

Immersion: Immersion and Emotion in Digital Games

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Abstract

Immersion and the study of the emotion are key elements to the creation of a digital game. The elements that change their influence on the player are also important to give the user a better experience on the game. The goal of this project is connecting this two concepts, based on theoretical studies on the influence of both items, inside and outside the primordial concepts of creating a virtual environment systems. To accomplish this, it was created an application that is divided into three parts: the first one, an expert system, collects data on the degree of immersion in digital games of the Action Adventure style. The second part, a system based on fuzzy logic, analyzes the data collected in the first part to relate the emotion with immersion of that games. Finally, the third part groups the games studied according to degree of emotion they have. Ninety-six players of digital games in this survey answered the expert system, resulting in one hundred thirty-three completed questionnaires, with six hundred seventy-two variables defined and immersive three thousand four hundred and six statements defined. With this, it was concluded that the games of the studied style are more likely to give the player emotions such as Love, Hate, Pride and Shame.

Keywords: immersion, emotion, digital games, fuzzy logic, self-organizing maps

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1. Introduction

Digital games constitute elements of culture in general and because of this, they are showing a growth market over the years. According to in the late 90's, the digital games industry moved about nineteen billion dollars a year [Polsson 2007]. In 2011, it is estimated that sales reached 73 billion dollars worldwide, with a forecast to exceed the amount of 100 billion of dollars in 2015 [Takahashi 2011]. As a result of this growth, creators and developers of these games have elements sought to improve this games and make them more attractive. This requires study and analysis of some aspects that make up a digital game: immersion [Calleja 2007; Dansky 2006], in addition to the study of emotions in digital games [Craveirinha and Roque 2010].

Immersion is one of the main concepts to address the creation of a digital game. It is defined that the feeling

of immersion is connected to the identification of the player with the game, i.e., immersion defines how comfortable and engaged the player feels when participating in the context of a game [Dansky 2006]. This sentiment, from the standpoint of marketing, is critical to the success of a game, and provide greater satisfaction to the users of this and encourage the creation of more games that relate to this precept.

The objective of this research was to create a connection between the elements that change the player's immersion in relation to the game and the emotion that he/she feels in the digital game during his/her foray into the virtual environment. To this end, it was developed an intelligent system that allows the analysis of the immersion of digital games and its relation to the emotion of the player, according to the criteria established during the investigation, and that allows the grouping of elements for the verification of digital games that have a immersion similar profile. From this, this research aimed to calculate the specific degree of immersion in these games by creating metrics based on their characteristics [Mendonça 2008]; Other purpose of this research is relevant to the delimitation of the connection between emotion and immersion of the player that got in touch with a digital game. The intelligent system designed to analyze the immersion in digital games seek, through the use of artificial intelligence techniques (specifically fuzzy logic and Self-Organizing Maps), that contributes to the measurement and analysis of immersion and excitement of digital games.

In the Section 2, the concepts of immersion will be shown, from a macro point of view to the specific view of digital games. In the Section 3, the same approach given the immersion will be given to the concepts of emotion. In the Section 4, both emotion and immersion were connected into one new concept. In the Section 5, the methodology used to achieve this link is shown. After that, in the Section 6, the analysis of the results found by this research are discussed. An then, in the Section 7, the conclusion of this work is presented.

2. Immersion

Immersion is a psychological condition in which one person has all his attention on a single activity and feelings are channeled to that point in particular. To continue in this state, one needs motivation, until you reach a point of total immersion, where the brain actually believes that what is being shown for it is your new reality. This stage of total immersion is also known as flow [Csikszentmihalyi 1990].

The concept of immersion can be defined by a metaphor. The analogy used to define the word immersion involves the feeling of being underwater. In the words of the author, this sense refers to the “same impression we get in a dive in the ocean or in a pool: the sensation of being enveloped by a completely strange reality, as different as water and air, that takes hold of all our attention, all of our sensory system” [Murray 2003, p. 103].

Thus, it is noted that immersion will configure if there is a channeling of feelings coming from the user’s media [Murray 2003]. This means that the media should spend enough security so that the person using it can project their feelings and thus be involved. If it does not, the user may feel threat stemmed from the media and not open enough for the involvement occurs.

In the scope of digital games, immersion can be characterized in the psychological and emotional concept in the game player. Immersion is indicated as that moment when the user’s digital game feels “inside” the world presented to him, i.e., he feels like an integral part of story proposed by the virtual environment [Dansky 2006]. Within the scope of this definition, it is proposed that when the player feels psychologically immersed, his presence is transported to another medium (in this case, the game), i.e. the user of the digital game has the feeling that gradually in its mind the virtual world is can be considered as the real world [Sodowski and Stanney 2002]. To enhance this feeling, the sensations present of the world outside game should be removed. A way to cause this feeling is to increase the factor of isolation, both physical and psychological, of the user [Witmer and Singer 1998].

For the virtual world of the game involves the player’s feelings, the user of the game must identify himself with the elements of that environment, i.e., there must be a connection between the player and the items of the proposed digital game. Thus, the user of the digital game will feel comfortable and to increase this feeling is directly proportional to the growth of the degree of immersion between game and player [Dansky 2006].

