


# Guidelines for the development of Escape Room genre games utilizing the emotion-based MDA framework and its application on the Logic Gates project

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## Abstract

The maturing and growth of the game industry made stagnant genres get back into popularity, as it is the case of Escape Room. This process increased the expectations related to the quality of games that were being developed, something that is directly connected to the enjoyment that the player will experience through the product. The enjoyment is a result of a variety of emotions in different intensities that the player goes through while playing the game. However, there is a lack of research, articles and information in how to think, plan and develop the emotions intended to be transmitted to the player by the designer, especially in the Escape Room genre. Thereby, this article suggests alterations on the MDA framework, indicating which mechanics and dynamics should be inserted for the player go through the intended feelings, proposing a emotion based MDA framework. This framework is utilized to propose guidelines for the development of games in the Escape Room genre. And then those guidelines were applied to the production of a Game Design Document of an educational game called Logic Gates.

**Keywords:** *Game Design, Escape Room, MDA, Mechanics, Dynamics, Aesthetics, Emotions, SGDD*

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## 1 Introduction

The Escape Room genre stands out (Wiemker et al., 2015) in the increasing game market (Games, 2021) proposing unique experiences and inducing various emotions to the player (Lazzaro, 2009; Kavli, 2012). Emotions happen from the different activities that we perform (Bartle et al., 2009). They guide and influence our behavior in different areas, like creativity, focus, learning and even motivation wise.

These emotions can emerge on digital games, making a virtual and safe environment. In this environment the player is immersed and susceptible to new experiences, that enables them to live fantastic or surreal situations.

However, for the emotions to be induced as intended by the game designer, it is necessary a combination of a range of game elements. Developers and companies try different forms to clarify and formalize the process of developing a game, that allows designers to have control over which mechanics and elements need to be included, and how the interaction of these components result in the production of the game.

There are several processes, methods, models and frameworks that propose organizational solutions for the production of a game, regardless of the genre (Schell, 2019; Adams, 2014; Hunicke et al., 2004). There are even studies that utilize some of these models or other methods to analyse a specific genre or sub-genre (Ouriques et al., 2021; Wiemker et al., 2015).

Among several existing frameworks and methods, the MDA framework has great notoriety when compared to other frameworks, and is commonly used for game analysis and planning in the academic and industrial environment. However, even with its use, it is possible to perceive a difference between the intended experience planned by the game designer and the real experience of a player going through the finished product (Adams, 2014).

Therefore, the objective of this article is the proposition of guidelines to help game designers in the production of escape room genre game projects. The proposed guidelines use the combination of game mechanics to produce dynamics that facilitate the induction of emotions in players. The guidelines were developed through the integration of the concepts from the MDA framework and the concepts related to the definitions of emotions experienced by the players.

For this, an adaptation to the MDA framework is proposed, focusing on the player's experience, replacing the aesthetics present in the original framework with a new set of emotions to create a more direct relationship between the player's actions and their feelings while playing the game.

It is also proposed, following the development of the guidelines, to apply the results in the construction of an escape room game prototype called "Logic Gates" (Migliorini, 2021). The prototype should incorporate the elements mentioned in the guidelines in order to demonstrate a practical application of the results into real projects.

The game Logic Gates (Migliorini, 2021) aims to assist in

the learning of the Digital Systems discipline, which is taught in various computing and engineering courses. It teaches and reinforces the concepts of logic gates and electrical circuits through the challenges presented in its content.

This article follows the following structure: Section II presents the theoretical foundation, Section III defines the methods used, Section IV presents the results along with the analyses conducted and the outcomes achieved based on the proposed objectives. Section V provides conclusions and outlines future work.

## 2 Theoretical Foundation

### 2.1 Games as experiences

The game market lies on a constant and fast increasing rate, with a total value rated in 85.86 billions USD only on the year of 2020, growing to 195.65 billions USD in 2021. The same market has an estimate annual increase of 12.9% from 2022 to 2030. Constant innovations in diverse technologies applied on the game development, like hardware and software dedicated to the improvement of graphics in real time, are partially the reason for the mentioned increase, besides the rise in popularity of smartphones, and the expansion of better accessibility to internet and products (Games, 2021).

The increase of the game market implies the existence of a variety of options for the player to choose, and with a limited time available to play a game, a person ends up having to choose only a few, or even just one title. The criteria for someone to choose what they will play and how to spend their time is the enjoyment they will feel, according to Lazzaro (2009) people don't play games because of the content, they play because of the unique feelings and experiences that the game creates and induces. Players like to feel the adrenaline, to insert themselves on big adventures, relax in an unknown scenario, maybe get challenged mentally or by a strong adversary, seeking for a relief of the day to day obligations in a safe and fictitious space.

Therefore, games that try to immerse the player in the narrative and the world building and mechanics through realistic graphic artifacts, story direction, art and production, are becoming very common and acclaimed by the public. Big titles that are considered unique or innovative experiences, are annually awarded in different events, the most important is the *The Game Awards*, being *The Oscars* equivalent to the media, that since 2014 has been rewarding titles like *It Takes Two*, *The Last of Us Part II*, *Sekiro: Shadows Die Twice*, *The Legend of Zelda: Breath of the Wild* and others.

These games, besides being acclaimed by critics, are also acclaimed by the players. The circumstance of digital games as experiences is something that was answered by Lazzaro's studies, that proposes that the player feels what is presented to them through all of the elements that are present in the game, including the characters of the narrative. The same was found on studies made by Kavli (2012), that explain how parasocial relationships can also be applied to digital entities, creating a sentimental bond with whoever is experiencing the product.

### 2.2 Human Emotions

On the daily basis, emotions are the result of experiences that we live through as individuals and according to Ekman (2003) "Emotions can prepare us to deal with important events without having to think what to do". Thus, the diverse and countless emotions develop a fundamental job in our lives throughout the execution of different activities.

When applied to the realm of digital games, this correlation remains evident. Players experience emotions when they interact with the mechanics and elements present in the game. This interaction, whether positive, providing benefits to the player, or negative, imposing penalties, significantly impacts the overall game experience, as well as the performance and satisfaction of the consumer (Lazzaro, 2009).

