



TRILHA PRINCIPAL

CONTRIBUTIONS FROM THE LUDOLOGICAL ANALYSIS FOR THE DESIGN OF SERIOUS GAMES

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Abstract — This article aims to describe contributions that the Ludological Analysis can offer to the development of serious games. We describe a case study evaluating the characteristics of different digital Serious Games for the understanding of the main elements that make players feel challenged and motivated. This study was conducted based on the application of concepts of Ludology, seeking to validate the factors associated with the liminality, a psychological state in which the player feels so engaged in the gaming experience that focuses, almost entirely, in the game. After identifying these factors in the games analyzed in the case study, these features are mapped to the needs and possibilities in the field of education, specifically in the analysis and planning of digital Serious Games, considering that its observation may represent improvement in the conception and use of these materials.

Keywords — Ludology, Gameplay, Serious Games.

I. INTRODUCTION

The ludological analysis seeks to understand which elements are responsible to make digital games attractive to different types of gamers and also to create in them the mental state defined as liminality [1].

The liminality state is defined as the ideal experience reach, in which the player is so involved in the game experience that he develops an almost full attention in the game and the abilities it requires [2]. Applying ludological analysis to different serious games with wide acceptance in the literature we can discover relevant data that can lead us to understand and identify the elements that induce this liminality state, which we call liminoid elements.

These elements can then be applied to create more attractive serious and educational games, both in the esthetic and

playability aspects of the game, contributing this way for better results from these game initiatives.

We consider the increased interest of users in a specific educational or Serious Game as relevant, given that this increase potentializes the involvement and interaction of those users with the proposed topic, maximizing the developer's desired result.

Games and more specifically, the digital ones, are not anymore mere pastime for children and teenagers, but are a frequent part of their daily routines [3, 4]. We can say that these youngsters are part of a generation called digital natives, a term coined by Prensky in 2000 [5].

Above all, games stimulate spontaneity and motor coordination, logical and critical thinking, reflexes and the ability to work in groups, among many other aspects of personal cognition [6, 7].

The importance of games in the current market is clear. In 2010 alone in the USA, digital games generated more than twenty four billion dollars in business. In order to answer the demand of a growing public there are several types and genres of games, with many different purposes. Among them, there are games with three main goals: entertainment, education and training [8, 9].

The fact is that even though the games have shown its social and cultural value, there are still few studies on games with approaches and methodologies that are not derived from other áreas. For instance, there is the case of narratology, which is widely used to analyze aspects of the game's internal narrative [10, 11]. In order to answer this specific demand, in 1999 was proposed the ludology, a term coined to describe a new way to analyze games [12].

Lodology intends to study games treating them as the unique pieces they are, and its main focus in in the analysis of gameplay and of the elements in those games that make the game playing activity so immersive for the gamer.

The digital games called Serious Games have been more used in training, education and instruction situations [2]. Some authors, such as Michel and Chen [42], differentiate Serious games from the other based on the presence in the former of a priority on educational goals over the entertainment aspect.

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One of the important arguments to justify playing Serious Games is associated with the notion that the involvement that happens while playing them can help develop a skill or cognitive activities related to the subject matter [13]. Nevertheless, not always digital games are developed adequately to the topic [14] or with an adequate concern over the gameplay elements, often causing those games to be seen as non immersive or fun by the users.

Based on the fact there digital games have a great potential to support learning and teaching processes, the growing importance and usage of the Serious Games initiatives, as well as the shortage of research on the elements that create attractability for the users, this paper intends to propose a set of contributions that ludological analysis can help to develop Serious Games. In order to achieve this goal, we describe a case study for the evaluation of the characteristics of digital Serious Games to understand the main elements that challenge and motivate users. This study was performed using as a basis the concepts of Ludology, seeking to validate the factors associated with liminality.

After identifying these factors in the games we analyze in the case study, we discuss possible mapping of those aspects into the needs and possibilities of analysis and planning for Serious Games, given that its observance can make them better. In a more specific way, this research allowed us to discover the main liminoid elements¹ present at all different Serious Games and to point out their value in the context they are inserted. In order to achieve that goal, besides the theoretical framework, we performed an analysis of each of the select games, based on the ludological approach or analytical gameplay [1]. In this approach we must play the game under study trying to abstract what is not relevant to gameplay and searching during the session to keep the observation focus on the attributes proposed by Jeggers [15], so that we can afterwards analyze them and verify their importance for the game in question.

