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GAME AND MEDIA TECHNOLOGY - MASTER THESIS

Measuring Immersion Through Applying Cinematography to Story-driven Videogames

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Abstract

Cinematographic features such as cutscenes are known to be used by videogames to engage players. Story-driven videogames is the genre which usually requires these features and uses them as a tool to make players feel empathy for characters and storylines. However, there is no study yet which proves to what extent these features can improve an immersive experience.

In this thesis, a comparative study was conducted to verify this claim. Two versions of the same story-driven game scene were developed but only one contained cinematographic features. These features were introduced into the scene with an implemented tool named Timeline Node. Participants played the versions and responded to a questionnaire which was developed to quantify the immersion and the empathy felt by players whilst playing the game. Even though several studies have studied immersion in videogames previously, our study contributes to the researched topic by creating a precise questionnaire that can be used for any story-driven videogame.

The questionnaire allowed us to analyse the data from participants. By analysing the statistics of both groups, it was discovered that the group that played the version with cinematographic features had an increment on the immersion of 14.17% and an increment of the empathy felt by 10.49%. In addition, a significant correlation was found between the empathy felt by participants and how immersed they were in the game. When players experience a lot of empathy, the immersion felt is increased.

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1.- Introduction

1.1.- Context

The videogame market increases exponentially year by year, providing customers all sorts of offers. Customers' needs increase every year due to how quickly the hardware has developed, allowing games to be more demanding and contain much more features. The improvement of technology also caused demand for story-driven videogames to decrease, because players looked for fast action and quality graphics instead of an immersing story. However, the videogame customers' needs have been changing lately. Now, all games can have exceptional graphics; customers have grown accustomed to them thus lowering their capability to impress. Thus, the demand for a better story and characters is rising nowadays.

The videogame consumer's change in needs was seen at its finest in 2015 when the videogame *"The Witcher 3: Wild Hunt"* was awarded game of the year. Not only did it win this award, but right now this videogame is the most awarded game of all time having won 251 different awards [1]. CD Projekt Red, the company that developed the game, has been appraised many times worldwide for what they have accomplished. Their game not only has outstanding graphics, but all the storylines, characters, cutscenes, animations and so forth were the best that could be offered and are still the best today.

Piotr Tomsinski, the animation technical director from the company, hosted a GDC (Game Developers Conference) session where he explained their implementation of a ground-breaking system that allowed them to add as many cinematographic features as they needed to the game. This system, called engine RED 3, allows them to create all the cutscenes necessary, including camera positions and character animations. As mentioned in the GDC talk, this engine is useful for how much it decreases the costs of developing cinematographic features, allowing them to have a large amount of cutscenes which helps them develop the characters and story, thus getting customers more immersed in the story.

Cutscenes are a way of blending points between actions and tend to be more elaborated each time to help a customer be more immersed in the game. Their quality is a must for games nowadays. Despite old fashioned games that have their public, players expect to take out the best of their gaming rigs. That is why, this study intends to conduct a research that will quantify how cinematographic features can be used to engage players.

1.2.- Objective and methodology

There is an assumption that The Witcher's cinematic features are what made this game successful, however, there is no way of proving that this is correct. The aim of this thesis project is to study whether cinematic features can enhance immersion in story-driven games by conducting a comparative study between two iterations of a videogame scene. To achieve this, we first developed a tool to introduce cinematics into a game. This tool was then used for a scientific experiment in which we studied the impact of cinematics on the players by analysing their feedback about their immersion, perceptions and their feelings towards the story and characters of the game.

The cinematics necessary were introduced with a tool that has been developed with Unity3D. This tool allows us to integrate cinematic features into games. This tool, named Timeline Node, has been created at Wispfire, a company that is developing story-driven videogames.

To verify if the claim that *"cinematic features are important for in-game immersion"* is true or not, we designed an experiment verifying their impact on the following three aspects:

- **Immersion:** Feeling that players experience when they are absorbed by an activity. This sensation allows players to feel inside virtual worlds where they relate to its characters and story. Immersion can be divided into three dimensions: sensory, challenge-based and imaginative. **This study will focus on imaginative immersion**, which is related to the empathy that players feel for the characters of the game and the story [2].
- **Time Distortion:** Effect that players experience whilst immersed in a task. This effect makes them unable of estimating how much time they spent on an activity.
- **Narrative Agency:** Empathy that players develop for the characters and story from videogames.

The study's major focus is on immersion. However, to trigger immersion in a story-driven videogame, participants must relate to its characters and the storyline [2]. Thus, an analysis of the narrative agency felt by participants when playing the game will be conducted. Likewise, time distortion is an effect that often appears when people are fully immersed in a task so it will be studied as well [3].

The analysis of these three aspects is performed in a comparative study with two groups. In a between- subjects design, each group of participants played one version of the game. One group played the standard version of the game without cinematic features. The other group played a new version where cinematic features have been applied to the gameplay using the tool we developed. Once participants finished playing, they filled out a questionnaire. Their feedback was used to measure the above factors and demonstrate the differences in level of immersion when using cinematic features.

1.3.- Contributions

The contributions of this thesis can be summarized in three categories:

Technical contribution: We provide a new tool that allows game designers to add cutscenes and camera setups to existing games in a flexible and easy manner. Major challenges that needed to be overcome in its development include:

- Using Unity's new assets which are still under development, which meant a lack of information when developing our tool. In addition, we had to overcome minor errors from the tools which had to be solved in order to make our tool usable.
- Adapt an ongoing videogame which used Unity's default animator machine to use our tool's animations without breaking backwards compatibility, affecting the game.
- Upgrading the videogame project to Unity 2017 in order to use the tools need to develop our tool.

Scientific contribution: Our experiment proves that cinematic features are indeed a key aspect that can improve immersion in video games. Using two iterations of a scene from the videogame Herald, we showed an increase of immersion by 14.17%, narrative agency by 10.49%.

C**ontribution to the methodology:** Although introduced for the particular aim of our research, our methodological approach is of general value and can serve as blueprint for related studies. Our way of quantifying levels of immersion when playing story-based videogames and the questionnaire introduced to measure them are of particular relevance.

2.- Literature Review

The intention of the literature review was to look for a state of the art on the immersion in games. As some of the factors used to conduct this thesis were already described, the literature review helped in creating the roadmap for the primary study endpoint. After the initial investigation immersion, time distortion and narrative agency were found to be core items to consider.

This review lead to a methodology for the intended study objective, where the challenge was to know how to measure immersion in games as a qualitative item to explore and develop.

2.1.- Study Methodology

To develop the methodology needed for the study a review was made using tools that could lead to other studies on the core objective.

The pool of terms searched where: immersion, time distortion, narrative agency, game experience, interactive storytelling. Searches were conducted with different combinations of those terms. To measure immersion, items where needed for the research evaluation and that search gave us the factors that are related to it (narrative agency and time distortion). Web of Science and Google Scholar were used as tools to search for the aforementioned terms in different combinations, to select the literature for the review.

The purpose of this review is to demonstrate that cinematographic features enhance immersion in videogames and that we can measure the immersion felt whilst playing story-driven videogame.

The literature review will be divided in four chapters:

1. A review on how to use cinematographic features in videogames which might induce immersion and see if the new tool is going to provide such immersion effect on players.
2. Analysing immersion's effects and how to quantify them, trying to elaborate a good statistical tool for this purpose.
3. Narrative agency and how to measure it. As well as how the characters and story of a videogame can trigger said agency, leading to immersion.
4. After all items review, last one will be time distortion as time loss is considered an effect caused by immersion1.

Finally, the review will be concluded with a discussion section where approaches that will be taken into consideration will be discussed and how a game-specific research will be conducted in order to research immersion.

2.2.- Literature

This review is a concise description of conjunct of papers that have been investigated in order to find a way of quantifying the level of immersion's impact that cinematography and narrative agency can provide to videogames. It also explains how narrative agency and time distortion can be used as a variable to acknowledge when players are being absorbed by an activity.

2.2.1.- Using Cinematographic Cutscenes in Videogames

Cutscenes have been used in videogames throughout the years. They have been used in gaming since 1980s and have become more complex with time. The first games to use cutscenes were arcades such as Pac-Man or Donkey Kong, but the first time that the term was used was by Lucasarts in the development of Maniac Mansion.

Even though videogames are seen as an experience that requires players to participate, only allow players to observe. This feature can be used to give information to the player about, among others, controls and the plot of the story [4]. Cutscenes are not only a way of showing information to the player, but they also show him the effects of his actions upon the virtual world, making them feel more important. Hence, the player will relate to the story and empathize with the characters in it [5].

Klevjer defines cutscenes as a part of configurative experience inside a videogame [6]. Even though the player does not participate in or control the cutscene, it does not mean that the attention of the player is lowered. If players' attention is not lowered, their immersion will not be broken by cutscenes. On the contrary, cutscenes can help developing immersion.

Klevjer introduces the term "*gameplay catapult",* which is a method of using cutscenes in videogames. When a videogame solely uses cutscenes for climaxes, this is considered a "*gameplay catapult*". This method will build up suspense and create a situation until reaching the end point of the game scene.

In his book, Natkin argues that narrative control, game perception and the playful appeal of game rules will evoke immersion [7]. He believes that videogame cutscenes should have enough film ability to make the players relive a series of emotions they experienced in real life.

2.2.2.- Immersion & Measurement Tools

The concept of immersion has tried to be explained in many occasions, however the definitions are often vague or imprecise. Found are definitions that focus on the awareness of one's surroundings, like the definition proposed by Cairns et al. (2013) [8] "*the sense of being wholly absorbed in an activity to the complete loss of awareness of the real world*". Along with Cairns, Brockmyer et al. (2009) [9] who relates immersion to experiencing engagement whilst retaining awareness of your surroundings. The major problem found when reviewing immersion is that even though papers mention game flow [10], presence [11] and immersion, they do not make an effort to explain the correlation between them, thus ending in an uncompleted analysis of immersion.

Sherry's investigation [12] uses immersion to describe the Game flow state. It is reached when there is a balance between the difficulty of the task and the skills of the player. This state of focused concentration can be broken if the difficulty is too high or the skills necessary are low. A similar pattern is described by Jenova Chen [13] who researched how to maintain a person's flow experience. Chen extends the topic by explaining that the flow zone is a zone where the activity is perfectly balanced and there are no psychic entropies such as anxiety and boredom [14]. Some authors such as Holt describe flow as the feeling that a player experiences when he is totally immersed in an activity [15]. During this activity, the player will lose sense of time and forgets external pressures. That is why videogames that provide flow experiences are the most valued in the market.

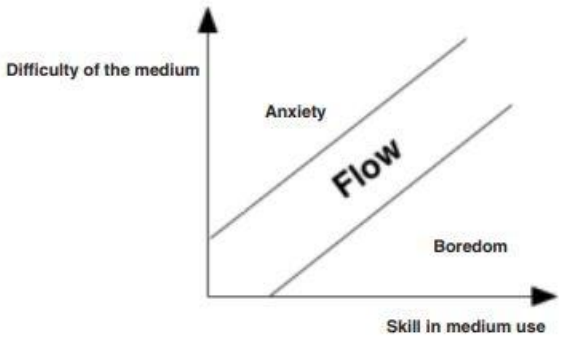

Figure 1.- Graph showing how the balance between difficulty and skill lead to the game flow state.

In the paper written by Jennet in 2008 we find a more extensive description about immersion and its effects [16]. Not only it explains the different stages of immersion, but most importantly, the paper shows the difference between and the relation of presence and immersion. The first stage is called **engagement** and happens when a player is skilled enough to master a game after having learned how to play the game and how the controls work. To reach **engagement**, the player needs time, effort and attention. Next, we find **engrossment**, where the player learns how to deal with the game design features that require skill to merge with the virtual space. In this stage, the player feels less aware of themselves and of the surroundings. Finally, the third stage is **total immersion**. In this stage players are entirely cut off from reality. The chance of reaching this state is very small. However, the previous stages are attained more frequently.