The elements of digital games that can be directly influenced by immersion are: narrative, gameplay, video, audio, social and artificial intelligence.

The narrative is defined as the representation of reality. This means that the narrative shows just what is needed now, at a given time, without the need to present all possible characteristics of the element being displayed [Frasca 2003a]. The narrative in a digital game can be divided into two parts. The first part is called the “High Level Story”. It is formed by the creative and developing team when they are building the game. It is displayed to the user through scenes and dialogues [DeMarle 2006]. The second is called the “Intermediate Level Story”. It is created by the player’s actions in all its forays into the digital game. This story

creates an intermediate level of non-linearity within the digital game, considering that each game has no similarities with the others, thus forming a different narrative in each.

The concept of gameplay can be divided into two distinct elements within the game: The interface and the challenges. The interface is the means by which the player can interact with the virtual environment proposed. This interaction through interfaces will influence the flow of communication between game and player. The measurement of frequency that the player responds to the stimulus provided by the game is essential to check the level of control that the player is having on the game: The faster his answer is, the more control he is feeling. And incrementing the level of the control causes the sense of immersion ascend also [Kusternig and Semanek 2006].

The challenges are considered as an essential part of the concept of gameplay [Rollings and Adams 2003]. For a cohesive gameplay, there must be a connection between the events of the game. The interconnected events are challenges themselves, because they are the choices the player took when they are forming them. These choices are made from elements that come from the game itself, which causes it to be regarded as an indirect interaction between game and player so the user can advance the story within the proposed virtual environment [Rollings and Adams 2003].

The challenges are also present in the game to motivate users to continue playing. It is a form of entertainment that digital games inherited from board games. And these challenges can be considered as learning experiences too. Users, when complete the objectives of the challenges, have the feeling that they learned something, even if only in the context of the game presented [Rouse 2005]. With this motivation and the sense of learning about the environment, the gameplay influences the immersion positively.

These two themes, both narrative and gameplay, are the main topics when dealing with the basic formation of a digital game. However, there is a division of how the game is developed as it can tend both to the interactive side, i.e. valuing gameplay, or having the composition the narrative more evident. These two forms, however, should not be opposed but collaborative, so they can work together in ways even if a game has a specific narrative or gameplay more in evidence. This causes the essential protrusion for both stand and also having their own dynamic, but they nevertheless act together [Teixeira 2008].

About the visual aspects of the digital game there is the concept of realism. This realism given to scenes of digital games should also be taken into account for the growth of immersion. It is controlled and optimized by the developers of digital games through the use of textures, resolutions, light sources, etc. These techniques should create objects that do not necessarily

have to be correlated with the ones in the world of the player. The looks of them can cause the sensation that is consistent, has continuity and connectivity with the rest of the virtual world and this will cause the user the feeling of what is real, thus increasing the immersion [Witmer and Singer 1998].

The audio within the digital game is used for three specific purposes: to deal with events related to time, to call immediate attention of the player and to guide the player when his visual attention is focused elsewhere. For the increasing of the immersion, it is necessary that these three aspects are inserted in a natural way. It is suggested that the sound from the game should be transmitted in three dimensions (through a surround equipment, for example), so the player knows exactly from which region in the virtual world the sound is coming from. However, the way the game viewing is done through the cameras can influence the sound output [Kusternig and Semanek 2006].

There are two distinct types of social relations within the virtual environments and digital games: among humans and between human and machine [Heeter 1992]. In either case, the immersion is incremented only if the player is felt that with which it is interacting part of the virtual environment proposed. Social relations between humans can be done with so much online as offline in social games.

In the case of the relationship between the player and the player, the closer the virtual environment is with what exists in the real world, more the player will be comfortable and, therefore, will also be more immersed [Kusternig and Semanek 2006]. One way of approaching the concept of social relations that exists in the real world with the creation of communities, which is directly linked with the online multiplayer social relations. Communities are formed when a group of players get together to achieve a common goal. The creation of a cohesive group and heterogeneous, that is, having avatars with each other and diverse skills that meet the needs of the team is vital to continue within the environment. Not only the skills of avatars influence the choice of the group, but also the social bonds between players, which increases the feeling of being part of a real community [Rodrigues and Mustaro 2007], thus increasing the immersion.

As mentioned, there is the human-machine relationship in digital games [Heeter 1992], which is dictated by the existence of artificial intelligence implemented in the system. The AI has five main objectives in a digital game: Challenging the player, not have inconsistent behavior, be unpredictable, help the narrative and create a living world [Rouse 2005].

To achieve the objective of challenging the player, the developer of the digital game should worry about not letting the AI too easy to beat and not hard enough to become inconvenient and take the fun of the game

[Rouse 2005]. The part of not having inconsistent behavior includes the fact that if a Non-Player Character performs some action that is incoherent with the environment they are inserted may cause weirdness in the player, diminishing the immersive factor present [Rouse 2005]. The goal to be unpredictable is based on what exists in the real world where unpredictability rules the behavior of humans from the point of view of an individual, considering he can not predict what the other beings of the environment will perform [Rouse 2005; Charles 2003]. The AI can help the narrative mainly due to the reaction that the NPCs have in relation to the events of the game or for the avatar controlled by the player. The characters in the environment may, for example, tell the story through dialogue to avatar controlled by the player. Finally, in some games, the NPCs are not designed to directly interact with the player, they are just there to make up the world. For this, the imposed artificial intelligence to these characters exists to make them behave in a natural way according to the created world. The establishment of this scenario gives greater vitality to the game, which will approximate what was presented to the real world, increasing the degree of immersion that the player's feeling in that universe.

