



A framework to support the development of empathetic games

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Abstract: An emerging category of games is gaining the attention of the academic community: empathetic Games. These games diverge from the conventional pursuit of entertainment only, opting instead to immerse players in the lived experiences of others and confront the challenges encountered in their daily lives. Examples include simulations of a doctor’s routine, exploration of the perspective of someone navigating prolonged grief, or portrayal of how individuals with physical disabilities surmount their limitations. While various works across disciplines underscore the significance of empathy, a noticeable dearth of literature delves into *how* digital games engender empathy in users. Addressing this knowledge gap, the current study introduces the conceptual framework **CERCO** (*Components, Elements, Requirements, and Concepts*) along with accompanying resources such as: *glossaries, empathetic game syntheses, historical analyses of empathetic elements in the gaming industry, design guidelines, and videos*. The primary objective of this work was to establish a comprehensive framework and associated tools to aid professionals at all skill levels in the game development process. These outcomes serve as the focal points of the study, offering detailed insights into how they can effectively support the creation of empathetic games. Through interactive engagement, these games can serve as powerful tools for navigating and addressing complex real-life subjects.

Keywords: Empathetic Games, Empathy, Game Analysis, CERCO framework

1 Introduction

The interest in games in many different areas has been increasing, even among academics. A notable reason for such interest is that the simulated space that games provide allows designers, developers, creators, and a wide range of professionals, to prepare experiences made to explore diverse (and sometimes) sensitive topics in an immersive, engaging, and safe manner to the user [Shliakhovchuk and Muñoz García, 2020].

Besides games made for pure entertainment, there are games that: support children, teens, and adults in their educational process [De Gloria *et al.*, 2014]; patients to better understand their rehabilitation and current condition [Bonchère, 2018]; promote awareness to the public of psychological or emotional issues such as grief and sorrow when facing the loss of a loved one [Santos *et al.*, 2018], simulate dangerous conditions for the training of employees [Williams-Bell *et al.*, 2015], etc. Alongside these, a recent category of games is gaining attention: The *empathetic games*.

Such games prioritize, in general, via interaction and game mechanics, the experience of how it is to be “in someone else’s place” [De Melo Pinheiro *et al.*, 2021]. These games provide experiences where the player has to confront situations that are dealt with daily by some individuals, such as: **i)** the daily lives of professionals like doctors, teachers, and police officers; **ii)** people are that are dealing with difficult/sensitive conditions (crippling debt, in long grief, a destructive addiction, etc.), or **iii)** people who are living with situations outside their control (old age, cognitive or physical

disabilities, natural disasters, etc.) [Wulansari *et al.*, 2020].

According to Lankoski [2007], empathy is essential for people to live better in the many social contexts they may find themselves in. In specialized works about games [Boltz *et al.*, 2015; Diogo, 2016; Belman and Flanagan, 2010], the authors advocate that the empathetic element is valuable for players to: be more attentive to the surrounding realities of others, to act in a more pro-social manner and take hard decisions responsibly, and to be possible agents of positive change on the places in their social contexts.

The Brazilian Human-Computer Interaction (HCI) community also has been highlighting studies regarding the definition of this game category, alongside design recommendations and guidelines [Santos *et al.*, 2020; De Melo Pinheiro *et al.*, 2021; Rodrigues *et al.*, 2021]. Learning and understanding how these games are planned and how they foster empathy in the player is of special interest to this community. Other kinds of computational solutions can benefit from the strategies and resources used in the interface, as well as in the interaction means.

The present work aligns with the *GrandIHCB* Challenges 2 and 4 [Baranauskas *et al.*, 2014]: *Accessibility and Inclusion, and Human Values*. Challenge 2 describes how computational solutions can be built in an accessible manner to promote accessibility via such solutions. empathetic games consider accessibility aspects as an empathetic element and seek to allow its use to the greatest diversity of users possible. Challenge 4, in turn, brings to light aspects such as ethics, privacy, and digital legacy in the development of computational solutions. The authors of this work believe

that empathetic games have the potential to discuss ethics, both in their themes and narrative, and this also extends to how the players' data are treated. Besides, this category can benefit from the graphical and textual elements to foment discussions about sensitive (and sometimes taboo) topics like death, grief, diverse prejudices, and many others. However, more studies about them are needed.

Empathy is a fundamental requisite for interfaces that are able to foster good usability [Jørgensen, 2004], accessibility [Sohaib et al., 2011], and inclusivity [Rangel et al., 2022; Beckwith et al., 2006]. Studies performed in academic literature demonstrate a considerable volume of works that emphasize the importance of empathy in games [Schrier and Farber, 2021; Bearman et al., 2015]. In contrast, very little was found regarding *what and how* structural game elements employed can instigate empathy in players, or yet, *what* artifacts and tools exist that can be useful to this objective.