Furthermore, to separate presence from immersion Jennet demonstrates that presence is just a fraction of a videogames experience. They explain this by referring to old games such as Pac-man or Tetris which do not involve presence and still can be very immersive. They show another example which proves that videogame experience can work the other way around. A game can stimulate presence but it can be non-immersive, like a boring task simulator in a virtual environment. Finally, the paper explains that being immersed will lead to players losing their sense of time due to the focus on the task.

In addition, Jennet develops a way of measuring immersion. Objective immersion can be measured by watching the eye movement of participants and the task completion time. Low eye movement is an indicator of focus which leads to immersion. The task completion is needed to compare to the time participants think they spent completing the task. Participants that are more immersed will experience higher time distortions. Additionally, to measure subjective immersion they have developed a questionnaire that must be completed after the participant played the videogame. In the questionnaire there are pairs of questions using positive and negative wording to control wording effects on participants. Brockmyer developed a questionnaire to quantify the levels of immersion too. This test is called the GEQ (game experience questionnaire). It does not use pairings of questions, which makes it

simpler to the test designed by Jennet, however, it does specify how the questions are related to immersion's effects: absorption, flow and presence.

Ermi & Mäyrä found a way to explain different dimensions of immersion [2]. They explain the SCI model which allows them to evaluate different types of game experiences. This model consists of explaining three different dimensions of immersion: **sensory**, **challenge-based** and **imaginative**. These three new dimensions clarify how different types of games affect immersion in different ways. They explain how arcade games were used to challenge people to score the most points whilst playing, in order to enhance **challenge-based** immersion. On the other hand, nowadays games like Skyrim which present a rich virtual environment and storyline will affect **sensory** and **imaginative** immersion. **Sensory** immersion is related to the audio-visual features of the game, while **imaginative** immersion is the dimension that relates to the characters and story elements from a videogame. **Imaginative** immersion occurs when the player gets so absorbed by the story that he identifies with the characters.

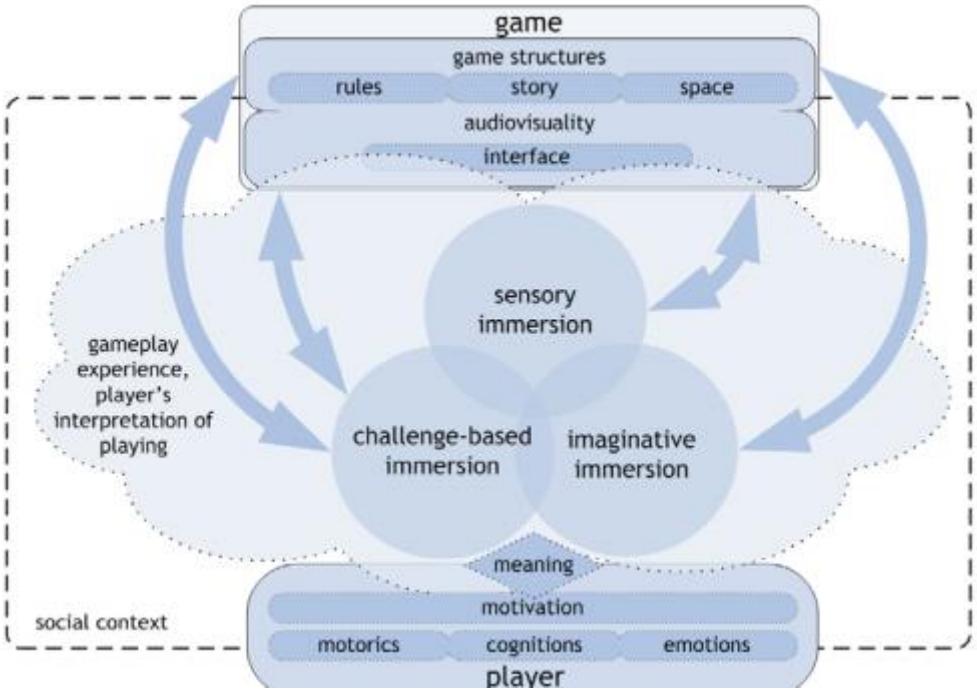

Figure 2.-SCI Model explained by Ermi & Mäyrä where the relations between different dimensions are explained

2.2.3.- Narrative Agency Applied to Games

Good character and storyline development are not the only factors to enhance imaginative immersion in story-driven videogames. Player agency also plays an important role in this videogame genre. Murray's book [17] defines agency as "*the satisfying power to take a meaningful action and see the results of our decisions and choices*". Players feel satisfied by knowing that their actions will change the story and help the characters they empathize with. Murray also explains the three aesthetic categories that can be used to analyse interactive story experiences; immersion, agency and transformation:

- **Immersion**: Is a feeling experienced when the player perceives he is present in another world instead of the real one. This sensation is given when the player is so absorbed by an experience that he will accept the internal logic of it even though it deviates from the real world's logic.
- **Agency**: Is a feeling that the player experiences which originates from taking actions in the virtual world that correspond to their intentions.
- **Transformation**: When Murray describes transformation we can extract three different meanings: variety, masquerade and personal transformation. When the game experience allows the player to transform into someone else during the experience they are experiencing transformation as masquerade. When the player is offered multiple variations on a theme that he can explore and gain knowledge about, then we are referring to transformation as variety. Finally, personal transformation originates when the player can get so influenced by the game experience that it will take him on a journey which will make him change personally.

Salen & Zimmerman (2006) [18] conducted a further study about agency. They stated that "*playing a game means making choices and taking actions. All of this activity occurs within a game-system designed to support meaningful kinds of choice-making*". This statement is their way of connecting the agency felt by videogame players towards the characters and the story of the games.

Mateas & Stern in 2006[19] introduced in agency the concept of "*constrained freedom*". This definition describes how the gaming experience still has two types of constraints inside the gameplay. First, the system will contain material constraints which are defined by the limits of the functionalities in the interactive system of the game. Second, the other constraints will be defined by formal thresholds, which are the amount of possibilities given when dividing the plot of the story. These possibilities will always be finite, meaning that the player will never have complete freedom.

In 2010, Madigan explained that immersion and agency are related [20]. Their relation is a result of agency increasing the emotional investment of the player and affecting his motivation, thus evoking immersion. The research states there are as many ways to increase immersion as there are of breaking it. These ways are divided into four different categories: broken presentation of the videogame world, inconsistent behaviour in the game world, incongruous visual cues in the game world and non-interactivity of the game world. Non-interactivity can be caused in videogames when cutscenes are shown, this can be a great disadvantage in videogames that want to use cinematographic features, such as story-driven games. If incorrectly designed, these features can detach the player's emotional investment in the game even though cutscenes are one of the key features of a videogame to steer its narrative.

In addition, Madigan explains that inconsistent behaviour of the game world should also be taken into consideration. If the player does not expect the behaviour of the game's characters or does not understand the result of their own actions, the immersion and motivation are affected negatively because the player's expectations are not fulfilled.

The Tanenbaums explained in 2009 that player type should also be considered when trying to improve player agency, providing a range of how participants play videogames and their expectations [21]. They introduce the player types from Richard Bartle proposing four

different types: achievers, killers, socialisers and explorers [22]. However, the players who are willing to play story-driven games are expected to be people that want to be impressed by a developed story and characters which turn the game into a unique experience. Hence, the player type approach from Bateman & Boon will be considered [23]. In this approach players are divided in: conquerors, managers, wanderers and participants. These categories are explained by describing player's expectations. The **conqueror** prefers a game where the primary goal is challenge-based and that makes him think and judge. The **manager** prefers thinking and perceiving and they take pleasure in process-oriented challenge. The **wanderer** bases his enjoyment in feeling and perceiving, they search for unique experiences and will stop playing the moment they feel the game is not fun. The last category, the **participant**, bases his game experience on feeling and judging. This player's primary pleasure is the narrative and social play which are offered in emotional or story-driven contexts, allowing them to participate in the story of the game.

Studies on ways of affecting player agency when designing an interactive storytelling game have also been conducted. Figueiredo & Paiva suggest that even though the player should be free to choose any option, the game should use psychological persuasion to influence players in predictable ways [24]. Not only do they address the issues concerning influencing players, they also conducted a successful study where results show that players, when influenced, are more likely to follow a certain branch of the story. By using their method to influences players' choices, agency can be controlled more easily.

Methods to analyse and measure narrative agency inside immersion have been developed: In 2009, Qin described a questionnaire in their paper that could be used to analyse and measure narrative agency inside immersion [25]. The questionnaire is divided in six dimensions: curiosity, concentration, control, challenge, comprehension and empathy. **Curiosity** is the arousal of senses of cognition and attraction to explore the game narrative [26]. Well-developed content makes players want to continue keep playing. They believe that by interacting with the game, they will gain the knowledge to best the game. **Concentration** is the ability to keep focus on the game narrative. Even though Cairns considers that more attention and effort invested in the game will generate more immersion [8], Lazzaro and Keeper also suggest that a proper relative workload is needed to keep players immersed [27]. **Comprehension** is a process of careful observation which allows the players to understand the structure and content of the storyline. Game designers can design a gameplay based on understanding of the story [28], if a player doesn't understand the story he will fail in the game. **Control** is the sense of control over the actions of characters in the videogame. By commanding them, players are translating their strategy and intention in the game world. Kane suggests that to improve both immersion and agency, players need to be given options which impact the game world [29]. **Challenge** is one of the most important aspects of game flow experience. If players feel challenged, they will maintain attention in the task thus keeping them immersed in the game. Finally, **empathy** is the feeling players have when they identify with a videogame character or the story. This dimension has the same effects as narrative agency. The player needs to feel emotionally attached to remain totally immersed in the game and feel like they are part of the story [30].

2.2.4.-Time Distortion

Time distortion is the loss of sense of time that may occur when players are absorbed by an activity. This feeling makes them perceive time spent completing a task differently. Cowley explains how the loss of sense of time is a common effect that happens to players who are fully immersed in a task [10]. Earlier studies written by William James explain there should be a division of the perception of elapsed time into two paradigms [31]. First is **prospective paradigm**, which is also known as experienced duration. If the person is aware that a duration judgement must be made, then we speak of prospective paradigm. However, if the person is not aware that a duration judgement must be made, we speak of **retrospective paradigm** [32].

Prospective paradigm can be seen as a dual task. The individual must divide his attention between temporal and non-temporal information processing. Due to this, papers wanting to study experienced duration will emphasize in attention. Wearden defined a cognitive counter that is used by players to perceive the time that has passed [33]. Their conclusion about prospective time perception explains that if the person tries to focus on the temporal information when doing a non-temporal task, the attention not dedicated to the task will negatively affect his performance. On the other hand, if the person focuses more on the non-temporal task, the cognitive counter will not receive as much time signals thus ending in a misjudgement of the time spent. As seen in the third experiment from Zakay & Fallach [34], the prospective time estimation was related to the difficulty of the task to be completed. The easier the task, the more accurate the time estimation and vice versa. However, they also concluded that the retrospective paradigm was not affected by the difficulty of the task.

Retrospective timing is based in the memory of the subject. It is related to the amount of experiences or events a person can store in their memory during a period of time. Ornstein investigated the effects of stimulus complexity on remembered duration [35]. They suggested that the more complex stimuli are, the more accurate would the retrospective time perception be. However, Block & Zakay show that the evidence provided by previous research was inconsistent [36]. It is found that many other variables affect retrospective time perception without affecting prospective paradigm, such as changing the way the person processes information. All in all, the research paper suggests that more studies have to be made to support their conclusion about the two different types of time distortion [37] [38].

Time distortion concerning videogames was also studied by Rau [3]. They studied the effects of time distortion on novice and expert videogame players to see if they overestimated or underestimated the time played. The paper mention that even though there is a difference in participants' distortion range, due to psychological clock ranges depending on the individual's life, there are two possible outcomes. An overestimation of the time means that the participant could have felt bored or has been induced in an intense period of concentration. On the other hand, an underestimation of the time means that participants had a good and fun experience. Underestimation effects happen because they take less cortical space which consequently is experienced as having taken less time.