The quest to understand liminoid elements present in Serious Games is relevant mainly to understand how to use them correctly in the development of those games and also of other interactive and multimedia products for different contexts, such as educational, entertainment and training so that those products achieve greater success with the digital native public. The lack of material in this area and the growth of the game market, which present yearly several innovative titles, are also factors that help underline the importance of this research.

This paper is organized as follows: in section 2 we make some general considerations about games and describe aspects of Serious Games. In section 3 we detail the concepts associated with gameplay. In section 4 we describe aspects of Game Studies and analyze the relationship between education and entertainment in section 5. At last, sections 6 and 7 present respectively the steps followed in the case study and the final

conclusions.

II. CONCEPTS: SERIOUS GAMES

In this section we will describe the main topics on Serious Games, providing an initial description of the general elements on games and the main characteristics of digital games.

It is not easy to define what a game is [16], because each one can understand it differently. For instance, in the English language we use the word game for the construction of many different meanings and situations. For instance, “I understand your little game”, “this is a game of thrones”, “love is the single game in which both players can win”.

The word game in Portuguese evolved from the word *Ludus*, which is Latin means fun, play and not from the work *Jocus*, which is more similar and means to make fun of [17]. Huizinga [18] suggests that the game or the act of game playing precedes the human culture, given that before society came, other living beings played for pleasure:

Game is a voluntary activity or occupation, performed under certain time and spatial frames well defined, according to rules freely accepted but forceably applied, that becomes an end in itself and is accompanied by a feeling of tension and joy and a conscience of being different from ‘daily life’. [18]

The fundamental characteristic of a game is to be fun and naturally pleasurable. Caillois [19] points out that “we only play if we want and when we want and for how long we want. This means that games are a free activity”.

The importance of games in the formation of the individual is intrinsic because, as Pearce [20] suggests, games in general have a strong relationship with simulation and historically the act of simulating situations is used as a contributing factor to help learning. Besides, games make the players to make an effort to reach the proposed goals [21]. Learning while playing or simulating is one of the oldest methods we know, because such method can be observed even in young animals that play hide and seek and fight, hence learning and exercising abilities that will be useful to them in the future.

Kishimoto [16] endorses the importance of games in the development of individuals in the educational, psychological, social and cognitive aspects, when he states that playing them potentializes exploration, development and knowledge building, for relying on internal motivation, typical of ludic activities and inherent to any human being.

Digital games are not seen any more as mere entertainment software, but as software capable of helping the educational and psychological development, being capable of serving as tools to analyze social relationships and communication [22]. This made it important to study the history of electronic games from the educational, anthropological, scientific and software industry points of view in order to better understand the phenomenon of their popularity and also what to expect from its future. Besides, we need to explore the possible negative effects in the formation of a person’s character, which can be associated to some of the underlying themes in some of

¹ Liminoid elements are those elements that contribute for the gaming experience to be immersive and end up instigating and motivating the gamer.

the games or how they are played.

According to Hjorth [23], digital games are related to the emergence of digital technologies and culture. An electronic game is above all a simulation of situation and stories that have already been seen in other environment or media [24]. This is true ever since the development of online chess, which can also be played in physical format, and up to the development of war games, with soldiers as pilots of battle robots that existed in fiction books even before the invention of the first digital game.

One important object of study and analysis in the area of digital games are the Serious Games, whose main goal is not entertainment, as usual, but to help the education or training on a specific subject matter. Mann [25] suggests that Serious Games can be the solution to training problems using computer games in an educational way. On the other hand, Michael and Chen [42] highlight that the main element of Serious Games are the educational and informational goals, even with the consideration that the aspects of fun and entertainment are important and collaborate in order to help the educational aspect of the Serious Games.