Given the above, and the growing market share that games have in popular culture and media [Shliakhovchuk and Muñoz García, 2020], this work seeks to present the conceptual framework **Empathy CERCO (Components, Elements, Requirements, and COnccepts)**, which was created to support game creators, of all skill levels, to grasp how game elements can be used to generate empathy in the player. This framework is also composed of 5 support artifacts: **i)** A glossary, **ii)** a historical look at the game's industry focusing on empathetic elements; **iii)** a synthesis of empathetic game examples; **iv)** guidelines and recommendations; and **v)** videos. Both the frameworks and its artifacts will be detailed throughout the present paper

The present work is based on the first author's undergraduate thesis, and it is also an extended and revised version of Galvão et al. [2024] study named "A framework to support the development of empathetic games" that was originally published in the XXII Brazilian Symposium on Human Factors in Computing Systems - IHC 2023. The current version of the framework has not been yet verified or tested by specialists; having had more details about the study and new references added.

The present paper seeks to contribute, simultaneously, with an in-depth overview of the framework, its artifacts, and usage to the academic community, and to detail our findings during the process of creation of the framework on how an interactive empathic game or game-like experiences can be created intentionally rather than incidentally. Therefore, supporting academics, designers, and developers in their creations that seek to approach sensitive issues in a novel way, like an empathic game, for example.

The present work is organized as such, in Section 2 we present how empathy is defined and importance, both in society and also in tech related areas, and we detail the found studies regarding empathetic games. In Section 3, we detail the methodologies that were performed, how the overview method was executed and how the artifacts were built. In Section 4, we present the artifacts and their results, we also demonstrate their contents and where they can be accessed. Finally, Section 5 addresses the present work's final considerations and limitations.

2 Theoretical framework

To better understand the nature and goals of the present study, this section presents how empathy is often defined, how empathetic games are currently understood. A critical overview of empathic games, the correlation between accessibility and empathic games, and the nature of frameworks in academia.

2.1 Empathy in different contexts

Empathy is usually understood as, "The capacity to imagine how it is to be in someone else's position", being able to interpret verbal and non-verbal communication patterns to understand the other's ideas and actions [Michaelis, 2022].

Similarly, empathetic games prioritize the emotional engagement of players, while complex gameplay and pure entertainment are secondary. These games, via their graphical, audio, narrative, and gameplay elements attempt to approach the player to the reality of the characters they control in a game, in a way that the players can "get into the character", so they act and take decisions and understand the weight of their actions in game - both for them and the others characters in the game's universe [De Melo Pinheiro et al., 2021; Goulart, 2017; Belman and Flanagan, 2010]. Boltz et al. [2015] detected that the empathetic engagement between the game and the player can positively affect players' physical and emotional state, even after game sessions.

The effects of these games, according to Martinez [2009], can develop pro-social behaviors and cognitive skills to understand and better deal with similar situations in their daily lives. Such effects are also present in Lankoski [2007] works, the author appoints that this occurs due to video games being a medium that, in contrast to books, movies, and music where the spectator has more of a passive experience; demands the active participation of the player, putting them in a position where they are both actor and spectator, therefore, due to this perspective, games have been an empathetic medium since their origin.

As aforementioned, during this work's initial investigation, we found few studies detailing the characteristics of empathetic games and how they can instigate such feelings in the player. Some of the found studies are the works of Santos et al. [2020], De Melo Pinheiro et al. [2021], Rodrigues et al. [2021], and Blot [2017]. The works of Santos et al., De Melo Pinheiro et al., and Rodrigues et al. are interlinked. In them, the authors sought to understand how empathetic feeling is fostered in commercially available games, however, each of them explored different aspects of empathy generation in the player. Each of these studies will be briefly described below, and a simple summary of these 3 related works can be seen in the **Table 1**.

Santos et al. [2020] collected and analyzed comments that players left on the Steam¹ platform regarding the following

¹ Steam is a digital game distribution service managed by Valve Corporation, it allows for players to purchase games, discuss and review them, create modifications, and form communities in a social network-like platform. Available at: <https://store.steampowered.com/?l=portuguese> — Last Accessed in May 2023.