2.3.- Literature Conclusions from the literature review

In this research, ways of providing imaginative immersion will be studied. The game used to conduct the research changes the main story depending on the player's choices in the dialogues. In order to keep players fully immersed in the game, there will be a focus on retaining the narrative agency they feel for characters. The players must use this feeling to choose the best path to follow in the story. In addition, cinematographic features will be applied to the cutscenes to improve the level of immersion experienced. We will refer to the stage of total immersion as flow stage. The intention is to never break immersion of players due to a badly developed narrative agency. If the options offered to the player do not fulfil his expectations, they will not feel immersed or connected to the story. The system is expected to always have meaningful actions which carry drama and evoke the player's feelings. Furthermore, for our study, the level of immersion will be determined by using a questionnaire which will help to quantify immersion and narrative agency. Time distortion will also be considered, because Cairns explains that the more immersed players are, the bigger the underestimation of the time spent playing.

The papers reviewed earlier explain that the most efficient way of testing the level of immersion is by using a questionnaire. Many of them use Jennet's questionnaire. However, this considers immersion to be a one-layered concept. Studying immersion this way may cause our study to turn out to be too generic, when there is a focus on one specific dimension of immersion. A more elaborate description of immersion's multiple dimensions can be found in the SCI model from Ermi & Mäyrä. This model explains how videogames can be extremely different yet can still provide the same levels of immersion like the examples provided above which mention the classic arcade Pac-Man and open world simulators. By taking into consideration their study it is deduced that the kind of immersion which has to be studied in this research is **imaginative immersion**, where the players are absorbed by the story and characters of the game.

For this thesis a questionnaire will be developed which will contain the GEQ followed by the questions related to empathy and curiosity from Qin's questionnaire. Due to the fact that Jennet's questionnaire does not segment immersion, the decision was made to use Brockmyer's GEQ (game engagement questionnaire) [9]. This questionnaire allows for a more precise analyzation by segmenting it into levels of absorption, flow and presence. However, to analyse narrative agency, Qin's questionnaire will also be used. The factors from Qin's questionnaire are the ones that relate solely to narrative agency. The other factors are irrelevant to us, because the questions which reference them are similar to the ones of the GEQ. Our questionnaire will be provided to the participants after testing our game.

Concerning narrative agency, thanks to Murray's aesthetic categories it is clear how agency is related to the levels of immersion as discussed in Jennet's paper. Their description of transformation is the same concept as the phase of total immersion, where the player feels like he is someone else and he does not feel part of the real world for a certain amount of time. To analyse narrative agency, as explained before, a part of the questionnaire will contain questions concerning agency, which we will use to show that the player relates to both the story and the characters. They also will be used to prove that immersion was never broken by any of categories explained by Madigan, such as unexpected behaviour or events in the game world after an action of the player's choice.

The personal details section from the questionnaire will contain some basic questions for participants, so they can be categorized with the Bateman & Boon approach. This will help us divide players into categories and clarify who should have higher ratings of immersion. For example, players who take more pleasure in narrative and story-driven games are categorized as *participants*.

The research paper from Figueiredo & Paiva motivated this research to create a scene with high emotional drama. In this scene, one of the characters tries to jump off a boat in an attempt to commit suicide, however, the main character is trying to convince him not to jump. Figueiredo suggested that even though the player is free to choose between different options of dialogue, certain branches of an interactive story have to be more tempting in order to influence the player to take a specific branch of the story. Thus, it is far easier to control player agency. Therefore, we implemented some branches that will be more tempting for the player, to guide him to the good ending rather than the bad one.

Thanks to Sanders & Cairns we discovered that time distortion is a key effect that is produced when someone is immersed in an activity. More attention increases immersion in players, which makes them lose the sense of time. The fact that we can divide it into two paradigms following Zakay & Block's paper allows for a more thorough analyzation of the time distortion effect desired for our game. In this case, the focus will be on the retrospective paradigm, due to the fact that still, after several experiments in this area, the easiest way of recording retrospective time distortion is asking the participant an estimation of the time they think they spent to complete the gameplay. Participants are not aware that they will be asked for a time estimation, so they won't be conscious of this during gameplay. They will have to remember the events as stored in their memory and based on that, make an estimation. Moreover, since problems have occurred trying to analyse and validate time distortion with the Stroop test [36], a decision was made to conduct the experiment in a lab environment, in a room without windows so that participants will receive as little feedback possible of other events which may help them to calculate the time of game play, such as the orientation of light.

Finally, Rau's study enables us to understand thoroughly why participant will underestimate or overestimate the time that they have spent playing the game. This study considers that due to the dramatic content of the scene (suicide attempt) they will overestimate their times because they will immediately be immersed and concentrated on choosing the correct dialogue answers to try and save the videogame character.

3.- Experimental Approach

3.1.- Research Question

To achieve the aim introduced in Section 1.2, we address the following research question: "*Can cinematographic features improve immersion in story-driven videogames?"*.

We particularly focus on the genre of story-driven games, because it relies mostly on its skill to make players feel engaged by the characters and story of the game rather than challenging features or impressive graphics. As a consequence, it allows us to study the dimension of imaginative immersion.

As stated, we will answer this question via a comparative experiment studying a combination of three different factors: imaginative immersion, narrative agency and time distortion. Imaginative immersion is one of the three dimensions of immersion from the SCI model. It is directly related to story-driven videogames, because it is enhanced by getting absorbed by the story of the game and empathising with characters. The feeling which makes players feel empathy for characters and story is narrative agency. In addition, time distortion is a disorder which happens when players are fully immersed in an activity. Therefore, we will try to measure the time distortion felt by participants to see if we can relate it to their level of immersion. These factors will be measured using a questionnaire that participants will answer after playing.

- **A - Imaginative Immersion** is, as explained before in Section 2.2, an immersion dimension where the videogame players get absorbed by the story and characters of the game and feel connected to both.

- **B - Time Distortion** happens when participants are so immersed in a task that they lose sense of time. This disorder is proven to be a sign that the participant is fully immersed. Therefore, time will be recorded. The questionnaire will have a section focused on discovering how many events from the gameplay the participant remembers, including a self-estimation of the time.

- **C - Narrative Agency** is the feeling that players develop towards the characters and the story of a videogame. A section of the questionnaire will be used to quantify the levels of agency that participants develop during the test.

Generally, we expect that cinematographic features will have a positive impact on all of these aspects. We formalize this assumption in three hypotheses:

> **H1.- Participants that play the game version with cinematic features will have higher immersion according to their statements from the questionnaire**. We expect to prove this hypothesis through the cutscenes aggregated to the game play, which will trigger narrative agency. This, in turn, is known to evoke imaginative immersion in players.

H2.- Participants that play the game version with cinematic features will have a bigger underestimation of their gameplay time. If the first hypothesis is verified, that is, if participants are more immersed whilst playing the new version, time distortion will occur. Time distortion appears when players experience higher immersion. It is more likely that participants which play the new version will underestimate the time played more than participants who play the game version without cinematographic features.

H3.- Participants who felt more attached to the characters (narrative agency) will be most immersed. Taking into consideration Ermi & Mäyrä's explanation about the imaginative immersion dimension, the way of triggering this dimension of immersion is by making the players empathise with the characters and story of the game. This means that the players who feel more empathy will be the ones who are more immersed.

3.2.- Game Versions

Herald is an interactive drama videogame which tries to engage people with its story and characters. It is set on the 19th century colonialism, where the main character is a steward who has to deal with various dilemmas such as inequality, injustice and interacts with important or downtrodden characters. Its dramatic storylines change depending on how players choose to play the game. They have to choose what they want to answer when dialoguing with other characters of the game. Depending on the answers the player chooses, story takes different paths.

Herald has been chosen as a study case because of its focus on the story-driven videogame genre and its highly dramatic storylines. These attributes allow our study case to generalize our research for almost any story-driven videogame. Herald's objective of evoking immersion by making players empathize with the characters and storyline helps us to study imaginative immersion and allows us to value how changes in cinematographic features impact this immersion.

Two iterations of the same game scene are needed to be able to perform the comparative study. The scene chosen for the two versions had to have highest dramatic action in order to trigger imaginative immersion in a short period of time. Therefore, the scene selected was the one containing the most drama from the first chapter. In this scene, the main character Devan has to deal with a character who wants to commit suicide. Depending on the dialogue choices they make, the players will or will not save him. We believe that one scene is enough to see changes in players' immersion. Moreover, a longer gameplay couldn't be shown to participants due to the fact that Herald is a commercial product.

Both executable versions contain the same scene, however, one of them contains cinematographic features. These features consist of camera setups inside the scene which offer more dynamism via distinct camera shots and camera movement to follow the action, which can improve players' game experience. On the other hand, the old version has a setup of static cameras in the game's scene. We will discuss the concrete implementation in detail in Section 4.1.

3.3.- Participants

30 participants volunteered for this experiment (26 males, 4 females). The age of the participants varied between 20 to 30 years. Group members were assigned randomly with the exception of age and gender, both of which were equally distributed over both groups.

Selected participants were students from universities which offer studies about videogames (Utrecht University, La Salle Ramon Llull). We believe that the majority of these students have the same experience or ~~basic~~ knowledge about videogames. In addition, they were asked in the questionnaire about their background experience with videogames and story-driven games. ~~and~~ These aspects have been taken into account when analysing the gathered data.

3.4.- System Setup

The study used a between group design where each group played a scene of the videogame, but each a different version. One of the versions has an iteration of the scene with no cinematic features. The other version contains the scene with cinematographic features, meaning dynamic cameras during gameplay.

Due to the fact that this game is a commercial product, it had to be played through Unity in a computer controlled locally. Mailing the .exe files of the game to participants so they could test our game remotely was discarded for legal and copyright reasons.

To test both versions of the videogame we used a laptop with a screen size of 14', 1920x1080 resolution, and 60Hz refresh rate. A non-intrusive environment had to be set up, which is why we decided to use a headset for the audio. For interaction, we used the keyboard and mouse because the game was developed for the PC platform. The tests were executed indoors to give as little ~~less~~ information as possible of how much time had passed. The room did not contain any windows or clocks and participants were asked to put their phones away.

3.5.- Experimental Procedure

Initially, all participants were informed about how the test was structured. It was explained that if at any moment they wanted to stop and leave, they could. After that, they had to fill in some questions concerning personal details and video gaming background.

Since participants can only play one scene, a trailer of the game was shown to the participants to get in context with the game. Afterwards, the story of Herald was explained to them so they could get engaged in the story. We also explained the situation which the main character is facing at that point in the game and the backstory of the other characters appearing in this scene, so the participants never feel misguided due to the fact that they are only playing one scene of the game.

After the introduction to the story, participants were taught the controls of the game. To minimize the possibility of misunderstood directions and to maximize the immersion,

participants were asked if they had any doubts before starting to play. After all doubts were solved, the player was requested to play the game without any external interruptions. In addition, without the participant noticing, we timed the gameplay.

Once participants finished playing through the scene, they were asked to complete the questionnaire about their experience. Afterwards, we conducted a closing semi-structured interview to note any other comments that the participant had to analyse as qualitative data later.

Both groups followed this same procedure. In addition, for each session of the test, the participant's time spent playing the scene was noted. The average duration of the experiment for one participant was expected to take between 20 and 30 minutes. Participants were not recorded because of unavailability of the necessary equipment, however during the gameplay notes were annotated about anything that might be useful to ask in the later interview.

3.6.- Questionnaire Design

Because no standardized questionnaire exists that could be applied to our scenario, we designed a new one based on existing related work. Here we will describe the questions that were included and what they are meant to test.

The questionnaire is formed by a conjunct of questions which have to be answered by participants using the Likert-scale (1 to 5). These questions were selected from earlier studies which allow to quantify immersion and narrative agency felt by participants.

The first section of the questionnaire contains questions Q1 to Q6 and gathers general background information of the participant. The purpose of these questions is to identify any kind of potential bias that may affect the latter results of the experiment. Participants should answer these six questions before playing the game.

