Natura and Introspection. The reader should note that some of the groups have unequal populations, as well, because many of the questions regarding the story were only answered if participants had a narrative experience. These were N = 14 in Natura and N = 18 in Introspection and the questions that have equal population samples will be noted with (N = 20). All the following p-values are given from a one-tailed student t-test, assuming unequal variance between both groups. A p-value will answer if the two sample groups are significantly different by giving a value below 0,05 (Lazar, Feng, & Hochheiser, 2010, pp. 76-77)

| **Dimension** | **Question focus area** | **Natura** $\bar{X}$ $SD$ $SE$ | **Introspection** $\bar{X}$ $SD$ $SE$ | **P-Value** $P$ |
|---|---|---|---|---|
| *Attention Focus* ***(N = 20)*** | • During the experience, my attention was on: *Exploring the world* | 8,5<br>2,01<br>0,45 | 7,95<br>1,57<br>0.35 | 0,170 |
| | *The story in the experience* | 4,9<br>2,61<br>0,58 | 6,6<br>1,95<br>0,43 | **0,012** |
| | *things outside the experience (personal issues, surroundings)* | 3,4<br>2,41<br>0,53 | 4,15<br>2,90<br>0,65 | 0,190 |
| *Narrative Presence* | • At the end of the experience, the story was finished – unfinished. | 2,5<br>1,34<br>0,35 | 3,05<br>2,31<br>0,54 | 0,201 |
| *Comprehension of Narrative* | • The story experience, I had, was: Abstract – clear (intelligibility) | 4,71<br>2,33<br>0,62 | 5,22<br>2,28<br>0,53 | 0,271 |
| | • The happenings throughout the story[39]: Was completely unstructured – Had a clear common thread | 3,78<br>2,54<br>0,68 | 5,55<br>2,09<br>0,49 | **0,022** |

[39] This question also regards cause-effect relationship throughout the story

| | | | | |
|---|---|---|---|---|
| *Emotional Engagement and Character Identification* | • The story experience I had, affected me emotionally: not at all – very much | 6,42<br>2,02<br>0,54 | 5,72<br>1,56<br>0,36 | 0,145 |
| | • I was emotionally affected by the actions I performed in the experience: not at all – very much<br>***(N = 20)*** | 4,9<br>2,93<br>0,65 | 5,6<br>2,28<br>0,5 | 0,202 |
| *Experimentation* ***(N = 20)*** | • During the experience, I experimented with: Changing the outcome of the story (Checking if my choices influenced the story experience) | 3,05<br>2,18<br>0,48 | 4,45<br>2,30<br>0,51 | **0,028** |
| | Playing different roles (Taking different identities for myself) | 2,1<br>1,25<br>0,28 | 2,2<br>1,0<br>0,22 | 0,391 |
| | Trying different possibilities (attempting to interact with things) | 5,9<br>2,31<br>0,51 | 7,4<br>1,46<br>0,32 | **0,009** |
| | Navigating through different paths in the environment | 8,4<br>2,21<br>0,49 | 8,15<br>1,42<br>0,31 | 0,336 |
| *Disengagement Causes* ***(N = 20)*** | At the end of the experience, you stopped playing[40]. Please lists the main reasons for disengaging with the experience: The narrative situation (A specific situation in the story) | 3,2<br>2,44<br>0,54 | 4,6<br>2,64<br>0,59 | **0,045** |
| | The character(s) (for instance if the characters are dull or if you are "out of character") | 3,35<br>2,18<br>0,48 | 3,5<br>2,06<br>0,46 | 0,412 |
| | The story world (The entire story) | 3,65<br>2,45<br>0,54 | 3,05<br>1,66<br>0,37 | 0,186 |
| | The virtual environment (The game world itself) | 3,45<br>2,85<br>0,63 | 3,3<br>2,49<br>0,55 | 0,430 |
| | Other **(No p-Value presented. It is not** | 5,5<br>3,83 | 6<br>3,53 | |

[40] The "stopped playing" might change across the different tests, since some experience might have an ending

| | | | | |
|---|---|---|---|---|
| | **comparable since it is not labelled)** | 0,85 | 0,79 | |
| ***Total*** | The values of all the averages of the narrative engagement. | 4,57<br>1,88<br>0,48 | 5,08<br>1,78<br>0,43 | 0,208 |

Regarding the level of attentions, the results are very interesting. There is a decreasing attention level towards exploring the world (though not completely statistically significant, P = 0,17), and a statistically significant increase in attention towards the story (P = 0,012). This could be because of the fact that participants pay more attention to the environment when no other elements are there to distract and more attention towards the story, since presenting a character gives more story material to let the users construct their own story. On the other hand, it seems that some of the attention imposed on surroundings or personal issues, as there is an increasing attention towards this (P = 0,19). It could be because of the fact that participants were in a more stressed phase, since all were university students possibly focusing on their own projects.

There is a slight increase in narrative closure; however, it is still in the very low end, indicating that participants did not consider the story as finished. Despite this, the standard deviation of this question is quite high on the introspection level, suggesting more parted opinions towards this. Looking closer at the results, two participants (*Participant 3, male, immersionist,* and *Participant 15, male, immersionist* - answering 8 and 9 on a 10-point scale) are increasing the average. Otherwise, it is roughly the same clusters of closure in the two levels. On the other hand, achieving closure does not belong as a design goal in Introspection, but in Causation, derived from Ryan's sixth level on the narrative scale.

An increase is also seen in narrative intelligibility (P = 0,271), however not significant and the story, not surprisingly, remains on a somewhat abstract level. This could be because no other thing than a character and buildings are provided from the author. On the other hand, a stronger cause-effect relationship is interpreted in the Introspection level, giving a significantly different P-value (0,022). This might be because of the creature's reoccurrence throughout the experience, giving a higher notion of causation due to its somewhat repetitive behaviour.

A somewhat surprising result, is to view a decrease regarding the emotional influence of the experience (P = 0,145) which is close being significantly different. It is unknown what might cause this, but one could speculate that it could be because Natura provides nothing much to take the attention away from the environment, which could result in becoming a stronger sensory experience and thus more emotional. However, there is an almost opposite result regarding whether participants were emotionally affected by their actions performed in the experience (P = 0,20), which indicates that giving the user interaction can increase the emotional level. However, the results regarding emotions are not valid, since participants are not necessarily aware of their own emotional level.

Regarding experimentation there is a significant difference in experimenting with agency, i.e. changing the outcome of the story (P = 0,028), though still in the low end, it can be considered positive in adding narrative control. There is also a significant difference in interacting with objects and surroundings (P = 0,09), which might seem obvious since interaction is not provided in Natura. Playing different roles is almost completely out of the question, which might be because the experience is played in first person and

no character customisation is given. Additionally there is no real difference in navigating through the environment (P = 0,336), but a very high score in both experiences, indicating that when participants are given an open world, they experiment a lot with trying different paths through the environment, being highly aware of their navigational agency. It could also be argued that the high values in navigation, simply is because participants are not that drawn towards the story, and because of this, people are more interested in navigation and exploration than seeking out the story.