Consequently, there have been numerous studies aiming to establish the most prevalent emotions experienced during gameplay. Bartle's work (Bartle et al., 2009) initially proposed ten emotions commonly felt by gamers. Subsequently, Lazzaro (2009) identified eight emotions experienced by players, four of which were also present in Bartle's work. Paulin's study (Paulin, 2014) further suggested the inclusion of two additional emotions, resulting in a total of fourteen emotions: curiosity, fear, frustration, relief, contentment, triumph, surprise, admiration, enthusiasm, fun, naches, astonishment, schadenfreude, and anger.

It is important to acknowledge that despite the significant attention given to the study of emotions by the scientific and psychological communities over the past century, there is no consensus regarding the nature of emotions, their definitions, or even the identification of a definitive set of "basic emotions" or "fundamental emotions", if such a categorization exists (Dillon, 2010).

Thus, different processes, methods, and frameworks that focus on inducing emotions in games may adopt different sets of fundamental emotions to better cater to the needs and objectives of each specific project. Therefore, the list of emotions examined in this work is not intended to be comprehensive or exhaustive according to psychology. Instead, it draws from similar research to identify recurring and relevant emotions in players' experiences.

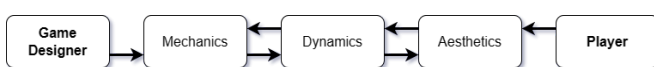
It is also important to note that the selection criteria of the emotions presented in this work was based on their high correlation. Both Bartle et al. (2009) and Lazzaro (2009) found common emotions in their respective studies. Additionally, Paulin (2014) examined Carl Jung's studies and the typological classification of Myers-Briggs, and identified a strong relationship between fear and anger with the other emotions described by previous authors, suggesting their inclusion in the group. This approach aimed to include emotions that have been consistently identified and supported by multiple studies.

### 2.3 MDA Framework

There are various formal approaches that have been proposed to understand and structure games and their different components. One such approach is the MDA framework (Hunicke et al., 2004), which was introduced in 2005. The MDA framework abstracts a game into three distinct layers: mechanics,

dynamics, and aesthetics. This separation enables game designers to have better control over the elements of the game and its development process, providing a clearer understanding of the outcomes of the decisions made during production.

The utilization of the MDA framework facilitates the attainment of the desired outcome through iterative cycles and playtesting. Within this framework, the approach of the game designer and the player begins from opposite directions. The player initially engages with the aesthetics and emotions presented in the game, subsequently comprehends the dynamics, and finally understands the mechanics and rules of the game. On the other hand, the game designer must consider how to construct the mechanics and dynamics in order to evoke the intended emotions. The flow of experiences in the MDA framework can be visualized in Figure 1.



**Figure 1.** Flow of experiences between the game designer and the player in the MDA framework. Source: the authors.

That being said, it is important to understand the details of each layer in order to be able to identify them within a game, as well as to comprehend how designers and players approach the experience from their respective perspectives (Hunicke et al., 2004):

- **Mechanics:** the fundamental individual components of a game, encompassing the rules that establish the foundation of the gameplay experience. They consist of unique actions such as walking, jumping, collecting and selling items, and many others. These actions can be directly presented to the player, as mentioned earlier, or can manifest indirectly, such as through score calculations based on the player's activities or the behavior of a bullet bouncing off a wall. Typically, mechanics are translated into code, data structures, and algorithms within software, libraries, and game engines. These implementations bridge the gap between the conceptual design of the game and the practical realization of the necessary elements to bring it to life.
- **Dynamics:** refers to a collection of mechanics that are interconnected and interdependent, creating a new system or method of interacting with the game world and its rules. For instance, let's consider the board game "Monopoly" as an example. The "Buying Property" dynamic is formed by the mechanics of walking around the board, buying empty lots and paying for a lot that has been acquired by other players. It is common for games to feature two or more prominent dynamics, which may or may not emerge from shared mechanics.
- **Aesthetics:** these elements, concepts, and emotions stem from the constructed dynamics within a game. When there is a clear vision of the desired aesthetics, specific and precise mechanics can be employed to foster the development of dynamics that effectively achieve the intended outcome. By carefully selecting and implementing mechanics, game designers can shape the player's experience, eliciting the desired emotions and overall aesthetic qualities.

According to the work done by Hunicke et al. (2004) there are eight different categories of aesthetics:

1. **Sensation:** games that provide sensory pleasure, allowing players to enjoy audiovisual effects and immersive experiences;
2. **Fiero:** games that transport players to imaginary worlds, fostering a sense of make-believe and encouraging suspension of disbelief.
3. **Narrative:** games that engage players through compelling storytelling, creating immersive and emotionally captivating experiences.
4. **Challenge:** games that present obstacles and require players to develop skills and strategies to overcome them, increasing the replay value of the product;
5. **Companionship:** games that provide social interaction and a sense of community, often found in multiplayer games where players can connect and collaborate with others;
6. **Discovery:** games that encourage exploration and the uncovering of hidden secrets and mysteries in a new and unfamiliar world;
7. **Expression:** games that offer creative freedom and allow players to express their own ideas and solutions to various problems within the game;
8. **Submission:** games that provide a sense of relaxation and leisure, allowing players to immerse themselves in the game experience without external pressures or demands;

The relationship between mechanics, dynamics, and aesthetics poses a challenge for game designers. Designers have direct control over the selection and implementation of mechanics, with the goal of creating engaging dynamics that ultimately lead to desired aesthetics for the player. However, the player experiences the game from the opposite perspective. They engage with the aesthetics initially, which are shaped by the emergent dynamics facilitated by the underlying mechanics. The player's experience is heavily influenced by the connection between aesthetics, dynamics, and mechanics, and it is through this interaction that the overall game experience is formed. Balancing and aligning these elements is crucial for creating a compelling and enjoyable game.

The MDA framework was developed with the aim of providing clarity and enhancing the iterative processes of developers, academics, and researchers involved in game design. Its purpose is to facilitate the decomposition, analysis, and design of various types of games and game artifacts (Hunicke et al., 2004). Since its introduction, the MDA framework has gained significant recognition and acceptance, particularly in academic circles. It has become a fundamental approach in game design, widely cited and utilized as a valuable tool for understanding and creating games. Its influence and application extend beyond academic purposes, as many game developers also embrace its principles and methodologies.