Although many companies, education centers and industries have already benefited from the application of Serious Games, there is still prejudice against the word "Game" to be fought, given that many still associate this word only with fun [26]. Another barrier to transpose for the application of Serious Games in the formalism that sometimes is not as attractive and immersive as those developed for entertainment alone [14]. This formalism can be broken with the understanding of the elements that make those entertaining games captivating to users and the application of these elements in the Serious Games, making them more interesting and effective. This is the object of study of this research, with the utilization of an experiment and analysis of those elements which will be described in this paper.

According to Elam [27], the military and the medical emergency areas were the first to use Serious Games. Given the high danger associated with both areas, it became necessary to recreate virtual situations that could express reality in a realistic way, in order to train and educate their personnel in an environment where mistakes would not be fatal. A success story of Serious Games is the game America's Army, presented in Figure 1, which was developed to simulate tactical environments where the players need to go in missions similar to those they would perform in war situations. This figure shows an action scene where both the player and the environment can be seen. These environments make it possible to users to explore different situations that may be found in real environments and stimulate the creation of a hypothesis set and the experimentation of possible reactions and the outcome of each one of those.



Fig. 1. Avatar of a player in the game America's Army.

As described above, in spite of its ability to help areas such as training and the search for solution for complex problems, Serious Games are sometimes not conveyed with the adequate attention to elements that are fundamental for its success with users, like the elements known as *gameplay*, which have been studied in specific approaches like *Gamestudies*. These two items are detailed in the next two sections where we also describe elements of *Edutainment*, an important approach to promote the usage of Serious Games associated with educational purposes.

III. GAMEPLAY AND THE GAMERS WORLD

Games are deeply intertwined with other more traditional and respected forms of communication such as the movies and music. It is remarkable that dozens of professionals such as programmers, musicians, designers and artists are hired for the development of the current electronic games, whose costs can amount to millions of dollars.

Digital games are not restricted to children's bedrooms, arcade parlours and lanhouses, but have invaded less conventional spaces, such as the classroom and have migrated from the computer screen to other new and multifunctional devices, such as smartphones, interactive TVs and tablets.

Prensky [28] points out the growing importance of the role of gameplay aspects have in games as motivational factors for study and development activities. He also recommends to analyze the fast growth of the electronic gaming industry, especially from the end of the 1990s, because games, together with the development of communication and information technologies, have changed deeply the ways we communicate and socially interact.

Official and non official conventions have arisen and grown and in those places gamers meet in order to discuss a specific game and also to create jargon that belongs to the gamer community. Due to the Internet, these words and phrases were spread through a large number of players and they were called by Mäyrä *Gaming Neologism*, but the users know them as *1337* or *Leetspeak* [29]. Roseto [30] proposes that in order to participate and to be accepted by a playing group the individual "[...] must adopt the behaviour, the attitudes and follow the norms instituted by this mini-society that was

formed around the gaming, increasing the potential of socialization development”.

Gameplay, or playability, can be defined as the interaction and connection of the player with the game which instigates the user to continue with its rules and elements. According to Newman [31], gameplay is what does not change in the game when its graphic interface is changed, that is, the rules and the way to play it. For instance, there are many versions of the Monopoly board game where the street names and places are changed, but the way to play it remains unchanged.

Gameplay is not the whole game experience, but what makes it a game and, more specifically, “this” game [31]

The graphic interface and the story are not part of the gameplay. Gameplay is the part of the game that requires absolute user participation, as in a war game, where all users must cooperate with each other respecting the game rules in order to defeat the enemy army. The most interesting gameplays are those that cause both negative and positive consequences. This causes the user to make choices that are not always automatic or obvious, and forces him to think in a few seconds (depending on the game) about the action he will take next [32]. A good gameplay occurs when the game improves the users’ cognitive processes, such as rational thinking, motor coordination and others while feeling the urge to explore different tactics, in order to evaluate the advantages and disadvantages of each one of them.