It was clear that the majority of the disengagement causes were not the labelled ones, since 15 out of 20 participants argued for other disengagement causes. Most of these were causes such as *"Nothing more to explore"* (participant 18, female, socialiser), *"I couldn't figure out the story"* (participant 4, female, immersionist). Another participant was aware of the order of events *"The order of events experienced"* (participant 3, male, immersionist). Though negative towards the goal, there is an increase in disengaging with the narrative situation. This might be because no story was provided by the author in Natura, but a template of a narrative was given in Introspection but no ending was written. As such, some participants might feel cheated in not receiving closure or resolution to their answers.

Looking of whether the participants' were able to identify character goals, there is a very high positive increase between Natura and Introspection with an increase from 15% to 80% answering "yes" (see Figure 29). It indicates that even though the creature was not given prewritten goals from the author, the participants still imposed goals upon it.

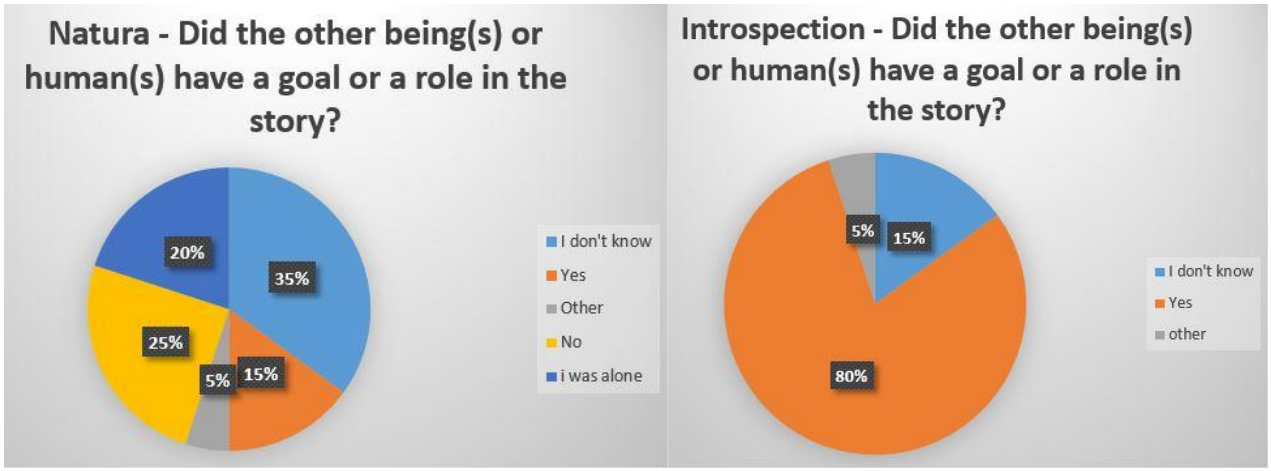


*Figure 29 - Pie charts showing the results of the goals of other characters in the experience. On the right, we see no answering "no" and the answer "I was alone" is obviously left out of the questionnaire for the Introspection level*

Regarding the purpose of the other character(s) many participants agreed that the creature was there to guide them or trying to tell them something: *"A presence was guiding me/trying to make contact, in order to solve a mystery"* (participant 2, male, immersionist). Others were more in doubt of its goal *"The character you keep seeing appears to want to tell a story, but I can't quite figure out if that is its purpose or if it's simply there to guide me to points of interest."* (participant 8, male, immersionist).

Overall, unfortunate towards the goal of the project, there is no significant difference in the total values (P = 0,208). However, engagement did increase in almost all aspects. A larger number of respondents could possibly be enough to lower the p-value to under the required 5%, giving a value below 0,05.

# 11 Discussion

The discussion section will work as a reflective description of the elements in the report, the missteps, the accomplishments in the methodological approaches, and the results of the two tests. The section will also bring alternative approaches towards methods, theory, and the design, together with thoughts of future work.

## 11.1 Method

The main purpose of the project was to confirm the validity of the framework by observing an increase in narrative engagement across the levels, but it was additionally created to facilitate the design process of ES experiences. It would prove interesting to let existing game designers use the framework as a formula for creating their own experience and through qualitative observations and interviews, improve, and validate the framework. It could also prove valuable to test whether game designers would actually be able to understand the framework and its guidelines or if the guidelines should be presented in a clearer way. The questionnaire could additionally have been designed to test the design guidelines separately. Making a within-group test across the two levels could also give more direct results, since the results of each participant could be compared across the levels.

Overall, the method seems quite well established; however, a few things could have produced results that would have been even more detailed. For instance, one could take a qualitative approach that could give more perceptual answers, regarding what the users felt and thought during and after the experience. This is something that qualitative questions cannot answer. As an alternative, the "think-out-loud" method could have been used to give immediate results by letting the users talk about anything that