The next section, questions Q7 to Q22, is used to quantify the levels of immersion felt by participants whilst playing the game. This section is composed using the questions from the Game Engagement Questionnaire provided by Brockmyer [7], which is a standard approach for evaluating immersion when playing games. In addition, this section can help to quantify the levels of absorption, flow and presence of participants, all of which are key aspects when trying to immerse game players. The answers from this section enable us to verify our first hypothesis, that is, prove whether or not ~~if~~ the new version of the game is more immersive.

The section with questions Q23 to Q26 also contains some questions from Brockmyer's questionnaire. These are used to analyse how much time distortion the participants experienced whilst playing the game. An additional question asks participants to estimate how long they thought they were playing the game to confirm their time loss. This can then be compared with the actual playing time recorded in a log file. The results of this section are used to verify our second hypothesis, that the most immersed players experience the highest time distortion.

The next group of questions, Q27 to Q35, is used to measure the narrative agency that participants felt about the story and characters. These questions are a subset extracted from Qin's questionnaire [24] to analyse immersion and agency in computer game narrative. This subset contains the questions about curiosity and empathy factors, because these aspects are related to imaginative immersion.

Finally, questions Q36 to Q38 are open questions which are used to gather qualitative data. Participants are asked about which features triggered their imaginative immersion when playing the videogame. They are also asked for their approach when handling other avatars' problems to see if they care for the virtual players and if they would buy the game to continue playing it. A concluding "other comments" question will be filled in by the interviewer after the closing semi-conducted interview. In the interview, participants are asked about their opinion on the camera setup of the game, the importance of cameras in videogames and about any of the observations that the interviewer may have written down during the gameplay.

Question nº	Description	Value
Q1	**Name and Surname**(DD/MM/YYYY)	No experience □ □ □ □ □ A lot of experience
Q2	**Your date of birth**(DD/MM/YYYY)	No experience □ □ □ □ □ A lot of experience
Q3	**Your sex**	Male □ Female □
Q4	**How much experience do you have with videogames?**	No experience □ □ □ □ □ A lot of experience
Q5	**How much experience do you have with story-driven videogames?**	No experience □ □ □ □ □ A lot of experience
Q6	**Are you familiar with the game Herald: An Interactive Period Drama?**	Yes □ No □
Q7	**I really get into the game**	Totally disagree □ □ □ □ □ Totally agree
Q8	**I feel different**	Totally disagree □ □ □ □ □ Totally agree
Q9	**I feel scared**	Totally disagree □ □ □ □ □ Totally agree
Q10	**I lose track of where I am**	Totally disagree □ □ □ □ □ Totally agree

Q11	**I feel spaced out**	Totally disagree □ □ □ □ □ Totally agree
Q12	**I wouldn't answer when someone talks**	Totally disagree □ □ □ □ □ Totally agree
Q13	**I can't tell I'm getting tired**	Totally disagree □ □ □ □ □ Totally agree
Q14	**If someone talks to me I don't hear**	Totally disagree □ □ □ □ □ Totally agree
Q15	**I feel like I can't stop playing**	Totally disagree □ □ □ □ □ Totally agree
Q16	**The game feels real**	Totally disagree □ □ □ □ □ Totally agree
Q17	**I get wound up**	Totally disagree □ □ □ □ □ Totally agree
Q18	**Playing seems automatic**	Totally disagree □ □ □ □ □ Totally agree
Q19	**I play without thinking how to play**	Totally disagree □ □ □ □ □ Totally agree
Q20	**Playing makes me feel calm**	Totally disagree □ □ □ □ □ Totally agree
Q21	**Things seem to happen automatically**	Totally disagree □ □ □ □ □ Totally agree
Q22	**My thoughts go fast**	Totally disagree □ □ □ □ □ Totally agree
Q23	**Time seems to stand still or stop**	Totally disagree □ □ □ □ □ Totally agree
Q24	**I lose track of time**	Totally disagree □ □ □ □ □ Totally agree
Q25	**I play longer than I meant to**	Totally disagree □ □ □ □ □ Totally agree
Q26	**Estimate how much time you were playing the game:**	___ min
Q27	**My emotion often varies with the story's progress**	Totally disagree □ □ □ □ □ Totally agree

Q28	**Sometimes I really think I am the avatar of the game**	Totally disagree □ □ □ □ □ Totally agree
Q29	**After I finished the scene, it takes a time for me to return to the real world psychologically and emotionally**	Totally disagree □ □ □ □ □ Totally agree
Q30	**I can sense the relationship between events**	Totally disagree □ □ □ □ □ Totally agree
Q31	**I want to know the rest of the storyline in the course of playing**	Totally disagree □ □ □ □ □ Totally agree
Q32	**The avatar in the game is attractive**	Totally disagree □ □ □ □ □ Totally agree
Q33	**I feel successful when I overcome the obstacles or tasks of the game**	Totally disagree □ □ □ □ □ Totally agree
Q34	**The story quickly grabs my attention**	Totally disagree □ □ □ □ □ Totally agree
Q35	**I concentrate on the story for a long time**	Totally disagree □ □ □ □ □ Totally agree
Q36	**Which features of the game you found more engaging?**	
Q37	**Which approach did you use when selecting the dialogue to talk to Ian?**	
Q38	**Would you buy the game? Why?**	
Q39	**Any other comments?**	

Table 1.- Questionnaire developed for story-driven videogames to quantify levels of immersion and narrative agency

4.- Implementation

The designed cutscene tool was developed in Unity, a free cross-platform game engine, which can be used for both commercial or non-commercial applications. At early stages, it was already decided that the new tool had to contain functionalities to improve the immersion of a videogame.

This tool had to contain multiple animated cameras which needed to be activated in a fluid sequence. Characters (3D models) and animation files had to be selected and consecutively animated inside the tool. Configuration features were also needed, these allow developers to stop and restart the cutscenes whenever they need to display character dialogue boxes. Finally, the developed tool had to be as simple as possible so any employee of the company could use it without having previous programming experience. This will allow the company to produce many cutscenes in a short amount of time.

4.1.- Videogame Design

Herald is a story-driven interactive game which wants to engage players with their characters and dramatic story. The gameplay interaction is limited, however, their mechanism to branch the story narrative depending on what the player decides is outstanding. This feature enhances players' emotions for the game's characters, because the story is built on the players' decisions taken during gameplay.

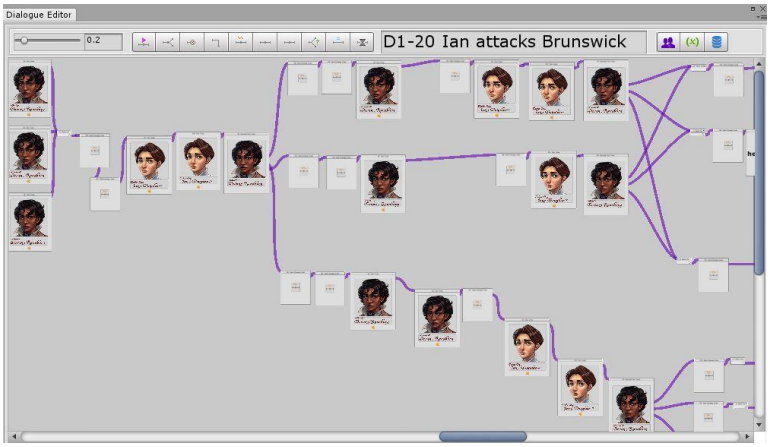

Figure 3.- Dialogue map inside the Dialogue Editor from the scene used in the research.

The tool behind the narrative branching is called Dialogue Editor, which is shown in **Figure 3**. This asset allows developers to create **dialogue maps** which contain a sequence of nodes that form a scene. This tool is especially designed for in-game dialogues between characters. It has basic functionalities, but its high flexibility allows the user to adapt it to the project.

The text node allows developers to add dialogue text, which is shown depending on the option chosen.

These options are selected through the branched text node, which allows the player to select a response text inside dialogues between characters. This can be seen in **Figure 3**. Choices can affect the story, reward the players with clues about what can happen or give them information that they will need later.

As for animations, an animation node is used to select an animation file which will be triggered for a character. This node can also be used to activate cameras in the game and change their position.

Even though this tool has a high usability, it lacks an optimal way of integrating cinematographic features to a game. None of the nodes implemented at the time in the tool are capable of adding dynamism to camera setups.

Herald uses the dialogue editor to setup its cameras in two ways. Firstly, whilst controlling the character, cameras are set in different rooms or sections of the environment. These cameras are supposed to make the players watch the action whilst being static. Secondly, in order to develop a camera sequence, multiple animation nodes are to be placed in a dialogue map. However, this breaks the dynamism of the game and overloads the dialogue maps.

Due to the limiting features to create cinematographic features, it was decided to implement a tool that would be capable of creating dynamic cameras and cutscenes which can be modified according to the project's needs. This tool was named Timeline Node.

4.2.- Designing Guidelines & Solutions

When the task was given, the following guidelines to design this node were established:

- The node has to be able to contain a full cutscene with cameras and character animations.
- The development of these cutscenes must be easy for non-programmers.
- It must decide the behaviour of the cutscene after reaching the last frame.
- Cutscenes must be played or stopped at the desired moment, either on specified seconds or frames.

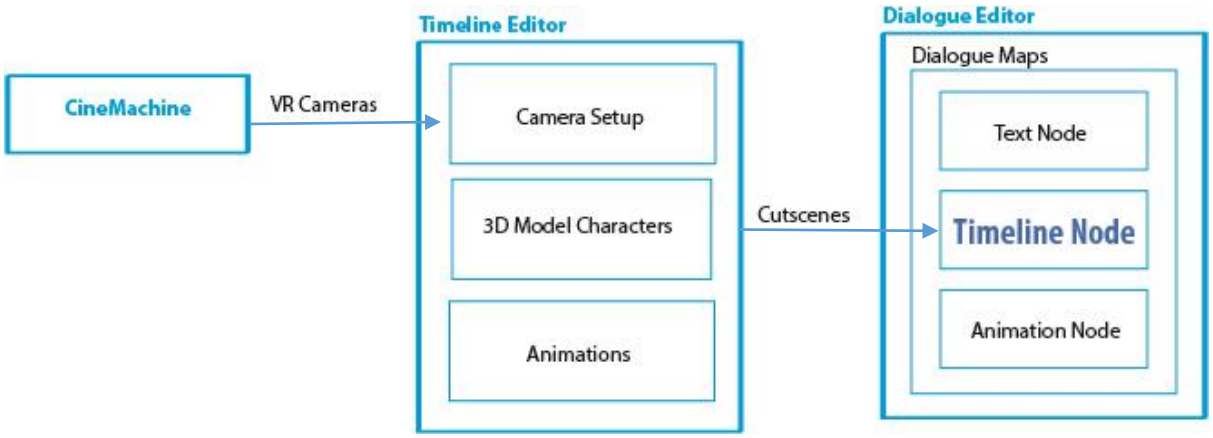

Figure 4.- Module diagram showing how the different Unity assets which are used to create the cinematographic features which will be added to the dialogue maps with the Timeline Node.

The objectives set at the beginning of development were completed by combining free assets from Unity and programmed system, which is shown in **Figure 4**. The system connects the assets together, creating the functionality of the Timeline Node. First, CineMachine, further explained in Section 4.2.1, is used to add virtual cameras to the scene. These cameras will later be used by the Timeline Editor. The Timeline Editor consists of a timeline where developers can drag these cameras, 3D models and animations to create cinematographic content such as cutscenes or dynamic camera setups for the videogame. Once the cinematographic content is designed, it is linked to the Timeline Node. This node is added to the Dialogue maps between nodes, applying the cinematographic features to the dialogue scene.