Jeggors [15] introduces six attributes for the evaluation of gameplay in electronic games which form the foundation for the analysis presented in this paper. The attributes are:

- 1) Learning: Identified as how easy it is for the player to master the rules, interactions and goals of the game. Most games use a learning curve, so that difficulty is increased slowly as the player progresses. Others have help screens in which they present the rules and tips for a better understanding of the game as a whole.
- 2) Efficiency: A game with an efficient gameplay is the one that calls the attention of the player right from the start and keeps him captivated until the end. It can also be defined as the correct use of challenges during the game, keeping them in balance.
- 3) Immersion: This maybe the most important of the highlighted attributes. The state of immersion is achieved when some user’s ability is highly required by the game, making the gamer to concentrate so much that he focuses less in the real world than in the game, and starts perceiving the game in a most refined way, becoming able to react to actions in the game with quick and almost automatic reflexes while responding to stimuli outside the game in a slower and less attentive way.
- 4) Motivation: These are the characteristics that induce the gamer to perform certain actions and to persist in them until their fulfillment. In order to achieve high motivation, the game must have a good reward system, instigating the player and showing him the relevance of performing the tasks.

- 5) Emotion: These are the involuntary impulses originated from game stimuli that induce feelings or lead to automatic reactions, such as smiles or frights.
- 6) Socialization: This is an attribute that can be achieved mainly in online games or those that allow multiple players at the same time. The socialization attribute promotes the social factor in the gaming experience, allowing the games to appreciate the same game in a different way, thanks to the relationships established among players.

IV. GAME STUDIES

The social, cultural and economic roles of games have changed through the years, as well as the game industry, who started to invest more in its products. Some of their launch events even became phenomena in several media. From simple software developed for the entertainment industry to important pieces whose goals can include many aspects such as entertain, train, educate or even a mix of those.

The study of games and the need to understand their function in the formation of the human being is a consolidated fact in different areas of knowledge. Nevertheless, most initiatives tend to study and analyze games applying techniques and methodologies that were developed for other fields of study, instead of creating a specific methodology for the investigation on games [33]. Given that a game is a complex product, it is developed with the help from many fields, such as information technology, communication, psychology, sociology, pedagogy and others. Hence, it must be analyzed taking into consideration all those factors, and not under the scrutiny of a single specific discipline [9,20].

Those changes made it imperative the creation of new techniques to evaluate and analyze games. The Game Studies are the set of disciplines that study digital games, their design, rules, players and their role in society and culture. The Game Studies approach may be described as multidisciplinary and dialectic, given that the understanding comes from connecting concepts, lines of thought and ideas that already exist, but are separated. Among those disciplines involved, we can mention Computer Science, Communication, Design, Cognitive Psychology and Sociology. All those disciplines offer specific contributions to areas connected to game development, from the script and argument conception to the chosen visual aspect and the implementation resources. The goal of Game studies is to analyze the games using more than a single field of study in order to connect those concepts and achieve a more detailed and generalizable analysis of the game at hand.

One of the main objects of research from Game Studies are the elements that make the game addictive and take the player to the liminality state, that is, the elements of the game that require such level of skill from the player that he becomes entirely immersed in them. Those elements are part of what makes the game interactive and unique: the gameplay, which is its main object of study and analysis [34].

V. EDUTAINMENT: EDUCATION AND ENTERTAINMENT

Rapeepisam [35] in his book “*A Model for Personalized Learning*”, states that the term *Edutainment* was first described by the Walt Disney Company, in 1948, to describe a series of educational documentaries that were meant from the young viewers (children and teenagers). The term is a contraction of the terms education and entertainment.

Edutainment is the act of concentrated learning through different medias, such as television shows, videogames, movies, music and computer software [36]

Edutainment consists in teaching in a funnier, more dynamic and interactive way, using the ludic characteristics of different types of media and taking the student from his more traditional role of a spectator. The same author states [35] that more and more, educators are searching for new teaching techniques based on edutainment, especially for children and teenagers. The digital natives have a huge fondness for technology, what makes them appreciate a slide presentation with animations more than printed material, for instance. He also stresses that the initial contact of every individual with the digital world through effective interactivity happens usually through games. Hence, when they are used educationally they tend to be very effective. Nevertheless, it is important to point out that using media with the single goal of offering the student a differentiated way to present content may not be enough to ensure the expected motivation. If the usage of those resources is not associated with the students’ interests and context, the motivational effect may not happen.