With the immersion and its components defined, another important factor to this study is the emotion, whose definition and relation to digital games will be exposed in the next section.

3. Emotion

There are two approaches to dealing with emotions: The organic and the interactive [Hochschild 1979]. These two approaches differ from one another when they deal with how the human body is capable of managing emotions.

When emotion is seen through the organic approach, it is related to the biological concepts of "instinct" and "impulse". From these concepts, the emotion is treated as if it is a natural reaction, a way that the body is dominated by some experience, i.e. as if the body will automatically have a reaction to the perception of the stimulus. In this case, social factors are not responsible for how it is suppressed or raised [Hochschild 1979].

But when the emotion is seen under an interactive approach, social aspects permeate it more intensely, more efficiently, based more on the moment, i.e., in this view emotion fits the sociopsychological moment presented, always linked to other adaptive mechanisms of the brain, as for example, "to think", "to perceive" and "to imagine". Unlike the organic perspective, here are the social factors responsible for labeling, the interpretation and the administration of the emotion [Hochschild 1979].

Games are divided into two parts, the storytelling (represented by cutscenes) and the interactive part. The

storytelling can be seen as an art that develops coherent structures in time events to trigger certain cognitive and emotional reactions in the audience. To the author, the storytelling could be defined as the art of generating and managing expectations. In this part of storytelling, emotional games resemble that presented by the film, because there is no direct interaction with the game. Unlike the study presented by the author, this study does not distinguish between these two emotional parts, considering the excitement generated as a whole [Zagalo 2007].

Within the scope of emotions based on the interaction, it was created a structured model of emotion based on studies related to cognition [Ortony et al. 1990]. The creation of this model was based not only on how people express their emotions, but also how they perceive the world as they interact with it. This world is divided into three areas: events, agents and objects.

For each of the parts of the world cited above, it is indicated what can happen when they are highlighted: If the events that are focused at that time, the expected result of this interaction is the consequences they can bring. If the focus is in an agent, their actions are expected to come out as a result. Finally, the focus on objects is accomplished with an interest in their aspects or properties. With this, it is concluded that the emotions, then, are reactions to the interaction with these elements of the world [Ortony et al. 1990].

It must be taken into consideration that the construction of this theory was based on a simple and direct view of the three areas, since it is known that there are an infinite number of events, agents and objects. In these simplified visions, events are only interpretations of people about things that happened, except for any belief about what they think really happened. Objects are considered only as simply objects. Agents are those that cause the events. They are typically human, but any non-human be excited can be considered also as an agent, within the context they are inserted [Ortony et al. 1990].

Based on the approach that views emotion through interaction, it is established that the interaction between the virtual environment and the user is the main way to achieve their feelings [Craveirinha and Roque 2010].

This interaction can be presented in two ways: The first is the bond that exists between the user and his avatar in the presented virtual world [Craveirinha and Roque 2010]. It is established that the emotions that the avatar “feels” can be transported to the user if there is a strong link between them, i.e., the user must have reasons to connect emotionally to the character that is controlled in order to experience the feelings that the path passes by it. With this, dangerous or frightening situations, for example, can cause fear, distress and/or scary feelings to the user virtual environment.

The second form is done with the reward scheme as soon as he completes a goal. With this, some points where the user feels positive feelings for having completed part of the objectives can be created, i.e., the moments the user will feel better in a virtual environment can be manipulated. The authors indicated, however, that many ways to achieve these emotions is still in theory, that is, virtual environments have the ability to exert greater influence on people emotionally as well as other media, however the developers do not focus in this area [Craveirinha and Roque 2010].

This refers to the concept of interactivity. There are some ways to improve the interaction between the virtual environment and its user. One key tool is the reward system cited before, where each step completed will result in the receipt of awards. Interactivity can be considered as a measure to check how big is the dimension of freedom that a user of a certain system control has to influence in what is happening [Sá and Albuquerque 2000]. With this interaction, the system becomes more human as it facilitates access and communication between man and machine. This can be achieved by facilitating more directly via an interface, which will also facilitate the development of digital hypertextuality the virtual environment.

4. Immertion: Immersion and Emotion

Given the theories set forth in the last sections, two aspects should be taken into account in order to be considered the existence of a link between emotion and immersion:

The first aspect is that virtual environments have as a major feature the interaction. This element in the presented virtual world causes the appearance of multiple paths to reach the objectives proposed there [S´ and Albuquerque 2000]. With this, the digital games environments are linked to the area of emotion, because one of the existing types of emotion is one that focuses on the interaction of a human being with other parts of the world (in this case is the virtual world) [Hochschild 1979].