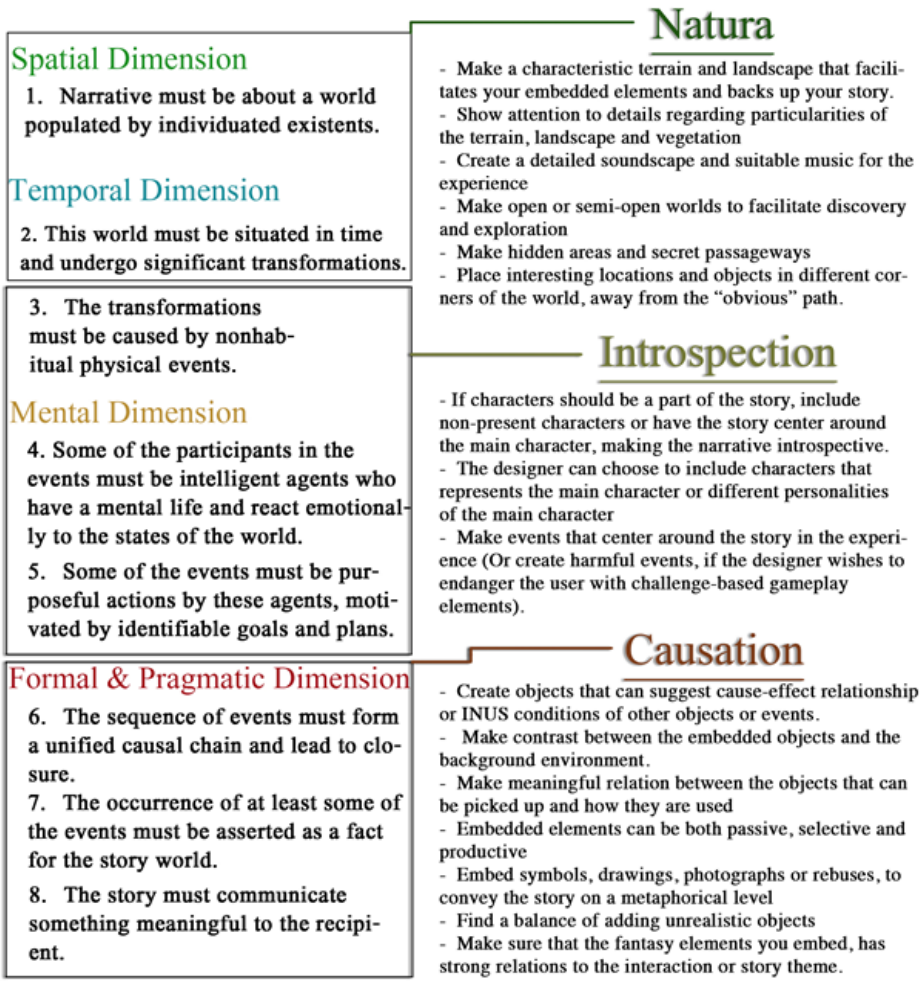


*Figure 30 - The design guidelines are a bit inconsistent in some of the levels, compared to Ryan's guidelines.*

comes to their minds when playing (Isbister & Schaffer, 2008, pp. 50-51). One downside to this method is that it seems like an immersion break, to make the users constantly have contact with the real world and increasing their awareness towards the research experiment rather than the sensory experience. Alternatively, one could conduct a qualitative focus group session with three to four participants, after the experience and let them discuss the narrative experience.

If we look at the dissection of Ryan's narrative scale and the converted requirements for each level, Natura Introspection and Causation, reflectively we get the idea that the level of narrative material does not seem to be equally increasing across the three levels (see Figure 30). The step between Introspection and causation is much larger than the step between Natura and Introspection. For instance, this could be facilitated by splitting the Causation level into two levels in order to have an increase that is more gradual. Generally, the converted guidelines could be given more thought to Ryan's items. For instance in introspection, the creature does not react completely "emotionally to the states of the world" (4) and the Natura level did not have any "significant transformations" (2). That being said, the Causation level seem to follow Ryan's items slightly better than the two other levels.

Not only do the results indicate an increase in narrative engagement, they also imply that there is some grain of truth in Ryan's work. Even though there were few questions from the questionnaire answering Ryan's items, it would have proven interesting to validate each point in her scale, disregarding the narrative engagement questions to validate her work properly. Implementing and testing the third level, Causation, could clearly also give a more complete result of the framework.

The chosen methodology can be considered as slightly unfitting when thinking about the fact that Schønau-Fog, Louchart & Soto-Sanfiel's list of items is meant for a full-blown narrative experience. It does not regard Ryan's scale, nor the three levels I have established in this project and therefore the measurement of the narrative engagement could maybe have been customised for each level. For instance, the closure question should be in the causation level where closure is actually desired from the designer and the question regarding character goals could be left out in Natura where no other characters are present. On the other hand, comparing to two levels would then be difficult. Moreover, including all questions in each level has provided interesting results.

As mentioned earlier in the report, it could have proven useful to back up some of the more sensory measurements such as emotions and their arousal, by using simple psychophysiological tools such as HR, GSR or EMG. They might also be able in providing some interesting results regarding the narrative engagement. More in-game metrics would have been a better choice if more resources were given to the implementation. The entire questionnaire regarding narrative engagement could be embedded inside the experience to make the test process less intrusive without breaking the immersion too much.

In addition, the questionnaire could have been designed such that it did not split into two based on whether participants had a story experience or not. The narrative engagement would probably just be lower if people did not have a story experience, making the results easier to compare and I would avoid having unequal sample sizes. The ultimate purpose of ES experiences is to be enjoyable by the users. Therefore, measuring the enjoyment could have proven valuable.

## 11.2 General

Generally, there is a positive increase in the level of perceived narrative. It is especially surprising in Natura with only two of Ryan's items embedded and still 70% were able to construct a story. This can be considered successful towards the goal. Opposed to this, many of the stories retold from Natura are very sketchy and short. Many do not contain either cause-effect relationship, plot or structure. This makes it difficult to know for sure, if an actual story was perceived *during* the experience, or simply if participants were able to tell any story (made up on the spot) based on the experience.

One idea I came up with during the process (which was later put aside) was to include some classical game-design aspects, rules, goals, and meaningful play, for each of the three levels respectively. Natura would only consists of rules, with no goals or purposeful interaction. Introspection would then include both rules and goals, giving players a purpose in the experience (and maybe even a winning condition). Causation would have both rules, goals and meaningful play, by including a stronger cause-effect relationship in the story and let meaningful interaction be connected directly to the story in the experience.

As known, questions were added to the questionnaire in addition to the demographics and narrative engagement questions. The results from these could be compared with the narrative engagement to look for any patterns. If more resources given, each participant could be evaluated separately, giving specific result.

Almost all of the engagement items increased and there were indeed significant differences in some items, confirming that the framework is partially successful in providing narrative material. However, the overall increase across all items was not statistically significant. In the future, the third level will be implemented too give a complete result of the evaluation of the framework. To get closer to a statistically significant result, a larger number of respondents, alternative qualitative methods and perhaps a revision of the methodology could increase the validity of the framework.

# 12 Conclusion

Due to the lack of research in this specific corner of interactive storytelling and the pre-existing knowledge gained through designing and investigating "Environmental Storytelling" experiences in 2½ year, it was desired to establish a framework and a conceptual toolbox. It was believed that the result could contribute with some valuable analytical and design-oriented aspects to the world of interactive digital storytelling.

To approach the creation of the framework, the main analytical concept needed to be reviewed and discussed. This review encompassed how to use interactive narrative theory in ES experiences, by looking into definitions & understanding of narrative, form, plot, cause-effect relationship, drama management and user experience features such as emotions, immersion, and introspection. Ryan's theory of viewing narrative as a scale inspired me to divide environmental storytelling into three separate layers of narrative based on her list of items. As such, the narrative engagement should increase across each level, resulting in the final problem statement:

*"To what extend is it possible to increase the user's narrative engagement across three distinct experiences, designed by using the established framework of environmental storytelling, as a set of design guidelines."*

To establish the guidelines, the main analysis dissects the major components and aspects of ES that designers should keep in mind, such as how to design objects, analogies, scenery, challenge fantasy etc. to effectively and aesthetically induce user enjoyment.

From here, the entire framework was established together with the given guidelines. The guidelines were matched with Ryan's eight scalar items of narrative and three levels, Natura, Introspection and Causation was established. The methodology for evaluating the framework was inspired by Schønau-Fog, Louchart & Soto-Sanfiel's list of quantitative narrative engagement items. The list of items provided the opportunity to construct a more in-depth investigation of the level of engagement on the narrative level. From this, a null-hypothesis was established to ultimately confirm or reject the final problem statement:

*$H_o$ – There is no significant difference between the user's narrative engagement levels, across the three different stages of environmental storytelling*

Two distinct computer game experience, Natura and Introspection was designed and implemented in Cryengine SDK, measuring the narrative engagement in two separate groups with a total of 40 participants with 20 in each group.