However, during 2015 and 2016, several articles were published that critically analyzed the MDA framework, raising concerns and offering counterarguments to certain approaches. The first comprehensive analysis and discussion

of the framework was conducted by Luis Claudio Silveira Duarte, published on the Gamasutra portal (Silveira Duarte, 2015). In the same year, Lana Polansky's article (Polansky, 2015) was followed by a publication from Lantz (2015), both adding further points of critique. In summary, these three authors identified gaps in the MDA framework's approach:

1. Neglect of other aspects of game design, with a primary focus on game mechanics;
2. Inadequacy for certain game genres, particularly gamification;
3. Lack of a solid framework for narrative design, resulting in a blurred distinction between mechanics and dynamics in the context of storytelling;
4. Insufficient theoretical support for the addition, elaboration, or replacement of aesthetics;

These criticisms point out that the MDA framework may not provide a comprehensive and adaptable approach to game design, especially when considering genres beyond traditional games and the integration of narrative elements. They emphasize the need for further development and refinement of the framework to address these limitations and provide a more holistic perspective on game design.

Despite the criticisms, it is true that the MDA framework continues to hold value and popularity as a holistic model for game analysis. Its emphasis on the relationship between player experience (aesthetics) and designer intent (mechanics) provides a useful perspective for understanding games. Therefore, when used appropriately and in alignment with the genre of the game being developed, the MDA framework can assist game designers during the planning phase by providing a structured approach to conceptualizing the implementation of their game.

It is important to note that while the MDA framework may not be suitable for all game genres or adequately address certain aspects of game design, its core principles can still serve as a starting point and provide valuable insights. Game designers can adapt and refine the framework to better suit their specific needs and explore other models and approaches to complement their design process. Ultimately, the application of the MDA framework or any other game design model should be flexible and tailored to the unique requirements and goals of each individual game project.

## 2.4 The Escape Room genre

Digital games have a vast variety of genres, each with its own intricacies and essential elements that define them. However, according to Clarke et al. (2017), unlike other types of media, digital games have genres that are not classified or named after the emotions they evoke in the public. Instead, they are named after their key mechanics. Examples of this include FPS (First-Person Shooter), roguelike, and escape room.

This allows a single genre to elicit a variety of emotions using the same mechanics. As a result, there is often a disconnect between the essential dynamics of a specific genre and the emotions intended to be conveyed. In light of this, this article will analyze the escape room genre and its essential elements in depth, particularly because, as indicated

by Wiemker's studies (Wiemker et al., 2015), the genre has gained popularity in recent years.

The escape room genre, as a digital game genre, is closely related to its name, which originated from physical challenges. In these challenges, individuals or groups must escape from a room or environment by solving puzzles and facing various challenges, all while under the pressure of a time limit. It is important that the challenges can be solved using the information available within the room. Therefore, participants should not be expected to possess tools or prior knowledge related to the theme, unless specified in advance.

It is crucial to understand that challenges and puzzles are the fundamental components of an escape room. The flow of gameplay is guided by a sequence, as depicted in the figure 2. When players encounter a new challenge, they must combine a range of information and search for clues to arrive at the desired answer. In return, they receive a reward that enables them to progress to either another challenge or the end of the game.

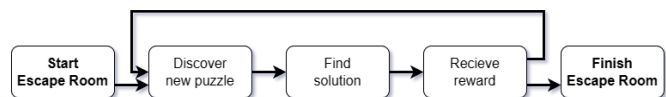


Figure 2. Playability of a Escape Room. Reference: the authors.

There are categories and criteria for the creation and insertion of new puzzles for a escape room:

- **Logical:** require abilities such as deduction and mathematical logic to solve the puzzle;
- **Physical:** require interaction with physical objects, buttons, books, boxes and other factors, or even crossing spaces;
- **Meta-puzzles:** require the previous puzzles to be solved. Its reward can not happen immediately, but it will be offered throughout the game.

Every puzzle, besides having to belong in one of the previous categories, it also has to be the answer of a series of question that determine the quality of the puzzle. The quality potential of a puzzle is proportional to its positive response of the question.

1. Is the puzzle related to the story theme of the escape room?
2. Do the clues lead to a logical answer of the puzzle?
3. Does the puzzle can be solved within the clues present inside the room or environment?
4. Do the clues contribute to the atmosphere of the room or environment?

There are also the categories related to the design that allows a puzzle to be solved. Different solution models are utilized to emphasize the theme and intended feeling. These are the categories:

- **Linear path:** in this type of approach there is an initial puzzle, and all of the puzzles that will come after it will utilize the reward of the previous puzzle as a starting point until the end of the game. This is a simple approach that enables an easy design for players to understand, but it also enables the players to get stuck in case they can not solve a puzzle, making them frustrated;

- **Open path:** in this approach there is not an initial puzzle and there is not a puzzle dependent on the reward of another puzzle. The only exception of this mechanic is the final puzzle of the room, that will need the reward of all of the puzzles solved. Is a recommended approach for games that are played by large groups, because it allows playfulness. This option instigates the curiosity of the players: if they find a hard obstacle, they can try to solve a new challenge.
- **Multilinear:** this approach runs by the specifications of the linear category, but on an unconstrained way that allows the existence of a bunch of initial puzzles, enabling that eventually their solutions and reward to be found. This approach allows that the emotions mentioned in the previous categories to be balanced.

Ultimately, is essential to comprehend that a key aspect for a escape room is the theme. The theme is responsible to immerse and guide emotionally the player by the physical aspect of the room or environment and also through the puzzles and challenges, regardless of the chosen approach used for the development or solution of the puzzles. In a lot of situations the room's theme is defined accordingly to the need of escaping environments that impose fear, pressure or insecurity in the players, for example: abandoned houses, prisons or high security places. Although other themes can be used as long as they guide the player to the challenge and has an objective.

Thereby, after comprehending the main characteristics and definitions of the escape room genre of games that happen in a physical environment, it is possible to comprehend which of these characteristics are important to be transported to digital games, even with the limitations and possibilities that the medium enables. Virtual games can propose new themes, situations or narratives that would not be possible in the real world, the same way that the interaction with items for the solution of puzzles can be limited in digital games.

## 2.5 Game Design Document

Game Design Documents (GDDs) are considered essential for game development. The document serves as the formalization of the game idea, outlining the specific content that game designers intend to include in the final product, sometimes providing details on how that content should be implemented.