The second aspect involves the fact that an immersive environment is communicating directly with the human sensory system [Murray 2003]. The virtual environment presented by the digital game, if it is immersive enough, can cause psychological transposition of the user to the presented world [Sodowski and Stanney 2002], causing the feelings directed to the avatar of the user, in its relation of interaction with the virtual universe, to “reflect” to the user’s sensory system. This psychological connection results in the existence of an emotional bond if that link is strong enough [Craveirinha and Roque 2010].

Given that the connection between emotion and immersion exists, the subsections that follow will

cover each area of the structured model of cognitive emotions [Ortony et al. 1990] and their relationships with the variables proposed by this research.

4.1 Consequence of Events

This area refers to the events that occur in a given world, defined by the interpretation of the people [Ortony et al. 1990]. Among the variables that affect immersion in digital games, the first that can be related to this area of emotion is the Narrative. Narrative in a digital game (or any other media that has narrative) is the object of study of an event or series of events [S´ and Albuquerque 2000]. These events affect all the elements that are present in the virtual world in which it is situated. In this world, the story creates the emotion into the player, who receives it as if it were a witness [Perron 2005].

The consequences of events can affect both “self” and “the other” [Ortony et al. 1990]. The interaction with this simulated world makes the consequences of narrative affect both the player’s avatar (“self”) and NPCs and other players (“the other”) [Frasca 2003b].

To analyze which emotions are involved with the element of narrative, it is necessary to observe who is being affected by it. If they are the NPCs and other players, how the user’s avatar is related to these characters must be taken into account. Two relations may be considered for the definition of emotions. These two relationships are encompassed in a set called “Fortune-of-Others” [Ortony et al. 1990].

The first relation is if “the other” wanted the event presented. If the avatar of the game has a positive relationship with this character, the emotion will be presented by “Happiness”. However, if the player’s avatar has negative relationships with “the other”, the emotion will be Resentment.

The second relation involves the fact that “the other” do not want the event. Likewise, there is a positive emotion, if the player’s avatar repudiates those who are suffering with the event, causing the emotion “Gloating”. If the avatar has some affection for “the other” that is being affected by the event, then the emotion involved is “Pity”.

If the one who are affected by the narrative is the avatar of the player, the analysis should also be divided into two parts. The first is presented in this subsection, because it involves only events. It is referred as a set of emotions named “Based on perspective”. The second also involves the action of other agents and is called by the author as “Well-Being” [Ortony et al. 1990].

When the event that caused the narrative affects the character controlled by the user of the digital game and involves some relevant perspective, i.e., the story presented in the game caused expectation of that moment, two opposing emotions are reported to this:

“Hope” and ‘Fear’ [Ortony et al. 1990]. Each of these emotions can become another kind of emotion when the expected time arrives.

“Hope” occurs when the event brings benefits to the player’s avatar. The emotion of Hope can turn into “Disappointment” or into “Satisfaction”.

The emotion “Fear” occurs when an event that is coming causes apprehension that it will bring some kind of harm [Ortony et al. 1990]. This emotion can turn into two other emotions: “Confirmed Fear” and “Relief”. This can occur depending on what happens after the fear emotion appears.

The other type of emotion caused by events not involving prospects, i.e., the event is not anticipated by hope or fear, their effect is immediate, directly affecting the welfare of the player’s own avatar. Again, there is the so-called positive and negative emotion for this type.

On the positive side there is the excitement “Joy”. In the opposite appears as “Distress”, which appears when the narrative brings something negative for the main characters.

The events that do not involve prospects may also occur because of the actions of the characters. In the next subsection are presented the emotions related to this type and also the relationship between actions and events mentioned above.

4.2 Action of Agents

The agents according are those causing events [Ortony et al. 1990]. They can be both humans and non-human, which occurs in the context of digital games. Thus, this area of action of agents is divided into two parts: those that are caused by Agent “Self” (in the case of games, the avatar controlled by the user) and the actions caused by “other agents” (NPCs and other players in the context of digital games). These two types of emotion emotions are defined as “Attribution”.

For the characters controlled by players acts, there must be an interface that allows this action. With this, the gameplay becomes linked to this area of the model of emotions, considering that it is responsible for the interaction between game and player [Kusternig and Semanek 2006; Sadowski and Stanney 2002].

Among the actions that are caused by “Self Agent”, two emotions are defined: “Pride” and “Shame”. The first emotion occurs when the action taken by the player results in something positive. However, if the action results in something negative, the second emotion, “Shame”, will come to light [Ortony et al. 1990].

The actions caused by other agents can be made by both NPCs and other players. In the case of NPCs,

their actions are controlled by Artificial Intelligence in the virtual environment [Heeter 1992], which binds this variable of the degree of immersion to the area of the model of emotions. In the other end of the Social Relations in virtual environments there are the characters controlled by other players a [Heeter 1992], where in some cases, may occur creating communities of players who have a common goal [Rodrigues and Mustaro 2007].

These actions can cause two types of emotions. The first type is a positive emotion, it occurs when the “the other agent” does something that somehow pleases the player’s avatar. The emotion is linked to this case is “Admiration” [Ortony et al. 1990]. In contrast of it, there is the other type, the negative emotion that is represented by “Reproach” [Ortony et al. 1990].