4.2.1.- CineMachine

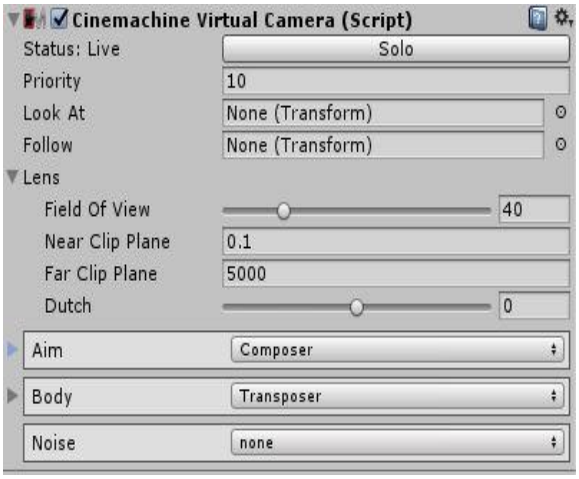

Figure 5.- CineMachine Virtual Camera Settings shown in Unity editor.

CineMachine [39] is a free asset which can be downloaded as an extension tool for Unity. This tool allows videogame artists to create compelling cinematic sequences inside a videogame project in Unity. It uses items called Virtual Cameras which can be placed in the game scenes. The Virtual Cameras from this tool contain many more features than the ones provided by Unity. These features include changing the field of view, near and far clip planes, and so forth. Virtual Cameras also allow automatic animations using the functions named "*look at*" and "*follow*". The function "*look at*" rotates the camera to keep sight of an object linked to it. On the other hand, "*follow*" will make the camera follow an object at a fixed distance set by the user. In addition, when developing a sequence, the Virtual Camera has a variable called "*priority*" which can be set initially to every camera. By incrementing the priority number of the Virtual Cameras, we can establish which one is used. These variables can be changed during gameplay to design a cutscene using multiple cameras.

To animate the Virtual Cameras created with CineMachine, another tool was needed, Timeline. This tool allows the user to animate cameras by changing their position and rotation and setting when each camera has to be activated or disabled.

4.2.2.- Timeline Editor

The second tool used in the project was Timeline Editor [40]. This can be used inside Unity to create cinematographic content and gameplay sequences by dragging game objects, including characters and cameras, inside the editor's timeline as shown in **Figure 6**. The Timeline Editor was used to animate the cameras of the scene's cinematographic version by changing their position and rotation and setting when each camera had to be activated or disabled.

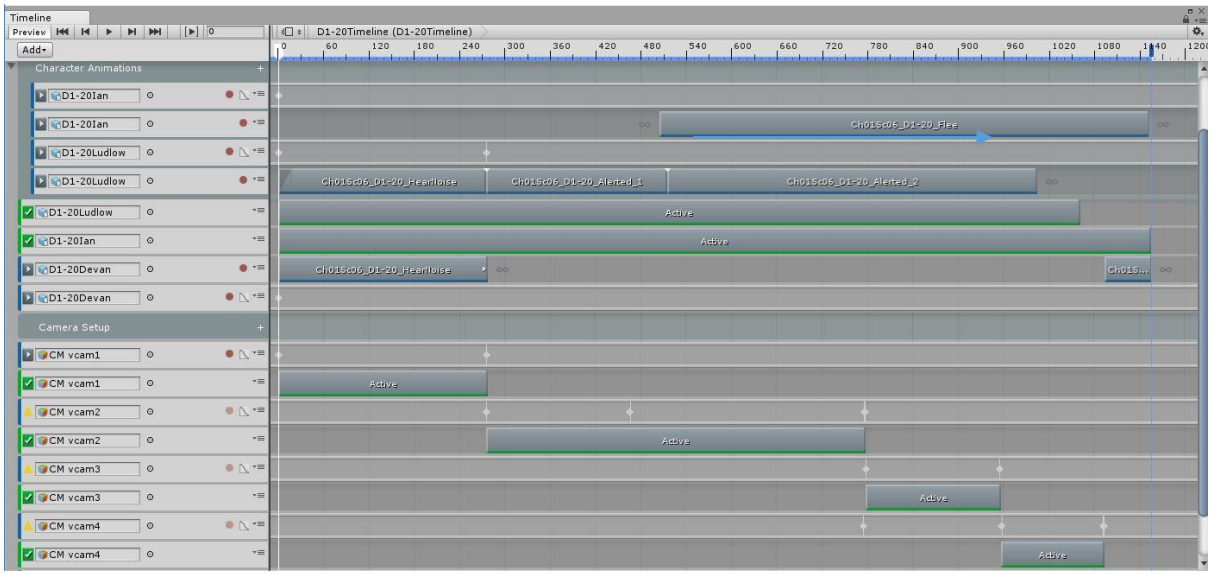

Figure 6.- Timeline window shown inside Unity where animations, cameras and 3D character models must be placed to create a cutscene.

When building a cutscene, the 3D models of the characters are set inside the Timeline editor. Once selected, these characters can be animated by adding .fbx files, containing their animations, into their tracks. Character's animations can also be enabled or disabled using the different tracks provided by Timeline Editor. These tracks are called activation tracks; in which we can define when or whether game objects will be used.

To develop the cinematographic version of the scene used for the experiment, a timeline asset (D1-20 Timeline) had to be created. This asset contains a Playable Director as we see in **Figure 6**.

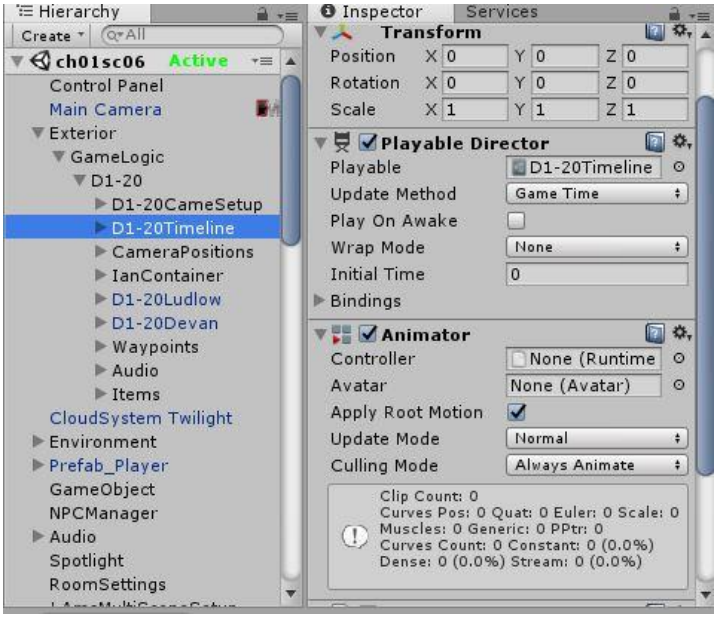

Figure 7.- D1-20 Timeline is the game object which contains the elements to activate cinematic features in the videogame scene.

The Playable Director is a game object that creates the bindings to all game objects added to the cutscene by the user, such as cameras, characters and inanimate objects which have been placed in the timeline. In addition, the Playable Director also has other useful features such as: setting an initial time, starting the cutscene as soon as the game scene starts and determining what will happen when the final frame of the cutscene is reached (stop or loop the cutscene animations).

4.3.- Timeline Node

4.3.1.- Design

To combine the three main tools of this project (Dialogue Editor, CineMachine and Timeline), Timeline Node was designed. This node can be integrated inside any dialogue map to add cinematographic features to the game without lowering the videogame's performance. The design of the node simplifies the development of possible cutscenes and simplifies the dialogue maps by reducing the amount of nodes needed to develop a cutscene. It maintains the sustainability of the game's performance even when applying new content.

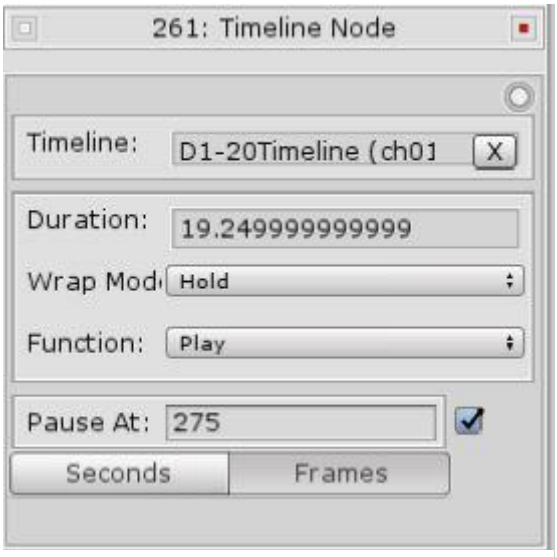

Figure 8.- Design of the Timeline Node interface shown in the Dialogue Editor.

The main feature of this node is its capability to segment an animation sequence between different text nodes to add dynamism to the scene. To do so, the **Pause at** function was implemented. This function is used to insert a certain frame or second which indicates where to stop the cutscene.

Inside Unity, any of the timeline sequences previously created inside Timeline Editor can be modified. Consecutively, the changes will be applied to the Timeline Node which will update all the features of the timeline cutscene.

Timeline Node was also adapted so the **Wrap Mode** of the sequence could be modified. This feature allows the user to decide how the last frame of the timeline sequence must be managed, using three options. **Hold** pauses the animation at the last frame of the sequence. **None** ends the sequence when reaching the last frame. **Loop** keeps the sequence running in a cycle.

The **Function** property was implemented so users can select if they want to **Play** a sequence, **Resume** it or **Stop** it. **Play** is used when initiating a cutscene in the game. On the other hand, **Resume** is used only when the timeline sequence is continued after being previously paused. Finally, **Stop** can be used to cut looped cutscene animations whenever they are not needed anymore. This property allows us to upgrade the dynamism of the timeline sequences used. Having the ability to segment the sequences and applying them between text nodes allows us to design the cinematographic version of the scene used for the experiment.

4.3.2.- Implementation

All nodes implemented in the dialogue editor follow the same pattern. There are three modules that must be implemented in order to apply it later to the dialogue maps.

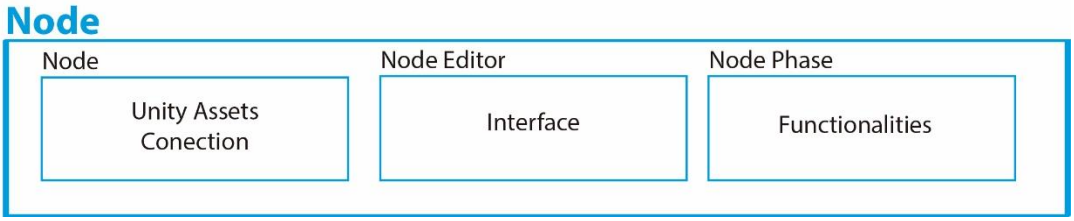

Figure 9.- System to implement Nodes for the Dialogue Editor

As shown in **Figure 9,** the three main modules that have to be written are: **Node**, **Node Editor** and **Phase**. The **Node** module is used to access different properties and game objects from Timeline Editor and CineMachine. By doing so, Timeline Node is enabled to change values from these assets, adding functionality to the node. In addition, this module links any Timeline Editor cutscene designed previously to the node. In consequence, when the Timeline Node is added to a dialogue map, developers can select the preferred cutscene to add to the videogame scene. All in all, the **Node** module is what brings together all the systems used to develop the cinematographic version of the game.

Node Editor is a module where the node's interface, which will be shown in the dialogue editor, is implemented. **Figure 8** shows the different fields that have been implemented. The first field allows developers to select a Timeline Editor Cutscene. Once selected, the duration of the file will appear. Next, a **Function** and **Wrapmode** have to be selected, depending on the desired behaviour of the cutscene. These behaviours have been explained previously in Section 4.3.1. Finally, if the **Pause at** button is enabled, it will allow developers to choose when to stop the cutscene by specifying the time in seconds or frames.

Phase is a module where functionalities of the node are developed. This module is used to implement the behaviour of the node depending on the settings selected (back-end programming). It incorporates functionalities such as calculating where a Timeline Editor

cutscene was stopped, calculating the conversion from frames to seconds or restarting the cutscene if it needs to be looped.