There are various models and types of GDDs used in the game development industry. Some companies or designers opt for the "bible" model, which consists of extensive documents with numerous pages. These GDDs provide detailed and in-depth information about each element of the game, often spanning 50 pages or more.

On the other hand, some prefer a medium-sized GDD that is around 10 pages in length. These documents provide a general overview and sufficient information for the implementation of the game's elements, without going into excessive detail.

Alternatively, there are short GDDs that are condensed into 1 or 2 pages. These concise documents focus on capturing the key aspects of the game, providing a brief summary

of the necessary information.

One of these models is described by Motta and Junior (2013), which indicates the production of the Short Game Design Document (SGDD), a brief text of up to one page containing only the necessary elements of art, sound, and programming. Given the small scope of many games, this option becomes viable.

The model described by Motta and Junior (2013), not only suggests that the SGDD text should be written in a narrative format but also proposes the creation of a table for each category: art, sound, and programming. The aim of the SGDD is to provide game designers with a document and a checklist of desired elements to serve as a reference throughout the game production process.

However, the GDD model to be used must be chosen taking into account several variables, including (Motta and Junior, 2013):

- The scope of the planned game
- The number of people on the team
- The task distribution model within the team
- The deadlines for partial or final deliveries of the product
- The project budget
- The technologies used

Thus, it is possible to say that there is no universal GDD that can meet all the expectations and needs of developers. The choice of organizational model for the GDD can significantly influence the planning and implementation of the game. Different teams or projects may require different levels of detail, documentation formats, and specific elements to be included in the GDD. Therefore, it is important to adapt the GDD to the specific requirements and circumstances of each development process, ensuring that it effectively communicates the necessary information and serves as a useful reference for the team throughout the game's production.

## 2.6 Related Works

Similar works also use formulated frameworks to create the concept of new games, or to even analyze certain titles and genres.

Ouriques et al. (2021) work is an example of this process, because he utilizes the MDA framework to analyse games of the wargame (warfare) genre. His work lists and links the essential mechanics and dynamics of those games. however the aesthetics are approached by the emotions and instincts that the player feels while playing a certain game. After the initial research, the work presents an evaluation of wargame professionals of the area to validate the work developed. There are a few important topics mentioned in his work, such as:

- The use of the MDA framework to analyse a genre and its main elements;
- The use of the wargames genre as serious games;
- The connection of the emotions and instincts as the main elements of the genre;
- The verification of the results by professionals of the area;

Zaffari and Battaiola (2014) work also uses the MDA framework, but with a different approach. He does not try to utilize the framework to analyze an existent title or genre, or even to build a new game from it. What is suggested by him is an iterative process, that uses a number of already existing concepts of the industry. Then he inserts the MDA framework as one of the main parts of the process, guiding the production of the product. The objective of this work is to associate these two similar and distinct ends: the gaming industry and the academical research. The following are the main concepts analyzed in the work:

- The constant increase of the gaming market in Brazil and worldwide;
- The spiral iterative method;
- The High Concept as a step in the production;
- Game Design Document and its variations;
- MDA framework as a guide to conceptualize the game;

Distinctly from the others, Wiemker et al. (2015) work does not uses the MDA framework. He tries to characterize, describe and detail the escape room genre as a physical challenge, played by an individual or a group, and his approach to a digital game, but without a framework. The work explains the origins of the genre, the increase in popularity that has been through, its different approaches, and the positive and negative points of each one. His work contains the following main topics:

- What is a escape room;
- The motivation that causes interest in escape rooms;
- What are the challenges in a escape room;
- Composition and characteristics of these challenges;
- Types of challenges in a escape room;
- Required abilities of the players and how to balance them;
- Escape room variations;
- Escape rooms as an educational tool;

Regarding the works mentioned (Wiemker et al., 2015; Zaffari and Battaiola, 2014), it is important to note that (Zaffari and Battaiola, 2014) utilizes the MDA framework as a tool for companies to analyse or comprehend better the development process, while Wiemker's work (Wiemker et al., 2015) approaches the escape room genre in a descriptive and detailed way.

However, in contrast to the other mentioned works, this research presents its contribution through an alternative to the traditional MDA framework, focused towards the escape room genre. The change takes into account the criticisms directed at the original framework and also relates to the different emotions studied. In addition, this work proposes guidelines for the game designer to follow, allowing the application of the results of this work in practical environments. This differential is the result of the correlation between the MDA framework, the analyzed emotions and the SGDD.

### 3 Methods

The objectives of this work are as follows:

- To comprehend the MDA framework, examining how these components interrelate and contribute to game design;
- To explore the human emotions elicited by digital games and establish their correlation with game elements;
- To gain an understanding of the escape room genre and identify the emotions that are crucial for providing a satisfying player experience;
- To analyze the escape room genre using the MDA framework, considering the emotions studied and their impact on the game's mechanics, dynamics, and aesthetics;

By pursuing these objectives, this work aims to enhance our understanding of game design principles, emotional experiences in gaming, and the specific application of the MDA framework to the analysis of the escape room genre, incorporating the emotions associated with it.

In addition, this work also aims to generate guidelines for the development of escape room games using the emotion-based MDA framework. In this modified framework, the component of aesthetics initially proposed by Hunicke et al. (2004) is replaced by the emotions described as fundamental and essential by Bartle et al. (2009), Bartle et al. (2009), and Paulin (2014).

Lastly, after developing the emotion-based MDA framework and the guidelines for the development of escape room games, the ultimate objective of this work is to apply the acquired results in the creation of a game project. This will be accomplished by utilizing the new MDA framework and guidelines in the production of a Game Design Document (GDD). To facilitate this process, the research conducted by Motta and Junior (2013) will be employed, which describes the utilization of a Short Game Design Document (SGDD).

By employing the SGDD approach, which emphasizes brevity and focuses on the essential elements of the game, this work aims to effectively document the design and development requirements for the escape room game project. The SGDD will serve as a concise reference document, providing clear instructions and guidelines based on the emotion-based MDA framework, facilitating the implementation and realization of the envisioned game.