The action of agents is one way to reach another group of emotions, which also takes into account the consequences of the events presented in the previous subsection. This group of emotions, known as “Well-Being/Attribution Compounds”, occurs with a mixture of gameplay, artificial intelligence, social and narrative, when the characters’ actions are triggers to events that occur in the narrative. This narrative can be both a top-level, proposed by the authors of the games, as well as a second-level or intermediate level, which is created in each player’s foray into the virtual world offered by the game in question [DeMarle 2006; Rouse 2005].

Firstly there is the antagonistic pair that refer to the emotions caused by actions of the agents that cause some kind of event. The two emotions are “Gratification” and “Remorse”. The first one appears when the player’s avatar has caused an event in the narrative that is considered positive [Ortony et al. 1990], affecting directly to the top-level narrative. The second emotion occurs when the characters controlled by the user of the digital game cause something negative to them, causing “Remorse”.

The actions of other agents may also interfere with the narrative, causing two other emotions. The first is the “Gratitude” when an NPC or another player does something that positively affects the story. However, there is the emotion of “Anger”. For example, if one NPC cannot adequately assist the user in a digital game, the second level narrative is affected, because the mission was not carried out properly, leading to this emotion.

In addition to the actions and events, there is a third category that encompasses aspects of objects [Ortony et al. 1990]. The emotions in this category will be presented in the next subsection.

4.3 Aspects of Objects

Objects are any kind of element is able to be interacted, but in which this interaction does not cause any event

(in this case would be an agent) [Ortony et al. 1990]. The emotions surrounding objects are encompassed in a set that is called the “Attraction” [Ortony et al.1990]. Within digital games, the representation of the objects of a virtual world is performed through two elements: Video [Witmer and Singer 1998; Kusternig and Semanek 2006], which visually displays the content of the environment, and Audio [Pichlmair and Kayali 2007; Boury 2010] which uses sound to interact and represent specific aspects of the digital universe of the game.

The representation of the digital world can cause two emotions in the player, depending on how and for what purposes it is presented. The game’s visuals and soundtrack can be placed there to make a positive impression on the player, which takes one to feel attracted by the environment in question. In this case, the emotion of “Love” is more evident.

In the counterpart, there is the emotion of “Hate”, when graphically and sonically the atmosphere is repulsive, but it is still immersive, because it is graphically realistic [Witmer and Singer 1998] and/or the audio is used consistently [Boury 2010].

The combination of immersion emotion depicted in the preceding paragraphs can be best viewed in the cognitive emotion model [Ortony et al. 1990] that was changed to insert the new concepts. This can be viewed in the Figure 1. In this amendment, the variables that influence the immersion in a digital game are arranged next to their respective quadrants of emotion, highlighted in red.

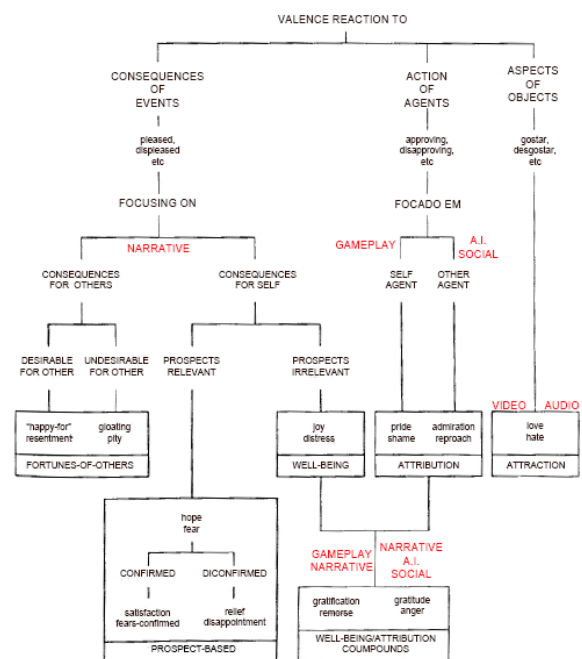


Figure 1: Structured Model of Cognitive Emotions adapted to the variables of Immersion

With these concepts defined, the next section will discuss how they were used for the analysis of immersion and emotion in the players of digital games.

5. Methodology

To find the connection between the variables that change the players' immersion and emotion, this research was based on a literature review on both issues, as lectured in the previous sections. After this study, it was created a questionnaire, based on the Likert scale [Likert 1932], to collect relevant data for the analysis of the immersion, which was later used for the connection between these points and the emotion of the player, as well as its analysis. To create this survey, it was involved the creation of an automated system that stores these answers into a database so that later they collected data to be used for clustering. This application described above was divided into three parts, each using a different concept of artificial intelligence: Expert System, Fuzzy Logic Application and Self-Organizing Maps.

The first, the Expert System, refers primarily to the collection phase. In this part of the application theories of immersion are taken into account to create statements that were presented to users, thus assessing the degree of digital immersion in each game chosen. This application also contains part of the analysis phase, with the analysis of the results of the expert system for each of the matches. This part of the application, which collects the data to put into a database for later analysis.

There is a predefined list of games that were included in the analysis of immersion in this first phase of the application. The criterion for choosing these games was based on four specific topics: 1 - The game fits into the category Action Adventure; 2 - Quality of the game, according to the website GameRankings [GameRankings 2012]; 3 - Number of games sold, according to the website VGChartz [VGChartz 2012]. This was created when the site had global sales to the date March 31 2012; 4 - The existence of another game in the same series.