4.3.3.- Functionalities

The main functionality of the implemented node is to apply cinematic features in dialogues between characters to increment drama, immersion and the agency that players feel towards the characters.

As explained in Section 3, a scene of the videogame will be used to test the differences between a version with cinematographic features and one without. For this scene, the cinematographic features consist of cutscenes with animated cameras that follow the action throughout the scenario. As shown in **Figure 9**, Timeline Node was applied to scene D1-20 Ian attacks Brunswick, which is the one used for the tests.

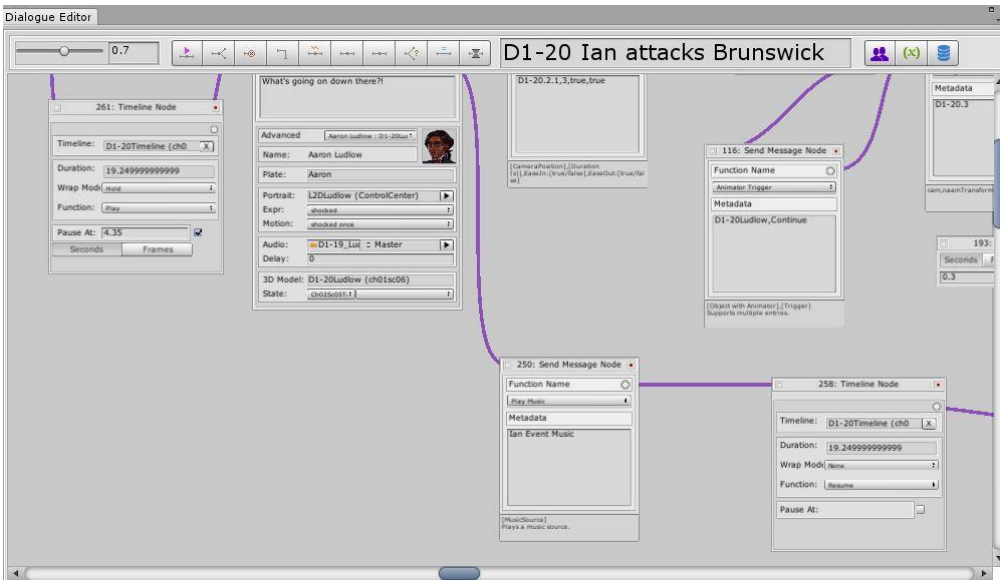

Figure 10.- Dialogue node map from the scene used for research.

In the dialogue map, the Timeline Node is used to trigger the cutscene at a certain point of the dialogue. In addition, the features explained in Section 4.3.1 allow us to stop the cutscene at the desired points where we need characters' dialogue boxes to be displayed. Finally, when the player clicks on the dialogue box, a new Timeline Node with the function **Resume** is added and the cutscene will be continued to until the end of the sequence.

Figure 11.- Camera dynamics showing how after clicking the dialogue box(pictured left) a new camera setting is activated to continue the cutscene(pictured right).

To prove that our tool can be used in other ways, Timeline Editor was used not only to design cutscenes but to design even more cinematographic content. In other scenes we can find Timeline Trigger Areas. They were implemented so that when players move the main character inside them, a timeline asset will be activated and looped until the character leaves the area. This feature is an unobvious way of offering guidance to players, since movement of NPC (non-playable characters) in the game isn't common and this movement attracts players' attention. In this scene, the area is placed next to the character the player is looking for. When Devan, the main character, enters the area, the character in the bottom left will start nodding his head and looking backwards as if he heard you coming.

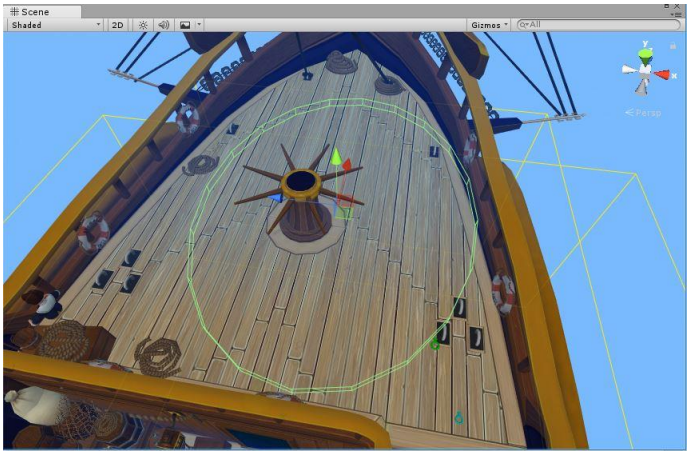

Figure 12.- When players enter the area, NPC animations are triggered

4.3.4.- Challenges and Limitations

During the development of the tool many limitations were found. Initially, major problems were experienced with CineMachine and Timeline Editor since they were still under development when our tool was implemented. By using features that had just been released, the implementation of the tool was arduous because of errors that had not been solved yet by the creators of CineMachine and Timeline Editor. In addition, the insufficient documentation at the time made us spend more time on learning how to adapt and work with the tools in our project.

Issues were found when using cameras inside Timeline Editor. Rotation values of the Virtual Cameras would change when dropped inside the Timeline Editor. Whenever the angle of rotation was 0º, it would be turned into 359º. Furthermore, when modifying objects from the game scene which are used inside the Timeline editor, it was important to move back the cursor to frame 0 before saving or compiling the project. Else, the timeline sequence could be damaged. If these actions were not taken, Unity would change the priority values of the cameras, thus changing the order of the camera setup for a cutscene.

Problems were also encountered when adding the Timeline Node to the node maps. Node maps were using animation nodes to trigger one animation in some dialogue maps. At certain points characters would be animated through the Timeline Editor and Unity's animator system simultaneously, which made characters combine both animations into an unexpected result. To solve this, a new feature had to be added to Timeline Node. The solution was adding the **Wrap mode** feature. We decided to freeze the last frame of a cutscene so that it can synchronize perfectly with the next animation from other nodes, thus providing a smooth change from cutscenes to playable content.

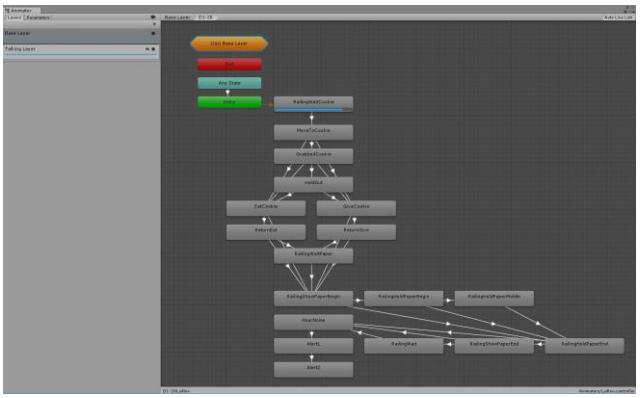

Figure 13.- Default animation system from Unity

Regarding the evaluation and the scientific result, we also found limitations. Even though CineMachine is great for designing the cutscenes, it still had problems changing cameras during a sequence. When a camera was deactivated, there was a noise frame before activating the next camera. This noise was an immersion breaker so we reduced it as much as possible at the time, by adding an extra frame to each shot. The noise is not completely removed but it is minimal so that participants will not notice it.

In addition, due to the fact that the game is a commercial product, we couldn't export .exe files for testing. It was decided that participants had to play from a local Unity project. This issue potentially impacted on the quantity of participants that could participate in this experiment. In order to test the game, an interviewer had to be present and all participants had to test the game locally. This made the testing process longer and more difficult as appointments had to be made so that participants could test the game. In addition, Unity can maximize the size of the game screen, however, it cannot display the game full screen and still shows the interface which also could break immersion as participants might be unable to focus completely on the game.

5.- Results

5.1.- Quantitative Results

In the following section, the group of participants which played the game version with cinematographic features is named the **new version** or **version played 0**. The game scene without the features is the **old version** or **version played 1**. Through the different sections we will answer the hypotheses stated in Section 5.1.

5.1.1.- Hypothesis 1

To answer the first hypothesis, "*participants that play the game version with cinematic features will have higher immersion results in the data extracted from the questionnaire"*, two t tests were performed to the subset of questions which analyse immersion (form questions Q7 to Q25) from our questionnaire. The first test measured the questions in three different groups which analyse immersion's absorption (Q7 to Q11), flow (Q12 to 20) and presence (Q21 to Q25). The latter test was performed englobing all the questions to analyse if the immersion felt by participants in both groups is different enough to be significant.

Group Statistics

	VersionPlayed	N	Mean	Std. Deviation	Std. Error Mean
Absorption	0	15	9.93	2.963	.765
	1	15	8.60	2.197	.567
Flow	0	15	28.13	4.969	1.283
	1	15	23.93	4.448	1.148
Presence	0	15	18.60	3.043	.786
	1	15	15.20	2.484	.641

Table 2.- Group statistics from immersion's t test, between participants that played the new version and old version, divided by absorption, flow and presence

In **Table 2**, a difference is shown in the means between both groups that shows how group **0**, which played the cinematographic version, obtained higher results for absorption by 5.32%, flow by 16.8% and presence by 13.6%.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Absorption	Equal variances assumed	3.366	.077	1.400	28	.173	1.333	.953	-.618	3.284
	Equal variances not assumed			1.400	25.822	.173	1.333	.953	-.625	3.292
Flow	Equal variances assumed	.224	.640	2.439	28	.021	4.200	1.722	.673	7.727
	Equal variances not assumed			2.439	27.662	.021	4.200	1.722	.671	7.729
Presence	Equal variances assumed	.007	.933	3.352	28	.002	3.400	1.014	1.323	5.477
	Equal variances not assumed			3.352	26.923	.002	3.400	1.014	1.319	5.481

Table 3.- T test performed to the subset of questions Q7 to Q25. Questions have been divided in three subsets which reference absorption, flow and presence.

The results from **Table 3**, obtained from the independent samples t test that quantifies the absorption of both groups, are not statistically significant ($p < 0.173$). However, both flow and presence do show lower p values (0.021 and 0.002), meaning that our hypothesis could

be true. By performing another t test evaluating all the questions to quantify immersion, we came to the conclusion that there is enough proof to believe that our first hypothesis is certain.

Group Statistics

	VersionPlayed	N	Mean	Std. Deviation	Std. Error Mean
Immersion	0	15	56.67	8.666	2.237
	1	15	47.73	7.086	1.830

Table 4.- Group statistics from immersion's t test between participants that played the new and old version.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Immersion	Equal variances assumed	.211	.650	3.091	28	.004	8.933	2.890	3.013	14.854
	Equal variances not assumed			3.091	26.938	.005	8.933	2.890	3.002	14.864

Table 5.- T test performed to analyse immersion containing questions from Q7 to Q25

Table 4 demonstrates that the group of participants who played the new version have a scoring mean punctuation of 8.94 higher than the participants who played the old version. This demonstrates that players who played the cinematographic version sensed 14.17% higher immersion than the other group. To confirm our hypothesis, the p value in **Table 5** ($p < 0.004$) is low enough to prove the significance of **H1** and affirm that the participants which felt more immersed where the ones that played the new version of the game which contains the cinematic features.

Further research was developed to confirm **H1**. Another t test had to be taken in order to evaluate if narrative agency was also much more valuable for participants which played the new version. As expected, narrative agency felt by participants which played the cinematographic version is higher by a 10.49%.

Group Statistics

	VersionPlayed	N	Mean	Std. Deviation	Std. Error Mean
NarrativeAgency	0	15	31.60	3.542	.914
	1	15	26.87	3.021	.780

Table 6.- Group statistics from narrative agency's t test between participants that played the new and old version.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
NarrativeAgency	Equal variances assumed	.787	.383	3.938	28	.000	4.733	1.202	2.271	7.195
	Equal variances not assumed			3.938	27.320	.001	4.733	1.202	2.269	7.198

Table 7.- T test performed to analyse narrative agency containing the questions Q27 to Q35 from our questionnaire.