The results indicated an increase in almost all engagement aspects, but overall the difference was not statistically significant in order to reject the null hypothesis. A, revision of the questionnaire, a larger amount of respondents or alternative approaches to the method might give clearer results on the matter, in order to fully validate the framework.

I believe that, given more effort and time, the framework can provide something valuable to both researchers and designers in the field of interactive digital storytelling.

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# 14 Appendix

## A. Dear Esther, Journey and Myst (From project report: Aporia – A Research of Environmental Storytelling and Emotional Involvement)

**Dear Esther**

Dear Esther is not build around goals and there are no action filled cut scenes and there is no AI, instead the player should explorer the island where the game takes place. This combination of no goals, no action sequences and no AI makes, according to the creator Dan Pinchbeck, *"the player's engagement with the piece *Dear Esther+ rest entirely with the narrative, visual environment and audio"* (Pinchbeck, 2008). On the island, the player is also able to find drawings and pictures, which all give hints towards an understanding of the story. Together with the pictures, candles were placed which the player could see from a distance. This gave an indication of in which direction to move, thus pushing the story forward. This is an interesting way of guiding the player; instead of denying the player access to certain areas or forcing the player to move forward the player is encouraged to proceed.

In Dear Esther, there is no interaction with objects in the game, and this lack of interaction functions partially in Dear Esther and it creates a new way to play, or in fact, experience a game. Even though the story is semi-randomised and the content can be interpreted in many ways, the path you follow though the landscape is linear opposed to the previously mentioned quote about the game being non-linear. At some points you can go away from the path, but you will not discover any hidden pieces of the puzzle and

You will have to go back to the path. This linearity becomes rather frustrating and instead of exploring every corner of the island, you wade from one place to the other through the game. As said, the engagement of Dear Esther rest entirely with the narrative, but the island invites the player to discover every corner of it and therefore it is shame that the story lies on such a linear path and that there was nothing to interact with. In addition, the island holds great potential to hide objects and clues relevant to the story and letting the player discover these, but this has not been utilised. The environment in Dear Esther is very tantalizing and it is enjoyable to look at the different sceneries on the island. The island gives a convincing image of a deserted island and the feeling of loneliness is essential and makes you want to discover more and more of the story and the mysterious atmosphere is an essential catalyst in the game. The feeling of loneliness, the island and setting together with the narrative creates a coherent whole. Making a visually attractive landscape that fits the story, as in Dear Esther, is something, which Aporia should achieve as well.

The lighting is also very important for the atmosphere and it changes from dim afternoon light to moonlight during the game. There are not any complete dark areas and this makes Dear Esther appear mysterious rather than creating an unpleasant scary experience (See Figure 2). This was particularly good and worked well in context with the underlying story. In short, lighting is very good to set the mood of a game.

Figure 2 – Screenshot from Dear Esther

The sound in Dear Esther is also very important for the mood and the music composed for the game is very evocative and it binds the story together. This is something Pinchbeck (2008) became aware of when developing Dear Esther: *"The importance of music became more apparent as the iterations progressed. *…+ it was critical to establish a continuity of mood, which allowed us to be more fragmented with the actual text. *…+ music also helped to create an affective score which enabled us to manipulate the player's emotional experience, orientation and position in the wider story arc, and even adjust exploration."* (Pinchbeck, 2008).

Regarding its overall narrative Dear Esther can primarily be considered as an evoked narrative in accordance with the four types of narrative presented by Henry Jenkins (2004), because of the setting and spatial design. However, Dear Esther also contains some elements of emergent narrative since the player can interpret the story in many different ways.

### Myst

*Myst* is an explorative first person adventure game from 1993 by Rand Miller and Robyn Miller where the player navigates around the island in pre-rendered stills. In one of the sequels *Myst III: Exile* from 2001 the stills was upgraded to pre-rendered 360-degree images with added animations with footage of real actors. In *Myst III: Exile* the added characters work as storytellers but they do not add any interaction element to the gaming experience. In *Myst,* the player uncovers the back-story by solving puzzles and finding items and clues. Besides the story, *Myst* also focuses on interaction, and the player interacts with objects by clicking or dragging and this control scheme is somewhat similar to the one in *Amnesia – The Dark Decent*. Uncovering the back-story is not intrusive, but an important element for the overall experience: *"It gives you the 'a-ha' feeling, and if you can do that where it doesn't seem like a game, where you are part of a world and naturally making logical connection, it feels real"* (Rand Miller in (Gillen, 1994)). *Myst*, as *Dear Esther*, does not have any time-constrains and the player can unfold the story in his own tempo, which enables the player to enjoy the environment. This is something to remember when designing the gameplay

for Aporia; not forcing the player forward by a time-constrain but letting him experience the environment in his own tempo and getting an "a-ha" feeling when finding connections in the story.

### Journey

In *Journey,* the player has to uncover the story while playing a game that involves no text or narration. Some of the story is told through wall-murals as cut scenes in a fashion almost similar to hieroglyphs but more visually descriptive. The game would explain a story with caricatured elements from gameplay, such as the character and buildings and with glowing points and lines of light resulting in a story and narrative very open to interpretation. Seen in Figure 10, is an example of such a sequence with a mural from journey telling a story. This particular mural depicts white caricatures of the player's character (which is red) standing around, and a series of machine-like objects generating what appears to be light and power in the midst of ancient buildings. These murals were only slightly animated with the points and lines of light expanding from left to right.

**Figure 10 – Storytelling in Journey (PS3).**

This has provided the project with the idea of telling a story with something resembling "hieroglyphs" and through this method achieve different interpretations for the player, as well as his/her possible interest in decoding these, as they are an example of an embedded narrative which this project aims to create.