The second part, the application of fuzzy logic is used from the results on the degree of immersion in digital games, from the Expert System, and the theories presented in sections Emotion, Emotion x Immersion, are examined which emotions can be found in digital games studied. Finally, the third part, which contains the Self-Organizing Map, uses as input the analysis of games by Fuzzy Logic Application to create a grouping of games against that kind of emotion they can generate on the player.

Each of the concepts that form the SOM was established in this part of the application. These subparts, known as a "class" are: Neuron (this class contains all the relevant characteristics of a neuron to a SOM); Neural Network (serves as a large array that stores the neurons that will be used for subsequent clustering); Trainer (where all the neural network is trained by means of the learning rate, and all pre-

defined mesh given as input is modified to generate the output in each iteration); Euclidean Vector (this class was created in order to help define the weights and calculating the distance between two neurons that are within a network that will be clustered); Presentation and Renderer (where the call to all other functions are, also where it is made the connection to the database to access information captured by the other parts of the application, and neurons can be formed to be trained to perform clustering).

The class Presentation and renderer is designed for rendering graphically demonstrate how each interaction is carried out, showing the groupings created from pre-defined colors for each. In the Figure 2 it is possible to see an example of the rendered screen before the interactions of the trainer.

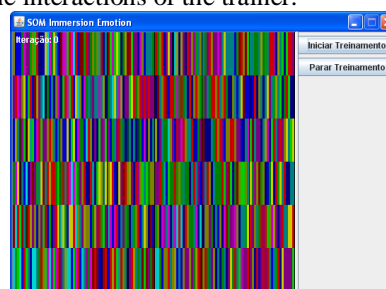


Figure 2: Representation of the training of neurons in the SOM application screen

Each one of the neurons displayed on the screen are formed by membership levels recorded in the database by the application of fuzzy logic, with the areas of emotion presented in each one of the games studied. I.e., the weight of each neuron is defined by the degree of membership that the area it represents for each Action Adventure game chosen to appear on the search.

The weight is defined by an array of three dimensions, where each dimension is a pattern of RGB colors (Red, Green and Blue). Thus, the closer to one color, the greater the fuzzy membership degree of one neuron regarding emotions areas previously presented.

When the training starts, the neurons are trained to reach one of the colors described at the end of this section, where some types of grouping can be achieved. The colors used to represent each group is guided in the patterns of color RGB as described above, and also the colors of the model CMYK (Cyan, Magenta, Yellow and Black), achieved by blending the colors of the RGB. The colors of the groups are divided as follows: *Red* (Represents the emotions group of Happy-For, Resentment, Gloating, Pity, Hope, Fear, Joy and Distress. All these emotions were included in this group because they are directly influenced by the consequences of events, i.e., the narrative style of Action Adventure games); *Green* (Contains the group of emotions Pride and Shame, i.e. emotions caused directly by the action of the self agent, controlled by the player); *Blue* (Grouping which includes emotions such as Admiration and Reproach,

which are directed to actions caused by other agents in the environment); *Yellow* (Group that contains emotions Gratification and Remorse, linked to how the actions of the protagonist of the game affect the story presented); *Magenta* (Gratitude and anger are the emotions of this group. They are part of the emotions caused by the actions of other characters, other than the avatar controlled by the user, causing the narrative purpose of the game); *Cyan* (Grouping containing emotions of Attraction: Love and Hate. They are related to aspects of objects in the universe of digital gaming); *Black* (Group that appears when the neurons represented on the screen failed to converge to any of the groups reported above, that is not owned affiliation relevant enough to cause potential emotional impact on the player).

6. Analysis of the Results

The first part of the application, the expert system, demonstrated how the immersion behaves in different games. It was studied, for example, how it behaves in games which are of the same franchise, i.e., a game was released and then its sequences. In the case of the franchise God of War, for example, immersion came from different sources in its first game and its third game. In the first game, the immersion of Audio and Video, for example, are smaller than its successor. This potentially is due to the fact that the system that runs God of War III has the hardware more powerful than its predecessor, producing more realistic graphics and sounds, thus increasing the immersion [Witmer and Singer 1998].

However, the immersion caused by the narrative in the first game proved to be higher than in God of War III, potentially because of the focus on the story of the main character, Kratos, that created a bond with the player in this first game, motivating and pleasing him, thereby increasing the feeling of immersion [DeMarle 2006].

Immersion was also analyzed in games that were released on different platforms, such as the case of the game Okami. This game was released for both PlayStation 2 and Nintendo Wii consoles, that have markedly different paradigms of control. Some immersive values proved to be close, as is the case with narrative and Artificial Intelligence, because it is essentially the same game in this two categories. However, the audio and video of the Nintendo Wii version is more able to immerse the player in comparison to the Playstation 2 version, because the first console is newer, with the greatest potential to generate audiovisual elements with higher quality [Witmer and Singer 1998].

But what stands out the difference between two versions of the game Okami is the fact that the game launched in the Wii platform have the gameplay immersion higher than the version of the PS2 console.