As shown in **Table 6**, the mean rank is higher for the group which played the cinematographic version. The mean points difference between both groups is of 4.73 points. In addition, based on the results from **Table 7**, we can state that there was a significant difference between the narrative agency felt by participants who played the new version and

the old version ($p < 0.000$). This proves that, as expected, the immersion being triggered on participants is the imaginative immersion, its key factor being the empathy that participants feel for the story and characters.

5.1.1.- Hypothesis 2

In order to analyse the second hypothesis, "*participants that play the game version with cinematic features will have a bigger underestimation of their gameplay time*", a **Time Difference** variable was calculated by subtracting, for each participant, their estimated game play time from their real gameplay time. Later, a t test was performed to see if the significance was enough to prove our hypothesis.

Group Statistics

	VersionPlayed	N	Mean	Std. Deviation	Std. Error Mean
TimeDifference	0	15	-3.47	3.270	.844
	1	15	-2.93	3.634	.938

Table 8.- Group statistics from the Time Difference t test between participants who played the new and old version.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
TimeDifference	Equal variances assumed	.001	.981	-.422	28	.676	-.533	1.262	-3.119	2.053
	Equal variances not assumed			-.422	27.694	.676	-.533	1.262	-3.121	2.054

Table 9.- T test performed to analyse the Time Difference

As we can see in **Table 8**, the means for both groups only differ 0.54 minutes when estimating the time played. The difference is minimal, causing p value to rise to $p < 0.676$ thus making our hypothesis non-significant. The results in **Table 9** confirm that the second hypothesis is false.

A correlation study was analysed between time distortion and immersion, which lead to a weak negative correlation between them as we can see in **Table 10**. **Figure 14** exposes that the higher the immersion, the higher the overestimation of time by participants.

Correlations

		Immersion	TimeDifference
Immersion	Pearson Correlation	1	-.391*
	Sig. (1-tailed)		.016
	N	30	30
TimeDifference	Pearson Correlation	-.391*	1
	Sig. (1-tailed)	.016	
	N	30	30

*. Correlation is significant at the 0.05 level (1-tailed).

Table 10.- Pearson's Linear Correlation Test between Immersion and Time Distortion

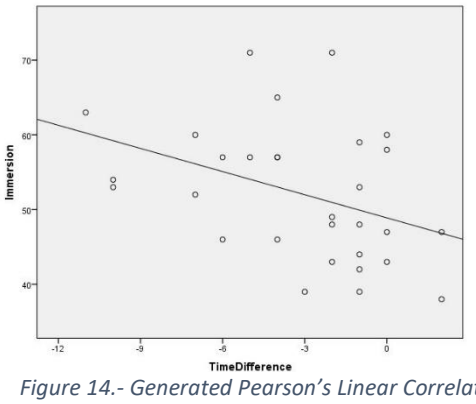

Figure 14.- Generated Pearson's Linear Correlation Scatter Plot Immersion to Time Distortion

5.1.1.- Hypothesis 3

To answer the third hypothesis, "*participants who felt more attached to the characters (narrative agency) will be the most immersed*", a Pearson's Linear correlation test in SPSS was performed to research a relation between narrative agency and immersion. The variable Narrative agency contains the sum of the scores from each question in our questionnaire from Q27 to Q35 which are used to analyse narrative agency.

Table 11 shows how a positive correlation between immersion and narrative agency. The coefficient r is high enough to confirm that there is a strong positive correlation between narrative agency and immersion. This means that participants which felt more narrative agency are the ones who also felt the highest immersion, as we can also see in **Figure 15**. Furthermore, the correlation analysis demonstrates that hypothesis **H3** is true.

Correlations

		NarrativeAgency	Immersion
NarrativeAgency	Pearson Correlation	1	.643**
	Sig. (1-tailed)		.000
	N	30	30
Immersion	Pearson Correlation	.643**	1
	Sig. (1-tailed)	.000	
	N	30	30

**. Correlation is significant at the 0.01 level (1-tailed).

Table 11.- Pearson's Linear Correlation Test between Narrative Agency and Immersion

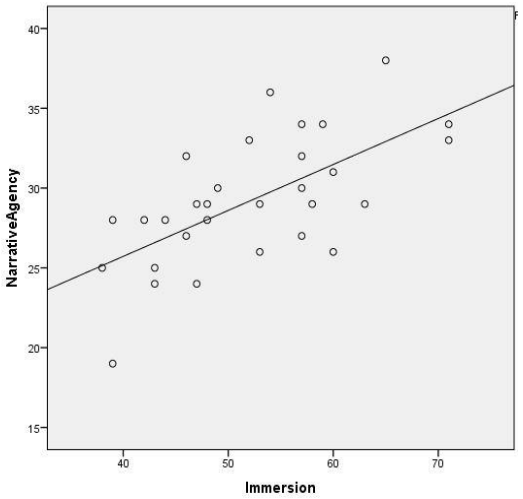

Figure 15.- Generated Pearson's Linear Correlation Scatter Plot Narrative Agency to Immersion

5.2.- Qualitative Results

Questions 36 to 39 from the Questionnaire were used in the final interview to obtain subjective data from the participants. However, Q38 didn't present any valuable results which could be analysed in this research.

Q36, which was used to research which features where valued the most, had the majority of both groups choosing the storyline as the most valuable feature from the videogame. The second most valuable feature in both groups was story branching, which had a higher value for participants which played the version without cinematographic features. However, the third most valued feature, in the group of participants that played the game with cinematographic features, was the camera settings which was mentioned by four participants. On the other hand, the camera settings only were mentioned by one participant in the other group. Next, both groups valued voice acting equally. The following feature valued was the characters of the game, which were valued higher in the cinematographic version. Soundtrack is the next feature ranked by the participants from the same group. Finally, graphics were mentioned by both groups once.

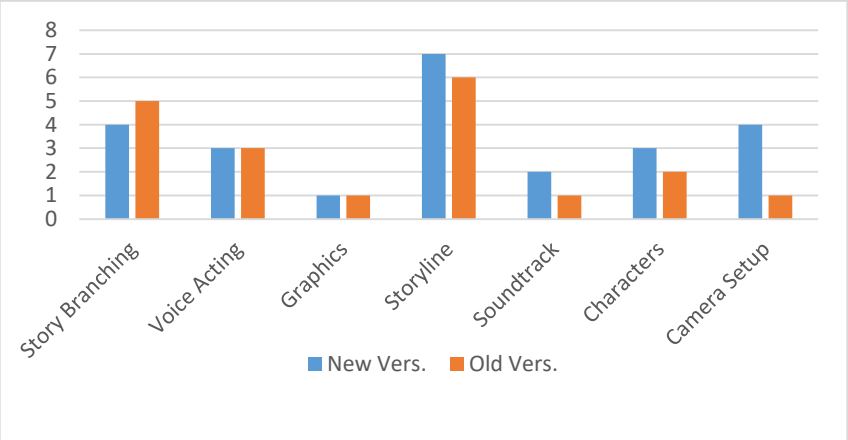

Figure 16.- Results from Q36 showing the most valuable features that people thought the game contained

Q37 showed us whether participants felt empathy for the character which they had to save in the gameplay. The way they answered the questions demonstrated which perspective they used when choosing the dialogue. For both groups we distinguished three different types of perspectives: having fun, empathizing with the character or searching for the right answer. "*Having fun*" was a perspective in which participants decided to play with the answers to see what happens instead of carefully selecting the answers which would save the secondary character. The "*empathizing*" perspective was followed by participants who mentioned that they thought about personal experience or real life situations to look for a similar answer in the dialogue options. Finally, the "*right answer*" perspective is the one in which participants decided an option by reading all the answers and choosing the one which seemed correct. As we can see in the figure below, most of the participants who played the cinematographic new version dealt with the situation using an empathy perspective (60%). However, only the 47% of the participants who played the old non-cinematographic version used this perspective. Only 27% of the participants who played the cinematographic version tried to select the answer which looked correct, whereas this perspective was used by the majority of the participants from the other group (53%). Finally, only a small percentage from the

participants who played the cinematographic version (13%) wanted to see what would happen if they chose answers which seemed fun.

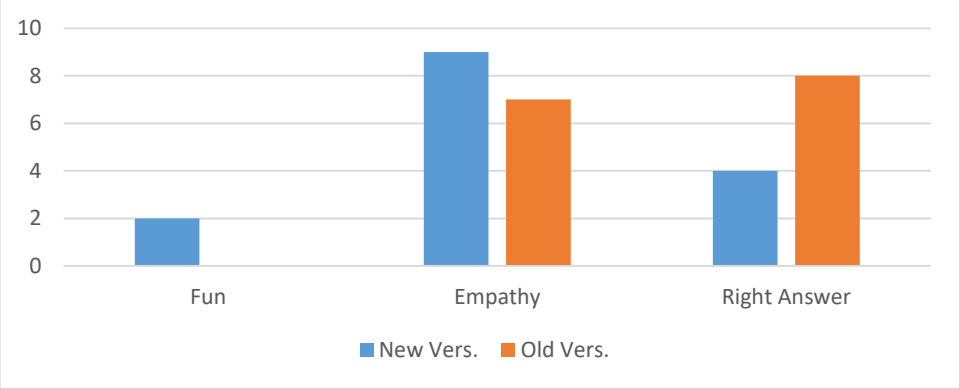

Figure 17.- Results from Q37 showing the perspectives which participants took when choosing the dialogue to convince a character not to jump from the boat to commit suicide.

Q39 brought us further knowledge about why people chose the features from Q36 and also supplied us with other comments which were useful for this research. As negative aspects, it was found that 13% of the participants thought that they had to click too many times to keep the dialogue progressing. This aspect didn't allow them to engage in the game completely. One of them suggested that some dialogue boxes could have been compressed into one, avoiding multiple interactions. In addition, 17% of the participants thought that the graphics were not enjoyable. They needed better quality graphics and more detailed animations to find the game realistic. 7% of the participants thought that one scene was not enough time to feel attached to the character and feel guilt or relief when saving or not the character.

When analysing the positive feedback, it was discovered that 27% of the participants thought that the storyline and the characters where intriguing and well developed. Music was also mentioned by 7% of the participants. Finally, camera setups were also mentioned in both groups. The group which had the cinematographic version of the game had only positive feedback about it, suggesting that the cameras made the game more dynamic and that the movement made them feel like they were part of the game. On the other hand, the participants who played the non-cinematographic version stated that they were missing part of the action due to the cameras. In addition, they stated that static cameras made them feel like they were watching an image rather than a scene, which made it less immersive.

6.- Discussion

As shown in Section 5.1, statistical significance was found to prove both **H1** and **H3**. On the other hand, there were no results significant enough to corroborate **H2**. In this section we will discuss and analyse how we obtained these results and the reasoning behind them.

The majority of the questions from our questionnaire that relate to immersion (Q7 to Q25) had a $\boldsymbol{p < .05}$. Therefore, when analysing all of them with the t test, **H1** had a $\boldsymbol{p = .004}$, meaning it is significant. However, when studying immersion's subsets **absorption**, **flow** and **presence**, it was found that **absorption's** results were not close to the standard.

Flow is used to describe the feeling of balance between skill and challenge, meaning that participants enter the flow state when they feel in control of the game [7]. The results concerning Flow can be explained because the game used for testing is an interactive story branching game. This videogame genre appeals to flow, challenge is not their main feature as gameplay remains easy. In consequence, the skills needed for the game remain at the same level during the game. These features might lead a player into the flow state because of the skill/challenge balance during gameplay. In addition, the participants feel in control from the beginning since they are the ones in control of what will happen to the characters in the branching story through the choices they make in dialogues.

Considering Presence is an experience of being integrated into a mediated environment [7], there are some ways in which our results can be explained. First, as Brockmyer suggests, this state is easily reachable for the majority of the players. Second, we believe that cinematic features, such as the camera setups trigger, this experience. In the qualitative results, from Section 5.2, it is shown that many people who played the cinematographic version thought that the cameras made the game more dynamic and helped them to feel part of the game. In the other testing group, some of the participants said that the cameras looked too static making the game look like an image, out of place and even disconnecting them from the action. As we can derive from their comments, camera setups are important to make people feel part of the virtual environment.