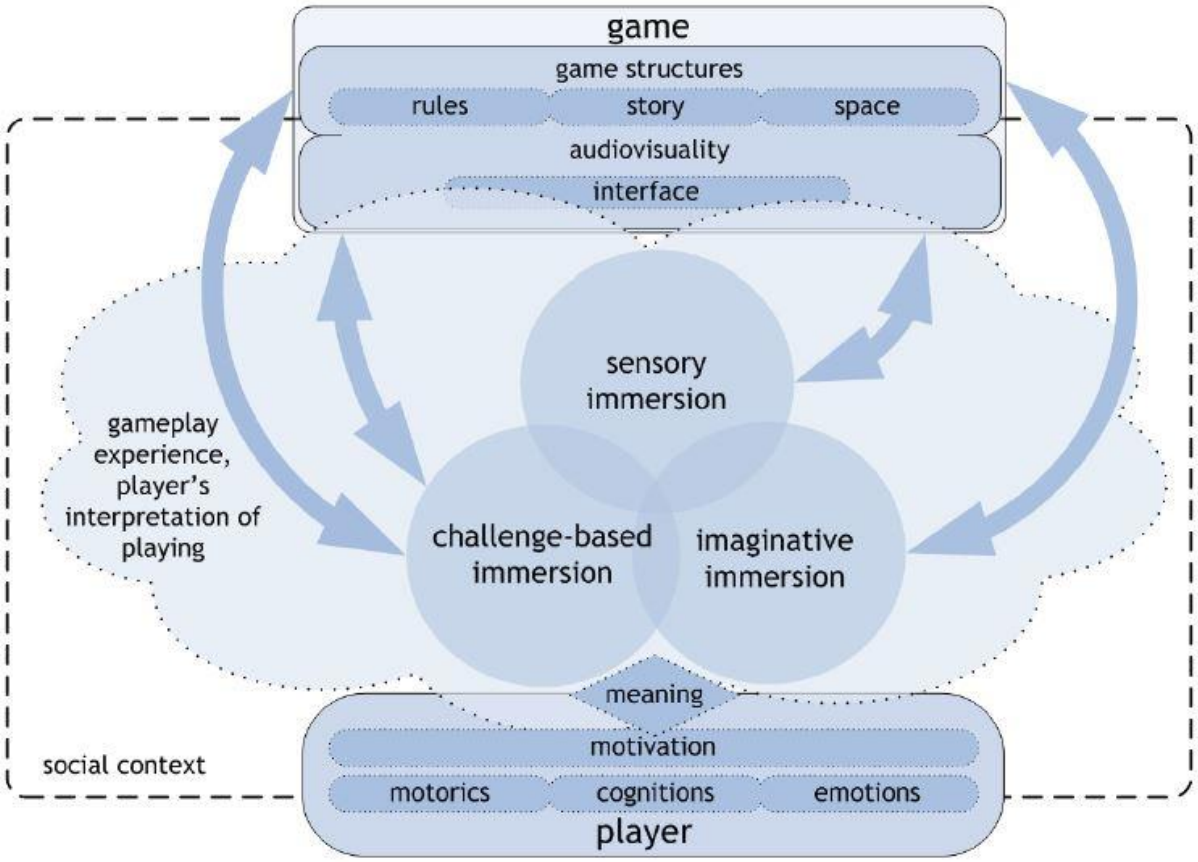
Furthermore, notes have been taken in Journey's stunning aesthetics that often involved simple areas and environments, with lights and interesting objects guiding the player through the game.

## B. Memoriam

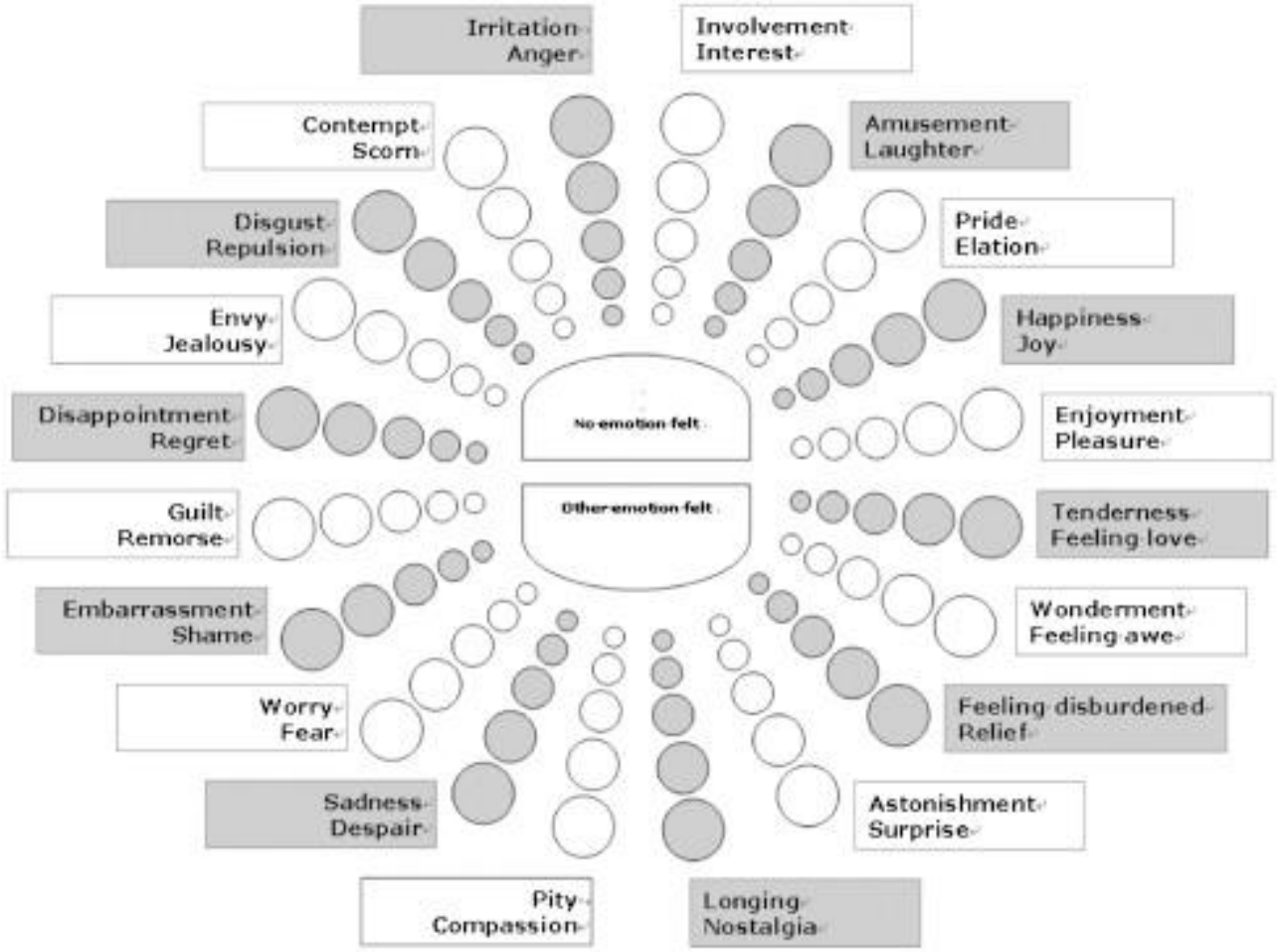
Memoriam is a part of a university study that investigates Productive Interactivity in Emergent Narrative worlds. It is a refinement of the concept of environmental storytelling and the computer game Aporia. This

project has focus on involving the user in the authoring process with the use of Ryan's concept of productive interaction. The productive interaction is based on the concept of memory. Each person playing the experience, can be interpreted as an instance or representation of the same person, leaving short or long-term memories in the story world which represents the mind of one single person as a limbo with a tumultuous of memories that players can create, share and view. As a player, you suffer from memory loss and are unable to experience the entire world until you help remembering your life by placing objects and writing diaries from your past. As you do this, the level will expand, allowing you to progress. This will allow for greater replay values in environmental storytelling experience.