Hence, we need to create an environment that favours the significative learning process for the student, one that makes it possible for the student to engage in functional exchanges with the software. This should not happen through the direct and explicit offer of knowledge, but by putting emphasis on the discovery and exploration of the subject matter, allowing for interaction based on ludicity and increasing the proximity of software and student and the learning possibilities for the latter. This way, we maximize the potential active engagement by the student.

The fact is that the concept of Edutainment has been increasingly explored by the educational game development entities and by researchers in the area of Game Studies, especially to change the stigma that educational games cannot be as fun as those that do not have an educational purpose.

VI. CASE STUDY OF LUDOLOGIC ANALYSIS

Ludological analysis has a different approach for identifying the elements that are responsible for the digital games attractivity. It is different from other Gameplay evaluations that use resources to follow physical signals [37], vídeo recordings [38] or prioritize aesthetic aspects [39]. In this approach we seek for a subjective identification of the aspects associated with gameplay [40, 41, 42]. The case study we describe in this paper follows this assumption and, therefore, considers that it is adequate to come to conclusions about the

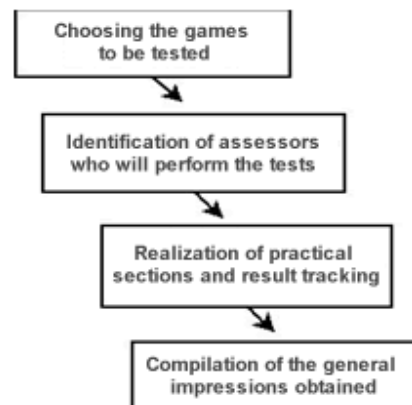
results obtained with ludological analysis of a small group of evaluators, given that the fundamental aspects are subjective.

The methodology adopted in the experiments considered the steps planned in such a way to promote adequate support to the experimentation and analysis proposed for this paper. The general steps of the adopted methodology were: 1) choice of games to test; 2) identification of evaluators to perform the tests; 3) actual execution of the practice sessions with the evaluators and follow up of the results; 4) systematization of the general impressions we came to.

In step 1 we chose five Serious Games according to the following criteria: they should have different goals and reach different audiences, be convenient to download or access and allow for experimentation of different strategies and interfaces.

In order to select the evaluators, which is the core of step 2, we used the criteria of convenience and availability to participate in the experiments, along with the determination of a composition of different player profiles (as explained below) in order to create a representative group.

Step 3 was conducted according to the analytical gameplay procedure presented by Mäyrä [1], which consists in execute game sessions trying to abstract the elements that are not part of the gameplay and trying to keep the focus on the pertinent elements.



Board1. Fluxogram with the steps of the adopted methodology.

Step 4 is oriented to collect the answers to the presence of the six attributes of gameplay analysis [15], which are learning, efficiency, immersion, motivation, emotion and socialization. Afterwards, the analysis of the results found allowed us to point out the liminoid elements of the Serious Games under scrutiny and their importance in the context they are in. The fluxogram in Board 1 illustrates these steps.

The games selected were analyzed based on aspects of their gameplay, as suggested in the ludological approach, and they represent different types of games (as was our goal, stated above) in order to achieve greater representativity in the set of analyzed material. Next we comment briefly on some of the characteristics of the games we studied, already including in these comments reports and observations collected during the

analysis performed by the games involved in the test.

The first game analyzed is the Realm Priston Tale, which is an online game in the *MMORPG* style (Massively Multiplayer Online Pole-Playing Game), which is nowadays played by more than 585 thousand simultaneous users in five different servers. A general view of its interface can be seen in figure 2. A very strong element of this game is socialization, because Realm Priston Tale is based on the main premise of team work and user collaboration. As we can see in figure 2, all characters have a speech balloon positioned right above their heads. All messages written by a player are also shown to all other involved players, facilitating the communication among all those involved in the game. Another very important aspect of the interface is the help panel located in the left upper corner of the screen, where a small dragon offers tips and describes the main characteristics of the games in textual form, enabling the learning process.



Fig. 2. Dragon presenting itself and helping user.

The second game we studied was Lider 2010, developed to execute inside the browser. This game turns the player into the leader of a four person team and forces him to make decisions on the management of a fictional company in the IT sector, taking into consideration the characteristics of each group member.