For a comprehensive understanding of the theories and methodologies proposed in this work, an extensive literature review was conducted. The survey took place between September 2021 and March 2022, and various sources, research papers, and references were collected from reputable academic databases, including Google Scholar (Google, 2020), SciELO (Scielo, 2020), Science Direct (Direct, 2020) and IEEE Xplore (IEEEExplore, 2020).

The search was conducted using relevant keywords in both Portuguese and English, ensuring a comprehensive coverage of the subject matter. The selected keywords for the search engines were as follows:

- MDA Framework/ Modelo MDA;
- Game Development Methods/ Métodos para desenvolvimento de jogos;
- Escape Room genre/ Gênero Escape Room;

- Mechanics/ Mecânicas;
- Dynamics/ Dinâmicas;
- Aesthetics/ Estéticas;
- Game Design/ Design de Jogos;
- Fun Games/ Jogos Divertidos;
- Serious Games/ Jogos Sérios;
- Emotions on games/ Emoções em jogos;

In addition to the previously mentioned search terms, additional searches were conducted for each of the emotions mentioned in the works of Bartle et al. (2009), Lazzaro (2009), and Paulin (2014). These emotions were considered as important factors in the understanding of player experiences and were included in the research to provide a comprehensive analysis of the emotional aspects in game design.

### 3.1 Aesthetics in the MDA framework

The articles resulting from the literature review (Bartle et al., 2009; Lazzaro, 2009; Paulin, 2014; Polansky, 2015; Lantz, 2015; Silveira Duarte, 2015) concerning the MDA framework provide critical analysis of certain aspects of its functioning. These criticisms primarily revolve around the framework's limitations in supporting narrative elements, the potential insufficiency of mechanics in encompassing all essential elements of a game, and the lack of comprehensive theoretical support for aesthetics across various genres and subgenres.

Such criticisms directed towards aesthetics indicate the need to adapt the model in order to analyze the various components of a game more effectively. This adaptation should consider the perspectives of both the game designer and the player, taking into account their differing viewpoints.

Additionally, the aesthetics, as defined by Hunnicke et al. (2004), encompasses the emotions experienced by players during gameplay. Based on the literature reviewed, it is suggested that this layer can be replaced by another set of emotions, as long as this new set captures the most common and recurring experiences of players.

### 3.2 Human emotions as aesthetics

Based on the findings of Ekman's research (Ekman, 2003), it is widely supported by 88% of scientists that there exist universal emotions. Among these emotions, the highest level of agreement is observed for anger, fear, disgust, sadness, and happiness. Furthermore, 66% of respondents concur that there are universal stimuli or triggers that elicit these emotions.

Therefore, upon analyzing the emotions discussed by Bartle et al. (2009), Lazzaro (2009), and Paulin (2014), a strong correlation can be observed with the emotions identified by Ekman (2003). Consequently, it becomes evident that the emotions chosen for this study encompass the fundamental and core emotions, as defined by Ekman (2003).

Additionally, it is apparent that the emotions described by these authors align with the aesthetics initially defined by Hunnicke et al. (2004), such as sensation, fiero, narrative, challenge, companionship, discovery, expression, and submission. As a result, these emotions can be regarded as sub-

categories or subsets of aesthetics, providing a deeper level of comprehension regarding the player's experience.

### 3.3 Emotions and dynamics in the escape room genre

The escape room genre has experienced significant popularity in recent times. However, there is still a limited number of research studies analyzing this genre. Among the available sources, the most comprehensive and informative work on the escape room genre is the study conducted by Wiemker et al. (2015). This particular work offers a detailed exploration of the genre, elucidating the key elements involved and providing insights into how these elements are structured within a game.

In his work, Wiemker et al. (2015) portrays the escape room genre as having the remarkable ability to engross players through their innate curiosity and the compelling desire to escape from the room in which the game takes place. These emotions can be characterized primarily as curiosity, fueled by the quest to uncover solutions to the challenges presented, and fear, stemming from the mounting pressure of the countdown while the player remains confined within the room.

While Wiemker et al. (2015) emphasizes the significance of curiosity and fear as fundamental emotions in the escape room genre, he also highlights the genre's versatility in accommodating various themes and genres. In recent times, the escape room genre has garnered significant attention due to its potential applications as a pedagogical tool and its relevance across diverse domains.

It is crucial to recognize that not all emotions hold the same level of prominence throughout the experience of an escape room game. While curiosity and fear may serve as foundational emotions, the specific emotional landscape within a game can vary depending on its theme, narrative, and design. Different games may evoke a range of emotions.

In order to provide a comprehensive understanding of the emotions within the escape room genre, the emotions identified were further categorized. The categorization was based on the correlation between the emotions experienced as described in Ekman's work (Ekman, 2003) and the works of Bartle et al. (2009), Lazzaro (2009), and Paulin (2014).

The scarcity of research in the field of escape room games has resulted in a limited number of identified dynamics. As a result, certain elements outlined in Wiemker's work (Wiemker et al., 2015) have been incorporated as dynamics within the framework. Additionally, dynamics have been formulated based on the authors' evaluation of the genre, taking into consideration the descriptions of the emotions employed and the frequency at which they occur.

Furthermore, the dynamics were incorporated into the framework as verbs, following the approach outlined in Dillon's work (Dillon, 2010). This representation captures the interactive behaviors that emerge as a result of the player's engagement with the virtual environment during gameplay, aligning with the principles of the MDA framework (Hunnicke et al., 2004).

### 3.4 Game Logic Gates SGDD

After developing the guidelines using the emotion-based MDA framework, we proceeded to create an escape room game project. To implement the practical application of the acquired results, we chose to use the Short Game Design Document (SGDD) model developed by Motta and Junior (2013).

The decision to use the SGDD model was primarily driven by the compact nature of the final document it offers. Given that the Logic Gates game is a prototype intended for concept demonstration and future testing of the achieved results, the SGDD proved to be the most suitable choice that aligned with the planned scope.

The content within the SGDD was chosen in an arbitrary manner, aiming to simulate the natural process by which game designers combine their experiences and world perspectives to propose a game concept. While the artistic, sound, and procedural elements were selected without strict guidelines, the implementation of the SGDD adhered to the process outlined in the work by Motta and Junior (2013).