## C. Immersion table



## D. Geneva Emotion Wheel



# E. General questionnaire

### 14.1.1 Before the experience

## Natura - The Devil's Hand

*Required

## Before the experience

**Gender** *

- Male
- Female

**Age** *

**How often do you play computer games?** *

- Daily
- Weekly
- Monthly
- Less than monthly
- I do not player computer games

**Please list your ulitmate favourite game genre** *
Even though you might have more than one, please list the one you enjoy most

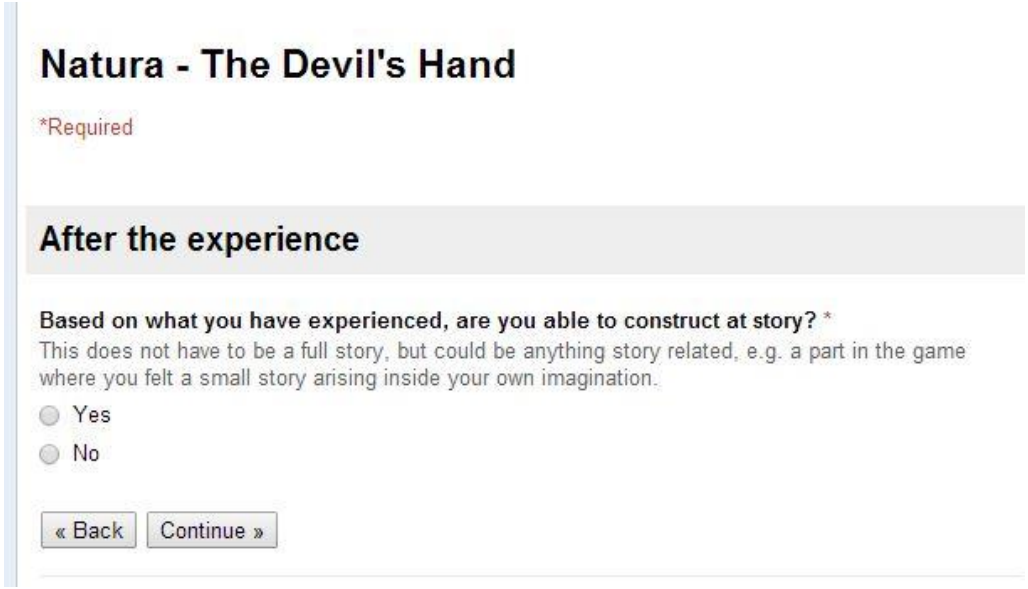
- ○ Action
- ○ Adventure
- ○ Roleplaying
- ○ Racing
- ○ Strategy
- ○ Platform
- ○ Sport
- ○ Fighting
- ○ MMORPG
- ○ Puzzle
- ○ Horror
- ○ Music
- ○ Simulation
- ○ Party
- ○ MMO
- ○ I do not player computer games
- ○ Other:

**What motivates you the most to play computer games?** *
Please define the highest motivational factor you have for playing computer games

- ○ Progressing in the game and earning points/rewards
- ○ Trying out different game mechanics, such as shooting, jumping, creating strategies etc.
- ○ Competing with myself or other players
- ○ Interacting with characters or other players
- ○ Establishing relations with other players inside the game and/or in real life
- ○ Cooperating with other players or computer controlled characters
- ○ Discovering new areas and locations
- ○ Playing different roles
- ○ Creating and costumising characters
- ○ Being in another reality
- ○ I do not player computer games
- ○ Other:

Continue »

### 14.1.2 After the experience



**Natura - The Devil's Hand**

*Required

**After the experience**

**Based on what you have experienced, are you able to construct at story?** *
This does not have to be a full story, but could be anything story related, e.g. a part in the game where you felt a small story arising inside your own imagination.

- Yes
- No

« Back | Continue »

### 14.1.3 Story experience

## Natura - The Devil's Hand

*Required

### Story experience

**Please briefly describe your story experience** *
Try to advoid just describing what happened - "I walked through the door, then i took the elevator". Instead try to describe it as a story - "I had to slay the dragon in order to save the princess from the castle"

**The story in the experience was:** *

- ○ Provided to me through the experience
- ○ Made up from my imagination (based on what i experienced)
- ○ Both
- ○ Other:

**The story experience I had, affected me emotionally** *

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Not at all | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Very much |

**At the end of the experience, the story was:** *
Was the story experience you had, finished or unfinished?

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unfinished | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Finished |

**The story experience, I had, was:** *
Remember, even though the things you experienced in the environment was abstract, you might still have a clear story from your imagination (which is what you should answer below)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Abstract | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Clear |

### 14.1.4 No story experience

**Natura - The Devil's Hand**

*Required

**No story experience**

**Why did you not have a story experience?** *
Briefly describe why you believe you did not have a story experience

**Please select one element, that was not present in the experience, but could aid you i having a story experience** *
There might be more, but please select only one. Ask yourself the question "The experience mostly needed this element (below) in order for me to have a story experience".

- Character interaction and dialogue
- Written text
- Staged objects & buildings
- Symbols & drawings
- General Interaction
- Events
- Other:

**The experience affected me emotionally** *

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Not at all | | | | | | | | | | | Very Much |

**Why?** *
Please describe why you believe you did or did not feel emotions. Was there anything in the experience that triggered emotional response?

### 14.1.5 General

# Natura - The Devil's Hand

*Required

## General

**At the end of the experience, you stopped playing. Please lists the main reasons for disengaging with the experience** *

On a scale from 1-10 what elements demotivated you to stop playing(where 1 is not demotivated at all and 10 is very demotivated by the given element)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| The narrative situation (A specific situation in the story) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The character(s) (for instance if the characters are dull or if you are "out of character") | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The story world (The entire story) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The virtual environment (The game world itself) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other (list whatever number and write below) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**If you chose "other" in the question above, please elaborate below**

**During the experience, my attention was on:** *

On a scale from 1-10, where 1 is no attention at all and 10 is very much attention that you pay to the given element

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Exploring the world | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The story in the experience | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Things outside the experience (personal issues, surroundings) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**During the experience, i experimented with:** *
On a scale from 1-10, how much did you experiment with the following (1 is not at all, 10 is very much):

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Changing the outcome of the story (Checking if my choices influenced the story experience) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Playing different roles (Taking different identities for myself) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Trying different possibilities (attempting to interact with things) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Navigating through different paths in the environment | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**I was emotionally affected by the actions I performed in the experience** *
For instance, when you succeeded with something in the experience, you felt happy or if you failed at something, you felt sad

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Not at all | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Very much |

**What was your goal in the experience?** *

**What was your (or your character's) role in the experience?** *
What was your purpose?

**The experience was:** *

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Incomplete | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Complete |

**In the experience:** *
Please define whether you felt entirely alone or you felt the presence of other beings (you can select more than one)

- ☐ I was alone (there was only me)
- ☐ Other humans were present at the same time as me
- ☐ Other beings (non-human) were present at the same time as me
- ☐ Other humans was there before I was
- ☐ Other beings (non-human) was there before I was
- ☐ Other:

**In case you felt other beings or humans was a part of the experience, did they have a goal or a plan?**
Did the other beings or humans, serve a specific purpose or had a specific goal?