Its genre is characterized as a combination of simulation and puzzle. The game lasts about 30 minutes, during which the player has to deal with delicate situations, constant pressure and crisis and need to understand each member of his team in order to achieve the expected results. Each player action generates an immediate response from each of the team members, motivating him to continue the good work or to improve some specific point. The game interface is quite functional, showing all the necessary information as images and text, which allows for quick learning. Figure 3 shows the first step of the game, where a textual profile of each of the fictional team members is shown. This textual information is complemented with an avatar that demonstrates some of the visual aspects associated with the character, enhancing the context to the gamer.



Fig. 3. Screen where it is possible to know the team profile.

The third game is called Stronghold, a medieval strategy game in which the player must build an empire and a big army to defeat his enemy, while worrying about economic aspects of the state and trying to keep the king's popularity at high levels. During the game, the player needs to choose how to rule his kingdom, being able to choose high popularity, making the villagers work more happily but slower or, through intimidation make them work harder, but with little enthusiasm and a shorter life span.

This mix of strategy and economy, adding to the lack of explanatory tutorials and the complex game interface lengthens the learning process, but the huge amount of options and available actions favours the immersion of the experienced gamer. Figure 4 illustrates a scene of the game where we can see the siege of an enemy castle and also allows to identify the priority given by this game to visual elements of the current scene, given that they occupy a large part of the available screen.



Fig. 4. High number of units attacking a castle.

The fourth game studied, *Darfur is Dying*, intends to discuss the crisis in Darfur, Sudan, and was the recipient of the Darfur Digital Activist award in 2006.

Initially, we must choose among eight characters of different ages that belong to the same family. This step can be seen in Figure 5, which also highlights the simplicity of the game interface.

After the character selection, the player needs to retrieve water for his village, while escaping from members of the militia, in order to use it to cook and for agriculture, ensuring the survival of everyone until water becomes scarce again. If the player gets caught during his water search, the family will receive a message informing what may have happened to the character, and the outcomes are based on the reality of the Darfur region.

The game interface is easy to understand and presents a help button with which the player can learn more about the commands available for playing.



Fig. 5. Screen for character choice.

In this game there is a strong appeal to the emotion attribute, given that it presents several aspects of the life of the Sudanese from Darfur in a very impactful way. Other three aspects present are immersion, because the game is very realist and the gamer must remain attentive to the presence of the militia men which can catch him at any time and no forewarning. At the same time he tries to keep his village alive and there is motivation through textual and graphic feedback for each of his actions. Finally, there is also socialization, given that *Darfur is Dying* extrapolates the game and tries to make the gamer contribute to the cause making it available through its site different ways to donate money, initiate activist movements at your university campus or even to send a message to presidents of foreign countries through the site of a non government organization.

In the last game analyzed, *FloodSim*, the gamer must take care of the flood prevention policies in the United Kingdom, deciding where he will allow houses to be built, which prevention measures the public money will be spent on and how to keep the public informed. Even though its theme is relevant and the graphics are quite good, something unusual in this kind of game, the game has a complicated interface and

uses a formal language and technical jargon in many different moments, breaking the gamer's immersion, given that its target audience are the common folk pessoas living in the areas affected by floods in the United Kingdom.

After this initial choice of Serious Games to test, we also defined the main context of each one of those, varying in categories such as information and entertainment game, educational game or training oriented game. According to the initial expectation of this work, we also observed that even though each game has its own liminoid elements organized in different ways, there are those that are present in all games, making it clear that the developers are aware of its importance.

The choice of evaluators intended to create a representative set of the different gamers' profiles. The group of ten players was made of 70% men and 30% women, and its average age was 27 years old. The group was classified into profiles according to the average number of hours it played digital games each week and the players' goals. It was then composed of professional players (average of 40 hours a week dedicated to playing and making 20% of the group), regular players (average of 18 hours a week dedicated to playing different games and making 20% of the group) and casual players (average of 10 hours a week dedicated to games and making 60% of the group). The average session time varied from 30 to 66 minutes and each session was followed and monitored by an expert in the development of digital games in order to gather the required data.