This is due to two main reasons involving the interface of the game: The peripherals used with the controls and the correlation that exists in the real world. In the first case, the use of devices that help control the actions of the avatars enhance the player's immersion [Sodowski and Stanney 2002]. This occurs with the Nintendo Wii, since its control, called Wiimote, is a peripheral control different compared to the control of the Playstation 2, because it captures movements and is similar to a remote control. For the game Okami, this facilitates the control of the brush shown on the screen that helps the protagonist to advance to the goals of the game.

The data of the immersion of digital games were then passed to the second part of the application, which uses fuzzy logic to find their relationship with immersion.

In the same series of games released for the same console, it was analyzed that different emotions may affect them. Emotion of Attribution and Attraction, for example, may be different, since the time that passed between the creation of one game and the other potentially made the game designers use more advanced techniques for creating artificial intelligence and rendering the sound and image of the game, thereby enhancing the user experience with the Action of Agents and the Aspects of Objects [Ortony et al. 1990]. This was the case of games of the series The Legend of Zelda that were analyzed: Twilight Princess, which was released first, and Skyward Sword, released five years later.

Also, it was analyzed games that were released on different platforms, such as Grand Theft Auto IV, released for both Playstation 3 and Xbox 360 platforms. In these two versions, basically all areas of emotions [Ortony et al. 1990] have high potential to be experienced by the player in his foray into the virtual world of the game. This may occur because the games in the GTA series are based on the "open world" proposal, where the player has the freedom to explore and move around the virtual environment offered by the game, creating their own history and performing goals without sense of being imposed on it [Sá and Albuquerque 2000].

However, some areas of emotion were considered less potential to be affected in the console X360 over the PS3, like Attraction and Attribution of Self Agent. This may occur due the Microsoft console is minimally inferior than the Sony's platform in the ability to create realistic graphics, and, potentially, the players who responded to the survey have adapted best to the interface of the PS3's gamepad compared to X360's one to control the avatar Niko Bellic.

The data analyzed by the fuzzy logic application entered in the database were then captured by the third and final part of the application of analysis of Immersion and Emotion in digital games. Each of the colored rectangles on the figure represents the degree of membership of all digital games analyzed for each

emotional area, presented in the previous section. After 500 iterations of training neurons, the presentation screen shows the data organized as follows, shown in Figure 3.

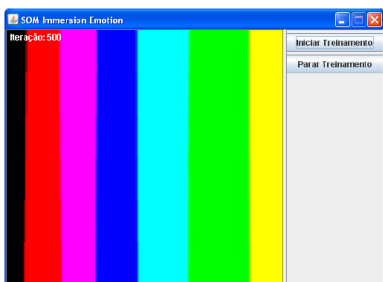


Figure 3: Data on emotions in digital games arranged after 500 iterations of the SOM training

From this figure it is possible to note the prominence of two clusters of emotions for games Action Adventure studied due to the increased area in the network shown. The first, presented through color Cyan, contains the emotions Love and Hate. These emotions are present when the being that is interacting with the world sees the appearance of objects placed there [Ortony et al. 1990]. With this, you can see that these games, action adventure style, can attract players with visual harmony with the proposed environment [Witmer and Singer 1998], and the audio consistent with the virtual world presented [Boury 2010].

With this point, it is possible to correlate these emotions generated by the games with the discourse the definition of Action Adventure games. The games provided with this style have focus on exploration in the environment by the avatar controlled by the player [Rollings and Adams 2006]. Thus, the user of the digital game in direct contact with the virtual world offered, increasing the chances of that environment, either through visual or auditory means, that can influence the player emotionally through the Love and Hate the look of objects presented [Ortony et al. 1990].

Another element that stands out in the pool created by the application that uses the Self-Organizing Maps is one that has the emotions of Pride and Shame, rendered by the program shown in the color Green. These emotions are directly related to the actions of the self that interacts with the environment in which it is inserted, i.e., are caused by the individual's interaction with the other elements relevant to the world to which it belongs [Ortony et al. 1990].

From this concept, it is concluded that the games studied in this research can influence the emotions caused by the interaction between the player and the universe shown for the game. This concept is also known by the name of gameplay [Kusternig and Semanek 2006]. Therefore, there is the possibility of the gameplay created from a connection that is strong enough to create a continuous and unbreakable by external interferences flow in the game [Sodowski and Stanney 2002].

The gameplay and the fact that the influenced emotions are those that leave are originated in the player are two elements found in the definition of Action Adventure games. The creation of this style of digital games does not rely on the existence of a multiplayer mode [Hitchens 2002; Rollings and Adams 2006], i.e., the gameplay of this kind of game is focused on single player mode, with the aim of exploring the environment and completing the challenges presented to achieve the player's goals [Rollings and Adams 2003].

Finally, there is also a fact that can be highlighted: in the Figure 4 presents the group of emotions stemming from the consequences of events not being in a group with the largest area in the network shown. This can be considered a important fact, because Action Adventure games have a focus on Narrative [Rollings and Adams 2006]. One possible cause for this case is the imbalance that exists in some games to focus more on gameplay and less on the narrative, causing a decrease in immersion [Woyach 2004], causing imbalance between the stories created by game designer and the story created by the player (in his foray and exploitation into the digital world) [Rouse 2005].