- ○ Yes
- ○ No
- ○ I don't know
- ○ Other:

**If you answered yes above, please briefly describe what goals or purposes the beings/characters had**

**General feedback**
(Aesthetics, Sound/Music, Interaction, Mechanics, Bugs, Duration etc.)

« Back | Submit

## F. Design of Darkmist Forest (Direct extract from Darkmist Forest report)

The level retained its dimensions (500x500m) and basic terrain map, but had many details and elements changed in total. As before, the level had a slight downwards slope from the start to end to gradually lead the player towards the ending. With the development of the final level, focus was directed towards implementing the series of guiding cues giving unimodal stimulus to the player and would lead the player to 6 different nodes on the map. This guidance was implemented in a full game environment that means that the test will be conducted in a rich environment with complex soundscapes and game objects (See Fig. 5 for an aerial view of the final map)

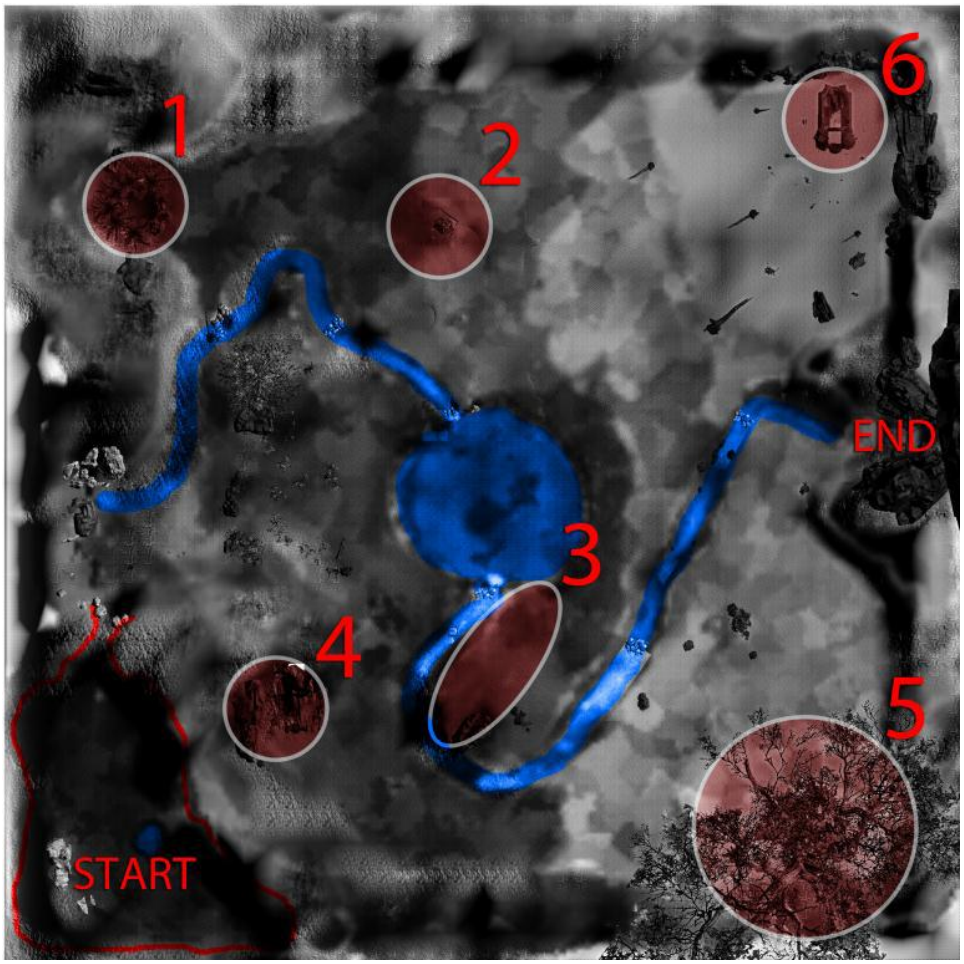



Fig. 5: Final Level with numbered cue- and node areas (map is without vegetation and filler objects). Circles represent locations, not areas of influence.

A guiding cue would lead to, what was referred to as a narrative node that consisted of various objects and changes in environment for the player to explore and discover. These were carefully created as to not feel like rewards to the player, but merely give them a sense of progression and that the cue actually lead them to something interesting, as opposed to having it lead them to nothing which was regarded as being a somewhat disappointing experience.

| Area | Guiding Cue | | | Narrative Node |
|---|---|---|---|---|
| | Event | Player Perception | Attention Category | |
| 1 | Wolf howl | Audio: Long decay, shifting pitch/frequency | Sound; Congruent with environment | **Glade:** Crater in the ground at a clearing in a pine forest |
| 2 | Lamp Light | Visual: Brightness, change in brightness | Light | **Cabin:** Wooden cabin in thick forest with large basement and a tunnel leading to center (swamp) |
| 3 | Ghost (Knud) | Visual: Motion | Movement | **Large Rock:** With large "cave painting" |
| 4 | Glass Breaking | Audio: Sharp attack, high frequency | Sound; Congruent with object | **Underground Cave:** Dark, wet, with strange pyramid. Has glass doors and a broken glass vial. |
| 5 | Gigantic Tree | Visual: Size, Contrast | Landmark | **Climbable scaffolding:** with a treehouse and a mystic box at the top. |
| 6 | Church Bell | Audio: Harmonic, semi-long decay | Sound; Congruent with object | **Monestary:** In ruins, and with a sizable graveyard. |

Fig. 6: Overview of cues and narrative nodes

The six guiding cues and their corresponding narrative nodes were labelled 1-6, and as previously mentioned these were placed in an open game world where the player was free to explore the landscape and find the narrative nodes and cues in what order they chose to. Each cue leads to a narrative node with specific content designed to be at least somewhat congruent to the guiding cue, which the player was then able to explore. The guiding cues can be dissected into three elements, which can be seen in Table 2 with their associated cue and node.

- The Event: Describing what the cue is about and what happens - mostly for reference.
- The Player's Perception: What stimuli the player is intended to perceive at a cue.
- The Attention Category: How we chose to categorize the stimuli concerning player attention.