Table I summarizes this context, indicating in the first column the name used in this paper and in the second column the detailed description of each profile and the average number of hours dedicated to games, as well the type of games they played. The third column indicates the number of participating players in each profile.

TABLE I
SUMMARY OF THE PROFILES OF THE INVOLVED GAMERS

DENOMINATION	DESCRIPTION	PERCENTAGE
Professional	Weekly dedication of more than 40hs to play specific games.	20%
Regulars	Average dedication of 18hs to play several games	20%
Casuals	Average involvement of 10hs a week to play casually different games.	60%

The method chosen to evaluate this dataset specified by the players with free observation of the analytical gameplay, adopted a free adaptation of the Likert scale, which is a widely used scale in polls. The scale varies from zero (0) to four (4), considering that the value 0 indicates that the game has nothing of the attribute at hand, the value 1 indicates that the game has the attribute but is badly developed, the value 2 represents a game that presents that attribute in a non marked way, the value 3 indicated that the attribute is well developed

in the game and the value 4 indicates that not only the game has a lot of that attribute but also that this is a highlight point of this game.

Table II organizes the data collected, summing up the impressions of the players involved in the tests of the selected games. Next, we highlight the relevant aspects in greater detail in order to support the analysis of the results.

TABLE II

EVALUATION OF THE ELEMENTS PRESENT IN THE FIVE GAMES UNDER STUDY.

	Realm Prison Tale	Lider 2010	Stronghold	Dartur is Dying	FloodSim
Learning	3	4	0	3	2
Efficiency	4	4	4	3	2
Immersion	0	3	3	4	2
Motivation	4	4	4	4	4
Emotion	0	1	2	4	1
Socialization	4	1	2	4	0

The analysis of Table II allows us to identify that the liminoid elements best developed in the five games under scrutiny are efficiency and motivation. In terms of efficiency, we can say that it refers to how much the gameplay can keep the player motivated, making a good use of challenges from the start. On the other hand, the motivation is related basically to the reward system and the feedback for each action the player takes.

These results allow us to evaluate which elements are most important, because, as a whole they help to keep the gamer playing longer, while feeling challenged and motivated and making it easier for him to achieve the liminality state. It should also be noticed that other two elements are present in an expressive way: the easy learning and the immersion, that should be the main element of a game, given that it is the sum of all other liminoid elements.

VII. CONCLUSIONS

In this paper we described a case study with the goal of evaluating characteristics of Serious Games using the concepts of Ludology. We presented concepts of digital games, serious games and analyzed and compared definition of authors such as Kishimoto, Huizinga and Caillois. Based on those definitions we highlighted the empirical and fundamental aspects present in game, according to Mäyrä [1].

The constant use and increase of this area is a testament to the important of researched to understand its application context. This means understanding and studying players, their conventions, preferences, many different game genres and, above all, identifying which elements make digital games so immersive and attractive, so that we can use those elements in different games and achieve the same results that were achieved by those serious games.

The identification of the main liminoid elements present in games that are widely accepted and the understanding of how they work allow those aspects to be recreated in games of different genres and applications. This way, we will be able to

create serious and educational games with the same immersion appeal present in famous titles.

We believe that this work can support mainly theoretical research on liminality and ludology, help create a native approach that belongs to the Field of digital games.

It is a known fact that there is a growing adoption of Serious Games and also its clearer importance as an element able to fulfill needs in several areas such as activities of training and capacitation. Nevertheless, the project and the design of those games must follow patterns and guidelines that are conducive to fulfilling expectations in both attractiveness and immersion. In this context, we identify in the studies suggested by the Ludologic approach a framework that can help support those activities in a way that is integrated to the game context itself, considering all its peculiarities and needs. The case study presented here allows for the collection of evidences in this matter through the identification of the presence and the importance of the liminoid elements in the performed tests.

Future works must contemplate some aspects such as increasing the number of evaluations with different populations and different game selection, in order to improve the findings and provide a statistically solid evaluation. Another important point for future works is the complementary analysis of several other aspects of Serious Games beyond the rule system and the interface used to interact with those games, in order to verify the possibilities of additional aspect to be predominant or even relevant in achieving good results with the players.

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