7. Conclusion and Further Work

This research presents evidence of how the players' immersion in digital games is one of the main ways of studying the elements that are contained in a game, because the variables that affect the player are separated as objects that influence the existing man-machine relationship. Thus, it creates a new perspective on studies that can be taken into account in the planning, development and creation of a digital game, as it is already done today with areas like Narrative, Interactivity and Hypertextuality.

The influence of immersion in the player was subdivided into six different variables: Narrative, Gameplay, Video, Audio, Social Relations and Artificial Intelligence. Each of these elements are integral parts of a digital game, and it is possible to carry out studies of each of them separately, as the bibliography used in this work shows. However, when the study makes the connection between them as the foundation using for a theme such as immersion, a new perspective of studies can be made. Through this unification, it can be easier to visualize how each of these elements can affect the overall relationship between player and game. For this study was conducted, the mapping of each of these variables, in addition to their intended use in the construction of games, it was essential for the development of the project, noting the specific literature about each variable and extrapolating to the whole concept of immersion in games digital.

With the analysis of the variable Narrative, it was possible to understand how the story of a game

influences the connection between the player and his avatar. The variable Gameplay showed how the relationship game/player through two different perspectives: the creation of interfaces, facilitating communication between game and player by means of specific commands, and the creation of the challenges posed by the game in order to see how they can motivate players to achieve their goals. The variable Video demonstrates how the study of graphical components and the visual elements of a game are presented to the player. The variable Audio performs analysis of the components of sound indicating that the dimensional and shape as the sound of the game is displayed. The variable of Social Relations aims to study the actual presence of other human beings in the environment introduced by the game and how the interaction between them. And finally, the variable of Artificial Intelligence, which includes how the system creates a “living environment”, trying to bring the Non-player characters to be with an acceptable behavior by a real human.

From the analysis of each of these elements was done then the connection between these to the study of emotions. For this purpose, it was created a theoretical foundation to investigate how the psychological concept of emotion is treated in academia, in order to create a policy to guide this research. It was found that the interactive emotion gave the basis for authors to study specific emotions from the digital games. It was indicated that these emotions relevant to digital games, specifically through the gameplay and the other interactive parts of the digital game [Perron 2005].

With this link between digital games and emotion, it was possible to define that each immersion variable is directly related to the areas of the structured model of cognitive emotion [Ortony et al. 1990], within the scope of games chosen for this study, which were described by the type Action Adventure.

Within the first area of the model, called the Consequences of Events, the narrative is the variable related, whereas the narrative is an event or series of events that affect all the relevant facts presented to the virtual world, they are controlled by the player, by other people or the system itself. In the second area, known as Action of Agents, the influenced variables depend on which is the agent, and this group is divided into two types: If it is the Self Agent, the element that will potentially cause the emotion is the gameplay. If the source of action is another agent, then the emotions will be created from the acts performed by the other characters in the game. They can be controlled by the system itself (in this case, the variable that influences is the Artificial Intelligence) or controlled by other players (in this case, it is the variable Social Relations). Finally, the third area is the Aspects of Objects, which are the emotions caused by the elements presented in the environment in which the individual interacts. In the worlds created for digital games, they are related to the variables Audio and Video.

The chosen games also obey some rules so that immersion in different situations could be analyzed. The first situation was to investigate how immersion behaves in games of the same series, but released on different platforms. In this case, variables that are based on technical quality of the hardware on which the game is being used, like Audio and Video, were affected according to the capability of creating graphics and sounds considered more realistic. However, the narrative immersion was influenced by the point of the series' history that the game tells, thus influencing the link between the player and the avatar that he is controlling. A second situation analyzed is the same game that was released on different platforms. In these cases, the experience that the player will have influence on the immersion in accordance with the technologies that the console provides.

In the second part of the research, the analysis has shown that emotions in Action Adventure games, even from the same franchise, can give different emotions to the player. The cause of this may be linked to how that game was developed, if it has been created specifically for that console or redesigned to meet its specifications.

With the data obtained through the groupings of the application that uses Self-Organizing Maps, it was possible to analyze the presence of the potential relevance of games research to cause emotions like love, hate, pride and shame in their respective players. This is because of these games focus on creating goals that lead the user to explore the presented virtual environment.

However, these Action Adventure games analyzed, in a global view, did not cause emotions related to events, i.e., caused by the narrative presented by the game. Some few games have achieved such a feat, as it was revealed in the analysis made on a case by the application of fuzzy logic. However, in general, the narrative created by the game and that player formed did not achieve a balance in the games presented and did not stand out in causing emotions like Happy-for, resentment, gloating, pity, Hope and Fear.

As future work, there is the deepening of research on practical results on the relation of the feeling of immersion that the game provides to the player with the level of emotion that the player is feeling at that moment. To do this, it will be necessary some physical measurements of the user of the digital game, by techniques such as cardiovascular measurements, Electroencephalography [Mandryk et al. 2006]. Finally, a feature that can be studied from the moment the player is fully immersed and to suffer the actions of emotion: Studying how his performance as a player may be influenced by these two aspects.

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