Furthermore, with the inclusion of emotions as a crucial aspect of game planning, the SGDD has undergone modifications. While the original version focused on listing the art, sound, and programming elements of the game, the implementation of the modified SGDD retains the practice of writing a narrative text that provides a generalized explanation of the game's functioning. However, in contrast to solely enumerating the elements of art, sound, and programming, the revised SGDD now incorporates the consideration of emotions during the writing process.

## 4 Results

In this section, we will present the results obtained from the research, specifically focusing on the relationship between the MDA framework and the listed emotions, as well as the practical application of these concepts in a Short Game Design Document (SGDD).

### 4.1 Emotions

To further explore the emotions proposed by Bartle et al. (2009), Lazzaro (2009), and Paulin (2014), we conducted an in-depth analysis to understand the nature of each emotion and how they can be induced in players. The descriptions of these emotions are provided in the list below and related with the dynamics and mechanics on Chart I:

#### 4.1.1 Curiosity

Curiosity is a basic element of human cognition, and in some way is what stimulates an individual's intellectual performance into comprehending unknown things. However this feeling in excess can lead someone to take themselves to dangerous or aggressive situations (the individual themselves or a third party), deepening the knowledge nature (Bartle et al., 2009).

#### 4.1.2 Fear

Fear is a basic and essential emotion, it comes as an indicator for eminent danger that can be physical, mental, or have a different nature. This feeling is responsible of preparing our bodies to deal with these situations, it can even accelerate a person's thought process.

This emotion is commonly used in various genres of games. The horror genre, for example, uses this emotion as the main element of the experience, focusing on persecutions, jump scares, the fear of the unknown, and other elements. Other genres such as action, adventure, strategy, or even games that have focus on the narrative can use fear to enrich the experience, but in their cases fear does not appear constantly and it is not the main emotion of the story (Bartle et al., 2009; Paulin, 2014).

#### 4.1.3 Frustration

To a lot of specialists of human behavior, the main reason people become aggressive is the frustration. One of the very first psychology theorists to be labeled a social psychologist defended this idea. He affirmed that the combat instinct is activated by any obstruction of someone's positive progress to their objective. Sigmund Freud had a similar vision in his first papers. Before developing the notion of the death instinct, he proposed that the aggression was a primary reaction that gets blocked for an individual as soon that they try to obtain pleasure or avoid pain. This concept is known as the frustration-aggression theory.

Thusly, it is possible to say that frustration is considered a negative emotion in a range of scopes. However this emotion has an important part on the learning theory. It is through this feeling, that is very connected to making mistakes (errors), that an individual can, through persistence, learn and associate new information (Cheok, 2004).

#### 4.1.4 Relief

It is the emotion that is expressed through happiness, that is connected to the occasion of lowering the tension that it was caused by an event. Relief has a time foundation, because this feeling happens after a deadline, after an event, or even after another emotion such as fear or concern (Hoerl, 2015).

#### 4.1.5 Contentment

Contentment is a neutral emotion that comes from playfulness, satisfaction, enthusiasm and astonishment. Although different from them, this emotion has low excitement and it is less energetic. Because contentment is connected to other emotions, it makes the individual accept their physical, mental, or social situation that they are inserted, these situations can be positive or negative (Cordaro et al., 2016; Paulin, 2014).

#### 4.1.6 Triumph

Triumph is similar to euphoria, which consists of an elevated humor and intense feelings of happiness and well-being, although different from euphoria, it is caused by situational in-



fluences. Triumph characterized by exaggerated feelings of happiness and exaltation, and can occur in situations where there is an achievement of a challenge, or overcoming a difficulty, such as a competition or a war (Alleydog, 2020; Lazzaro, 2009).

#### 4.1.7 Surprise

Surprise is the feeling of astonishment or wonder caused by something abrupt or unexpected. The experience of the surprise emotion fluctuates accordingly to the importance of the result, the same being valid for the beliefs of the result. Some researchers treat the surprise as a cognitive evaluation based on the probability of an event, while others treat it as an emotion, similar to happiness, sadness, disgust and fear. It is an unusual emotion because it can be positive or negative and drastically shape other emotions.

The concept of surprise is relevant to a lot of aspects of human behavior and it eases into curiosity and learning and it affects the beliefs someone have amongst other events. (Mellers, 2001).

#### 4.1.8 Wonder

Wonder is a positive emotion, it is related to the surprise as it emerges, or it can start from respect and approval of attitudes or accomplishments of people that someone is close, like a friend or a teacher, or it can even come off after the contemplation of the natural or the beauty, such as a landscape. Both definitions comes from the surprise that can cause a reaction on an individual. By these means it is important to know that games utilize wonder in both situations: when players interact with each other, sharing information and experiences, and when the player interacts with world around them (Lazzaro, 2009).

#### 4.1.9 Enthusiasm

It is a state of mind that is admired by an activity, playful and cheerful. It is an extravagant good humour condition, noisy and agitated, a special form of exaltation and interest. The enthusiasm contains a little portion from playfulness that comes from the euphoria from an activity, it is an active exhalation. The feeling of being captivated by the unknown, that is fragile and it can be rapidly broken (Ekman, 2003; Lazzaro, 2009).

#### 4.1.10 Playfulness

Everything that can immerse the player and brings joy; games, fun, distraction, entertainment, recreation, recess. It is related to the gratification that players feel in a certain game or system inside of a game. It is also related to other emotions such as wonder, enthusiasm and curiosity, or even social interactions inside of a game (Bartle et al., 2009; Lazzaro, 2009).

#### 4.1.11 Naches

The word naches has a Jewish origin and it is constantly utilized in religious contexts. The word reflects the positive emo-

tion of happiness, pride and satisfaction that occurs when a master, teacher or a parent figure sees their student or child obtaining success in a task or activity that they were taught (Bartle et al., 2009).

#### 4.1.12 Astonishment

The astonishment is connected to other emotions such as surprise, wonder and aversion. But it stands out from the others because commonly represents negative feelings, such as tumult, shock, excessive fear, horror and even frustration. The inducing of the emotion is related to appearance of other perspectives and unfavorable consequences that subverts the expectations on a sudden way that can even be concept breaking that were determined by something or someone (Ekman, 2003; Lazzaro, 2009; Mellers, 2001).

#### 4.1.13 Schadenfreude

It is a word that comes from the German language, in which represents the feeling of satisfaction for when something unfortunate happens to someone else, it is when we feel contentment or happy for the misfortune of somebody that we do not like or see as a rival (Lazzaro, 2009).