Additionally, the river winding through the map could be considered a guiding cue from the "path" or "trail" attention category. The player could choose to follow the river around the map as a guiding path, and the level was designed for this, as the river gets relatively close to all the cue- and node areas.

The ending would be triggered when the players had been exposed to all the cues in the map (but not the nodes). This was depending on the player being inside an area where they would have been sufficiently exposed to a cue, meaning that the cue would have the adequate intensity to be distinguishable from the rest of the environment, both visually and auditory. The ending itself can be considered as an "ultimate cue" as it contains many stimuli and modalities as immediately possible that would override other cues and lead the players to it. When the ending triggers the level would go dark, a big white pillar of smoke and a bright light ascending into a star above it would appear at the ending area. The music would change and the ending area would emit a loud sound incongruent with the environment. The game would end when the player entered the ending area, and its sole purpose was to give the player some sense of closure, without being included in the test.

As mentioned, the environment of the final level was designed to have intentionally rich scenery and vegetation (See Fig. 7). It had no elements for the player to orient himself or herself with and as such was designed to have the player feel somewhat lost within the map. There were different areas with varying topography (See Fig. 7) including area defining objects such as tombstones, cliff rocks, and dead trees,

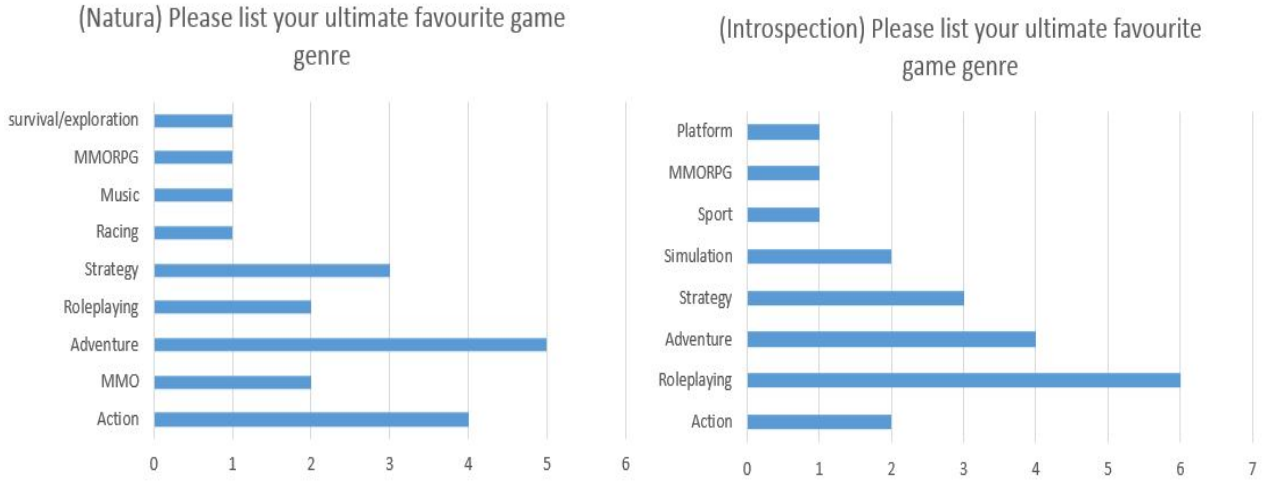
however the level had no rich areas besides the narrative nodes which otherwise might distract the players. Different areas had different particle and weather effects ranging from falling leaves to rain and thunder. The entire level was shrouded in a thick fog limiting ranged visibility and adding to an intended sense of mystery. This also helped obscure the narrative nodes and ensure that they player was only guided towards them by the cues.

Fig. 7: Different Areas in the final Level (a) Start area (b) Swamp in the middle (c) Beginning of the river

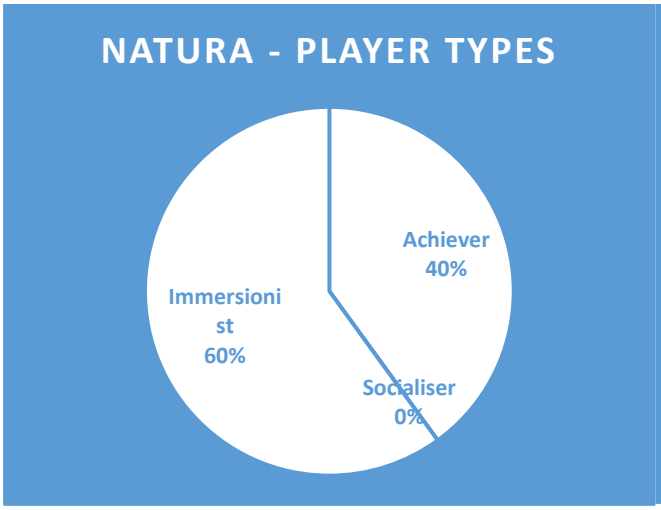
The level would start at a point in time designed to look like 15:00 in the afternoon during autumn, and the time would the progress at an accelerated rate until it reached 22:00 where the level still is not too dark for the player to navigate. Furthermore, all visual cues were designed to function in both light and dark lighting conditions. Additionally, the player was given "a vial" of glowing liquid that he/she could use at any time to illuminate dark areas in the level and reveal cave paintings that were only visible if lit by this special light. A specific splatter of luminescent paint would give away the position of these cave paintings, which were always located inside narrative nodes to facilitate the players generation of story for the environment.

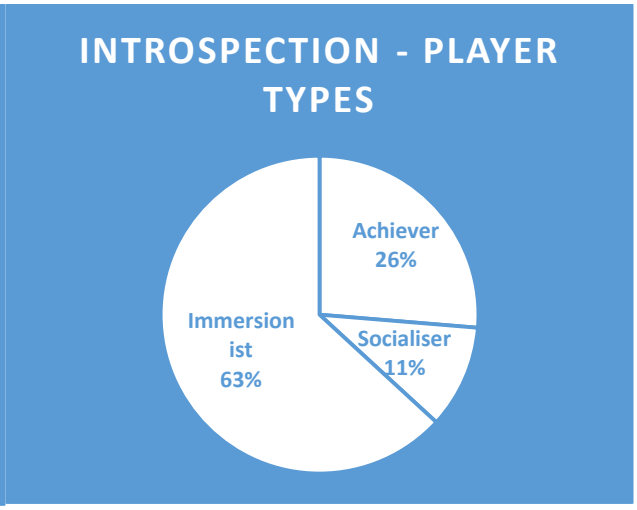
## G. Additional results

The favourite genres across the two levels. There is no major difference, other than more adventure gamers in Natura and more Roleplaying gamers in Introspection.




Regarding player types, we see equal number of immersionsts but more achievers in Natura and more socialisers in Introspection.




## H. Test setup of introspection