Absorption's results might not be significant enough because they are based on the state of total engagement whilst playing the videogame. We believe that one of the major causes for these results is the fact that players could only play one scene of the game. This might not be enough time for participants to get fully engaged in the videogame, as some participants suggested in the open questions from the questionnaire. In addition, we think that even though the genre of the videogame used (story-driven videogame) is suited for the imaginary immersion dimension and affects the sensory immersion dimension, it does require better graphics and animations to make participants reach a state of total engagement. Participants' expectations are understandable, as most games nowadays have both higher graphics and more detailed animations than the game used. They expect the game to have the same features that they see in everyday games. If they don't, they might feel unfulfilled, thus not allowing them to become fully immersed. Qualitative data from some participants does state that the graphics were a bit childish, meaning they were low quality and too basic.

Time distortion, which was assumed to be a variable to study in **H2**, isn't significant enough, as shown in **Table 9**. A possible reason for this is that estimating time is a complex task for participants and there is too much variation between all the estimates. The study

might have been affected, because regardless of participants being selected with similar age and gaming experience, they might not have the same motivation. This can also affect participants' time distortion as they do not all take the time estimation seriously. Sanders [39] suggests that how much a person likes the game can influence both their immersion and time distortion. Therefore, we think that by using only participants who like story-driven games, the results could have been significant.

Even though the results from **Table 10** are not significant, they do demonstrate a small relation between time distortion and immersion which is explained in Rau's research. According to their research, if participants' immersion is high and there is an overestimation of the time played, it would mean that participants were deeply concentrated instead of having a fun experience. Fun experiences require less cortical space, thus leading to underestimation of the time played. It is possible that due to the stressful situation of the scene (a character trying to commit suicide), players become more concentrated, thus ending in the overestimation from our results.

Estimates would have been more valuable if relative measures were used instead of absolute measures, or if the length of the gameplay was fixed for everyone, allowing data to be more restricted. Another way of improving the results would have been by dividing the groups into four, resulting in having participants that were experts and novices at playing videogames, similar to Rau's research. By having them separated, more significant results could have been acquired for the second hypothesis. However, getting a higher number of participants was problematic due to the aforementioned restrictions when using the tested videogame. The game versions had to be tested locally and not remotely, because Herald is a commercial product. In consequence, being present for each test required a large amount of time. It was preferred to keep a detailed test to cover the factors studied thoroughly rather than looking for more specific participants which might have influenced the final results.

Proving hypothesis **H3** shows that the SCI-model mentioned in Ermi and Mäyra's paper [2] is true at least for the dimension of imaginative immersion. A positive relation between narrative agency and immersion was found because the videogame used belongs to a game genre which relies on imaginative immersion. This genre of videogames fully relies on making players feel connected to the characters and the storyline. If the game is designed correctly, the game will trigger the imaginative immersion dimension and engage players in the game. A reason for our results might be that one dramatic scene was enough for participants to relate to the characters or to get hooked by the story of the game. In addition, the t test between the two groups demonstrates that cinematic features help to enhance narrative agency. Many participants mentioned that the camera setup made them feel like they were part of the game rather than watching the actions. Therefore, possibly cinematic features not only improve the immersion felt but also are a way of making people relate to the characters and story of the game.

Qualitative results obtained through the interview with the last questions of the questionnaire were useful to understand the results from SPSS, however, it might have been more useful if a bigger variety of questions were asked. Question 39 was the most useful question, because it allowed us to discuss the game openly with participants. Their answers where useful to understand the results from some hypotheses as shown above. In addition, their comments on other features that might affect immersion, such as the music or clicking

the dialogue box too many times, were useful to open new paths for future research. Question 36 confirmed that the features that participants liked the most from the game were the story, the characters and possibly the camera setups. However, question 37 could have been issued in another way to try and demonstrate the player's narrative agency towards Ian. Finally, question 38 didn't give us any valuable data for this research.

All in all, as a conclusion to this discussion, we believe that cinematographic features, such as dynamic camera setups, are extremely important to engage players in a story-driven game. We would like to outline our thoughts on the importance of adding cinematic features to story-driven games. As shown in the results of this research, in Section 5.1, these features improve immersion. In game scenarios, there should be a focus on developing quality camera settings that can transmit the desired feelings to players, making them feel that they are there, living the action. This does not mean that only with cinematic features a game will be successful, you need more features to make players feel engaged.

7.- Future Work

There are four interesting directions in which we can develop future research for this study. First, we could focus on our current research and improve it. A more concise selection of participants would allow us to better measure the responses and obtain precise results. Ideally, participants would be divided in two groups: experts and novices in videogames. In addition, only participants which like story-driven games would be selected for the test. These groups would be divided equally to try either versions of the game. Having participants with similar profiles will help when analysing the data. This might lead to new findings and more significant data to prove our second hypothesis.

The final interview performed after the tests should have more questions regarding other features to analyse how they can enhance or decrease immersion. Additionally, performing a study with different story-driven games which contain key features to trigger other immersion dimensions would allow us to study the relation between dimensions. As an example, one game could have high quality graphics and animations in order to trigger sensory immersion, the other game could be a difficult story-driven videogame which can trigger the challenge-based immersion by changing the flow state of players.

Another direction would be to amplify our research. Considering our questionnaire is usable enough to quantify the levels of immersion and narrative agency for videogame genres, we would start a new research on how to design new questionnaires which would be adequate for the other two dimensions of immersion. Hence, our next step could be designing questionnaire's that are able to quantify the challenge satisfaction or sensory amazement through other, more suitable games. This would contribute to a full coverage of all the dimensions of immersion from the SCI model and allow us to obtain more data to learn about the relation between them.

The third direction would be to focus on other videogame features to analyse how they affect immersion. Many features can be studied but an interesting analysis would be to study how the background music from a videogame affects players' engagement. Another feature to study is which device to control a game character is more immersive, a mouse and a keyboard or a console controller. This research would start new studies about interaction with virtual environments that could contribute to the study of immersion and how to evoke it in players. The final feature that could be studied is VR. This new feature would be the next step to actually being inside the virtual environment. Many videogame companies decided to update already designed videogames with VR. However, this is known to not work for all those games. Some end up not being immersive at all. So, as an option, it would be good to analyse if VR can be immersive or it's just an experience that does not engage at all.

Finally, the fourth direction to take would be regarding the technical contributions of this study. A next step to improve our tool would be to create automated camera setups which would decrease the time spent developing iterations and would give us many more versions to test more thoroughly which camera shots and movement are the most adequate to evoke the desired feelings in players.

There are many other ways to improve on this research which can bring us more knowledge about immersion in videogames. However, the ones explained above are the ways in which we believe that our conclusions could be improved. By having less limitations when

experimenting, our results will be amplified, demonstrating new insights regarding the relation between features and immersion dimensions.

8.- Conclusions

This thesis project has investigated and verified the usability and potential of cinematic features in videogames and how they can enhance immersion. The questionnaire designed can be used to quantify immersion in other story-driven videogames which want to know which cinematographic features are the best to apply to certain scenes of their games.

Timeline Node, a tool developed at an early stage of the research, gave us the ability to quickly obtain iterations of a scene from our game with different camera setups and cutscenes if needed. Consecutively, it improved the cutscene development process. This tool can be replicated and used by other companies which want to have a tool that allows anyone without programming knowledge to be able to design cinematographic features for their games.

Furthermore, the comparative study proved that the participants who felt more immersed were the ones that played the new version containing the cinematographic features. The participants which felt the higher immersion also felt major narrative agency. This demonstrates part of Ermi's theory about the SCI model and the dimensions of immersion. As stated in her paper, our results show that videogames from the genre of the game used (story-driven game) develop immersion by evoking narrative agency. A further study was conducted which proved that the participants who played the cinematographic version felt more narrative agency. This means that cinematic features are a key step to improve the empathy that players have for the characters and the story of a game.

Finally, as stated before, we provide a new questionnaire that can be used to measure both immersion and narrative agency of a videogame. This can be the first of many precise questionnaires that can be specific for different videogame genres. On the other hand, we would need a further study to reach significance of **H2**, proving that the more immersed people are, the more they underestimate the time played. The research would allow us to improve the time distortion measuring segment from our questionnaire, thus making it more valuable.

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10.- Appendix

10.1.- Experiment Questionnaire

This questionnaire had to be filled in by all the participants which took part in our test. It is divided by three sections: personal data(Q1-Q6), questionnaire (Q7 – Q35) and open questions (Q36 – Q39).

Q1.- Name and Surname(DD/MM/YYYY)

Q2.- Your date of birth(DD/MM/YYYY)

Q3.- Your sex: Male □ Female □

Q4.- How much experience do you have with videogames?

No experience □ □ □ □ □ A lot of experience

Q5.- How much experience do you have with story-driven videogames?

No experience □ □ □ □ □ A lot of experience

Q6.- Are you familiar with the game Herald: An Interactive Period Drama?

Yes □ No □

This section of the questionnaire will be answered after playing the game.

Q7.- I really get into the game

Totally disagree □ □ □ □ □ Totally agree

Q8.- I feel different

Totally disagree □ □ □ □ □ Totally agree

Q9.- I feel scared

Totally disagree □ □ □ □ □ Totally agree

Q10.- I lose track of where I am

Totally disagree □ □ □ □ □ Totally agree

Q11.- I feel spaced out

Totally disagree □ □ □ □ □ Totally agree

Q12.- I wouldn't answer when someone talks

Totally disagree □ □ □ □ □ Totally agree

Q13.- I can't tell I'm getting tired

Totally disagree □ □ □ □ □ Totally agree

Q14.- If someone talks to me I don't hear

Totally disagree □ □ □ □ □ Totally agree

Q15.- I feel like I can't stop playing

Totally disagree □ □ □ □ □ Totally agree

Q16.- The game feels real

Totally disagree □ □ □ □ □ Totally agree

Q17.- I get wound up

Totally disagree □ □ □ □ □ Totally agree

Q18.- Playing seems automatic

Totally disagree □ □ □ □ □ Totally agree

Q19.- I play without thinking how to play

Totally disagree □ □ □ □ □ Totally agree

Q20.- Playing makes me feel calm

Totally disagree □ □ □ □ □ Totally agree

Q21.- Things seem to happen automatically

Totally disagree □ □ □ □ □ Totally agree

Q22.- My thoughts go fast

Totally disagree □ □ □ □ □ Totally agree

Q23.- Time seems to stand still or stop

Totally disagree □ □ □ □ □ Totally agree

Q24.- I lose track of time

Totally disagree □ □ □ □ □ Totally agree

Q25.- I play longer than I meant to

Totally disagree □ □ □ □ □ Totally agree

Q26.- Estimate how much time you were playing the game: ___ min

Q27.- My emotion often varies with the story's progress

Totally disagree □ □ □ □ □ Totally agree

Q28.- Sometimes I really think I am the avatar of the game

Totally disagree □ □ □ □ □ Totally agree

Q29.- After I finished the scene, it takes a time for me to return to the real world psychologically and emotionally

Totally disagree □ □ □ □ □ Totally agree

Q30.- I can sense the relationship between events

Totally disagree □ □ □ □ □ Totally agree

Q31.- I want to know the rest of the storyline in the course of playing.

Totally disagree □ □ □ □ □ Totally agree

Q32.- The avatar in the game is attractive

Totally disagree □ □ □ □ □ Totally agree

Q33.- I feel successful when I overcome the obstacles or tasks of the game

Totally disagree □ □ □ □ □ Totally agree

Q34.- The story quickly grabs my attention

Totally disagree □ □ □ □ □ Totally agree

Q35.- I concentrate on the story for a long time

Totally disagree □ □ □ □ □ Totally agree

The next questions are open

Q36.- Which features of the game you found more engaging?

Q37.- Which approach did you use when selecting the dialogue to talk to Ian?

Q38.- Would you buy the game? Why?

Q39.- Any other comments?