#### 4.1.14 Anger

People refer to anger as an experience or a feeling, a set of physical reactions, and can be an attitude towards others, an impulse that leads to aggression or an open attack to some target. On social psychology, anger is related to a determined set of feelings. These feelings usually labled as anger may vary in intensity of irritation or boredom. It is important to say that even though anger is connected with the frustration feeling, anger goes beyond frustration, like it is said in the frustration-aggression theory (Cheok, 2004; Ekman, 2003; Lazzaro, 2009).

## 4.2 Categorizing Emotions

Through the analysis of the escape room genre and the fourteen emotions studied, it became apparent that not all emotions have an equal role within a game of this genre. Therefore, it was necessary to categorize these emotions into different groups based on their descriptions by Bartle et al. (2009), Lazzaro (2009), and Paulin (2014). Each group possesses its own specificities, methods of induction, and utilization.

The categories of emotions and their corresponding emotions, along with the motivations for categorization, are as follows:

- **Primarys:** emotions that are common and essential for a good game of the genre. The emotions that belong to this category are: curiosity and fear, because they are constantly mentioned on the definition of the genre and they last throughout the gameplay;
- **Punctual:** emotions that arise as the results of actions and interactions between the player and the world. Yet, these emotions only last for a few moments as they are transition emotions. The emotions are classified as

punctuals were: frustration, relief, contentment and triumph, because they are consequences of successes or failures of the players, getting followed right after by primary, consequential or complementary emotions;

- **Consequential:** emotions that comes as a result of the interactions and the immersion of the player in the presented world. However, opposed to the punctual emotions, these emotions are long-lasting and constant throughout the gameplay. The emotions that classify into this category are: surprise, wonder, enthusiasm and playfulness, because they are commonly felt while exploring a scenario, discovering and learning the narrative or through the continuous gameplay flow;
- **Complementary:** they are the emotions that are not consistent in different games of the genre. But they still play an important role complementing the other emotions. They are not long lasting, because they exist as momentary assistance for the other emotions. The emotions classified as complementary were: *naches*, *astonishment*, *schadenfreude* and *anger*, because they exist on alternative types of games, narrative structures tutorials and online ranks;

### 4.3 Development guidelines for escape room genre games

Based on the categorization of emotions, mechanics, and dynamics, guidelines for the development of escape room genre games were created.

The mechanics and dynamics utilized were derived from the work of Wiemker et al. (2015), as well as our subjective assessment and evaluation of the studied genre. Consequently, they serve as conjectures based on existing literature and would greatly benefit from validation through testing and research involving players and users.

The results of the analyses were compiled into a chart that can be referenced by the game designer during game production, serving as a guide.

The guidelines can be seen in Chart I.

### 4.4 SGDD using the emotion-based MDA framework

In order to implement and practically apply the obtained results regarding the relationship between the MDA framework, its mechanics and dynamics, and the emotions, a Short Game Design Document (SGDD) was developed for an escape room prototype named Logic Gates (Migliorini, 2021).

According to the SGDD guidelines, a general and broad text should be created to explain the overall operation of the game, including the artistic elements, sound, and programming procedures. In the text, specific terms will be underlined and numbered from 1 to 3 to indicate the corresponding art, sound, and programming elements. Additionally, the emotions experienced by the player at specific moments will be represented by the number 4. Chart II provides an overview of the elements present in the GDD.

The game starts in a menu interface<sub>1</sub> that contains the “Play” and “Exit” buttons<sub>1</sub>, on this moment the player hears a mysterious background music<sub>2</sub>. As they start the

game the screen gets dark, and a dialogue<sub>3</sub> appears to introduce the player the story of the game. After the explanation of the story, the screen will go through a fading effect<sub>3</sub> until the game begins. After the full loading the player will be found in an unknown environment: it is possible to hear an easy listening song<sub>2,4</sub> playing in the background. The player will feel familiar with the environment and display of the items, but they will also feel curious to find out the story of that place through the array of items spread throughout the room, such as shelves, drawers, post-its, papers, cellphones, computers<sub>1</sub> and other objects. Everything that the player will interact with will contain the sound of the object playing in the background<sub>2</sub>. As they wake up, they will see on a wall opposite to the entrance a circuit in a metal box<sub>1</sub> and a stopwatch<sub>1</sub> in the background. When they interact with this circuit, they will notice that are missing logic gates to be inserted<sub>3</sub> so the circuit is complete. They will need to dive into the notes and the story of the place to look for passwords, locations and codes to find logic gates inside drawers and vaults that are locked up with passwords and keys to satisfy their curiosity<sub>4</sub>. All of this occurs while the timer runs out and their screen gets darker because of the lack of oxygen. This will make the player feel very pressured and anxious<sub>4</sub> to find the answer of the puzzle and leave the place. At the same time that their wish to explore the place<sub>4</sub> is real, they are being conditioned by their time running out and everything coming to an end.

The narrative description developed for the SGDD allows the creation of a table that includes the elements of art, sound, programming, and emotions that were highlighted in the text. Therefore, the results obtained from extracting these elements can be observed in Chart II.

Based on Chart II, it is evident that the desired emotions in the game are curiosity, fear, contentment, and enthusiasm. By referring to the results presented in Chart I, we can identify the dynamics that best elicit these emotions. As a result, the dynamics recommended for the Logic Gates prototype are as follows:

- Curiosity (Primary):
  - Searching (puzzles);
  - Finding (secrets);
- Fear: (Primary)
  - Suffering (temporal pressure, menace and chase);
- Contentment (Punctual):
  - Conquering;
  - Exploring;
- Enthusiasm (Complementary):
  - Searching (puzzles);
  - Finding (side quests);

Hence, each of the emotions and dynamics outlined in the guidelines presented in Chart I align with specific mechanics. These mechanics serve as implementation suggestions to create the desired gameplay experience. In the example provided, some of the relevant mechanics that can be applied are:

Chart I  
Development guidelines of Escape Room genre games utilizing the emotion-based MDA framework. Reference: the authors.

Category	Emotion	Mechanics	Dynamics
Primary	Curiosity	Catch, rotate, inspect and read objects, walk around the environment and interact with items.	Searching (Puzzles) and finding (secrets).
	Fear	Clocks, counters, darkening screen, water level rising, damage indicators, footstep noises and running.	Suffering (temporal pressure, menace and chase).
Punctual	Frustration	Clocks, counters, game over screen, saving progress, restart of phrases, fill in answers of a puzzle or a challenge.	Failing and being defeated.
	Relief	Clocks, counters, level complete screen, visual indicator of success, fill in answers of a puzzle or a challenge, unlock doors and run.	Searching (information) and getting rid of danger.
	Contentment	Unlock achievements, level complete screen, visual indicator of success, read text or notes, receive new information of the narrative by dialogue.	Conquering and exploring.
	Triumph	Receive special or unique items, points indicator, success and failure indicator, progress indicator, score indicator, success, progress of other players compared to the user.	Conquering and exploring.
Consequential	Surprise	Walk around the environment and interact with items, catch, rotate, inspect and read objects, read and listen to dialogue and interact with other character, find new clues or alternative answers to puzzles or challenges.	Exploring, finding (secrets) and getting surprised (narratively).
	Wonder	Walk around the environment and interact with items, catch, rotate, inspect and read objects.	Exploring.
	Enthusiasm	Discover new clues or alternative answers to puzzles or challenges.	Searching (puzzles) and finding (side quests).
	Playfulness	Different levels unlocked, points indicator and progress by level, dialogue and scenario ambientation.	Progressing (narratively and mechanically).
Complementary	Naches	Multiplayer mode, easy difficulty and tutorial mode.	Cooperating and learning.
	Astonishment	Plot twist on the story and the break of expectations.	Progressing.
	Schadenfreude	False clues, adversary's point indicator and sabotage.	Competing.
	Anger	Adversary, villain or enemy of the story, sabotage and false clues.	Competing and failing.

Chart II

Art, sound and programming elements and emotions extracted from the SGDD from the Logic Gates prototype. Reference: the authors.

Art	Sound	Programming	Emotions
<ul style="list-style-type: none"> <li>- Menu interface;</li> <li>- Play and exit buttons;</li> <li>- Shelves;</li> <li>- Drawers;</li> <li>- Books;</li> <li>- Post-its;</li> <li>- Papers;</li> <li>- Cellphones;</li> <li>- Computers;</li> <li>- Circuit in a metal box;</li> <li>- Stopwatch;</li> <li>- Darkening screen effect;</li> </ul>	<ul style="list-style-type: none"> <li>- Mysterious music;</li> <li>- Easy Listening Song;</li> <li>- Objects sounds that were described on the column;</li> </ul>	<ul style="list-style-type: none"> <li>- Efeito de fade-out;</li> <li>- Dialogue system;</li> <li>- Fade-in effect;</li> <li>- Systems to solve digital circuits;</li> <li>- Stopwatch counter;</li> </ul>	<ul style="list-style-type: none"> <li>- Calm and contentment;</li> <li>- Curiosity;</li> <li>- Pressure and anxiety or fear;</li> <li>- Enthusiasm;</li> </ul>

- Grab, rotate, inspect, read objects, walk through the environment, and interact with items;
- Clocks and counters, screen dimming, water level rising, damage indicators, chase sounds and running movement;
- Unlock achievements, level complete screen, visual success indicator, read notes and text in puzzles and receive new narrative information;
- Discover clues or alternative answers to puzzles and challenges;

Finally, the development of the SGDD demonstrates that the flow of guidelines leads to directions on how to implement the desired dynamics, thereby inducing the necessary emotions in the players.

## 5 Conclusions and Future Works

In this work, our aim was to produce guidelines to assist game designers in the production of escape room game projects. Additionally, we proposed a modified MDA framework to better suit the characteristics of the studied genre.

As researchers, we have a strong focus on ensuring the quality of the player’s experience, considering various steps involved in the planning and production of a game. Similarly, we have meticulously taken into account the correlation of emotions with each other and with the gameplay elements throughout our research.

Therefore, our aim in this work is to address various weaknesses and gaps in the established MDA framework. Additionally, we emphasize the refinement of the MDA framework specifically for the escape room genre, which serves as the focal point of our study.

Thus, based on the analysis of the data obtained from the development guidelines that relate the MDA framework with emotions, as well as the SGDD developed for the Logic Gates game prototype, we can conclude that the produced results, when implemented during the development process, can be instrumental in facilitating the game development.

Furthermore, through the analysis of recurrent emotions found in games of the genre, it becomes easier to comprehend

the essential dynamics and mechanics required in a game. This understanding enables the game designer to better anticipate and plan the player’s response to the implemented elements.

Before this work, there was limited understanding of the significance of each emotion within the genre. However, with improved knowledge and comprehension of the game development process, it can be stated that this work not only helps to bridge the existing gap between the game designer and the player but also contributes to the creation of a more meaningful final product.

We expect game developers to utilize the constructed guidelines in future escape room games, aiming to create an enhanced product that can thrive in the expansive and continuously expanding game market.

### 5.1 Future Works

The current research opens up several avenues for future study and work. One expected outcome is the completion of the implementation of the Logic Gates prototype, which was mentioned as the practical application of the results obtained. The implementation must follow the development guidelines established during this research, aiming to further contribute to the results.

Furthermore, conducting surveys, questionnaires, and tests with players and students can provide an opportunity to quantitatively validate the literature’s assertions about emotions and dynamics. This research would focus on examining the correlation between the described emotions and the aesthetic layer outlined in the MDA framework.

Similar analyses could be conducted with the Logic Gates game to validate its effectiveness as an educational tool, particularly for undergraduate students. The evaluation process could involve comparing the students’ experiences and outcomes before and after the game’s implementation in the classroom.

Taking into account that the MDA framework is the focus of several criticisms, questions may arise when analyzing other models present in academia, such as the DDE, proposed by the same authors of the MDA framework:

- What was the need felt by the authors when proposing another model;
- How the problematic of this work is transferred to the new model;
- What are the common points and differences present in the MDA and DDE framework;

Lastly, it is worth considering the analysis and research of other game genres to further expand and generalize the emotion-based MDA framework. By exploring and studying a variety of genres, the model can become more comprehensive and applicable beyond its current scope, which is primarily focused on escape room games. This broader perspective would contribute to a deeper understanding of the relationship between emotions and gameplay in various game genres.

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