Table 1. Summary of the studies of empathetic games and how they foster empathy in players that were consulted

Name	Objective	Methods	Results
Interpreting posts in empathetic games: assumptions for a conceptual framework (Dos Santos et al., 2020)	Identify aspects in empathetic games through the players' experiences, via the comments they posted online	Collection of players' comments regarding the games: <i>Valiant Hearts</i> and <i>That Dragon, Cancer</i> . Analysis of collected comments via grounded theory.	Categorization of comments into 5 Aspects (Technical, Emotional, Physiological, Theme Specific, and General) to better understand how these games work and affect the player
Revisiting empathy games concept from users comments perspective (De Melo Pinheiro et al., 2021)	To understand the concept of empathetic games via the literature concept of empathy and how the player's perceptions can be categorized and defined	Collection of players' comments regarding the games: <i>11-11 Memories Retold</i> and <i>Fragments of Him</i> . Analysis of collected comments via grounded theory. Comparison of the analysis findings with the academic literature in order to define concepts of empathy and its aspects for empathetic games	Definitions and understanding of empathy for empathetic games. Creation of model cases to illustrate empathy in games, and the aspects that were found in dos Santos et al. (2020) work, abstracting them to the context of games.
Diretrizes para o design de jogos empáticos (Rodrigues et al., 2021)	To create directives to design empathetic games	Literature review of how game elements are used to foster empathy. Immersive analysis of empathetic games with 3 volunteer designers. Analysis of player's comments regarding the games: <i>GRIS</i> ; <i>Fragments of Him</i> ; <i>That Dragon, Cancer</i> , <i>Valiant Hearts</i> , and <i>Limbo</i>	14 directives to the creation of empathetic games, them being: 1) platform; 2) narrative, 3) genre; 4) time interval and strategy; 5) player mode; 6) collaboration; 7) characters; 8) point of view; 9) verbal development of the characters; 10) challenges and goals; 11) color pallet; 12) the game's dimension; and 13) perspective.
Exploring games to foster empathy (Blot, 2017)	To outline game mechanics that foster empathy	Research through design by studying 4 different games of different natures: a board game (<i>Feelings</i>); a digital game (<i>Papers, please!</i>); a dynamic game (<i>Three figures game</i>); and a Live Action Role Playing Game (<i>Ground Zero</i>). Design and testing of empathetic game prototypes created by the author.	Immersion and Role-Play through narrative are key to foster empathy in players. Immersion breakers need to be avoided whenever possible. Empathy is subjective, and the player must also be willing to engage emotionally with the narrative in order for the empathetic game to be successful in its goals.

games: *That Dragon, Cancer*² e *Valiant Hearts*³. The authors filtered comments via grounded theory⁴, and it consolidates findings made from previous studies from the same authors [Santos et al., 2018; Dos Santos et al., 2019]; in their latest work they detected and categorized users' perceptions in the following categories [Santos et al., 2020]:

- **Technical Aspects** - Narrative, game mechanics, game's technical qualities;
- **Emotional and Affective Aspects** - Feelings that a game can cause on the player (happiness, sadness, hope, despair, etc.);
- **Physiological Effects** - If the game has caused players to tear up, nausea, dizziness etc.;
- **Theme Specific Aspects** - Whether the game, in some form, deals with religion, grief, historical facts, etc.;
- **General Aspects** - Whether players recommend the game to others (or not), lasting impressions or inspirations that the game left on them, what aspects stroke the players as notable (be them positive or negative).

²That Dragon, Cancer — Available at: https://store.steampowered.com/app/419460/That_Dragon_Cancer/ — Last Accessed in May 2023.

³Valiant Hearts — Available at: https://store.steampowered.com/app/260230/Valiant_Hearts_The_Great_War__Soldats_Inconnus__Mmoires_de_la_Grande_Guerre/ — Last Accessed in May 2023.

⁴Grounded theory is a research method concerned with the generation of theory, which is 'grounded' in data that has been systematically collected and analyzed. It is used to uncover such things as social relationships and behaviors of groups, known as social processes.[Charmaz, 2009]

The authors of this work pointed out that game elements, mainly graphics, audio, narrative, and game mechanics, were the ones responsible for this empathetic link between the players' emotional responses and the game Santos et al. [2020]. However, despite their findings, they were not able to establish a central concept to the design of empathetic games, this is due to the sample size and the study focused on the users' perspective.

In the same direction, but attempting to find a central concept to empathetic games and its many aspects, De Melo Pinheiro et al. [2021] applied a similar methodology to Santos et al. (2020)'s study. The authors also collected and categorized players' comments via grounded theory and categorized them in the same aspects also established by Santos et al. [2020] work. The key difference in De Melo Pinheiro et al. [2021], is that, they did an in-depth look into the concepts that were detailed by each aspect, and created model cases to better encapsulate how these concepts are applied to empathetic games, and how they can be better defined according to established works in academic literature and their findings after analyzing a new sample. The authors sought to analyze a new game's sample that attended the following requirements:

1. **Narratives associated with grief and loss** - Game mechanics and narrative that are related, coherent, and significant to this thematic;
2. **Artistic games** - Games that seek to use the medium to send a message to the player;
3. **Simple gameplay** - The ways for a player to interact

with the game and its systems are accessible, intuitive, and easy to understand;

4. **Significant amount of comments in the Steam forum** - The game needed to have 100 comments or more.

Initially, five (5) games were considered, but only two (2) fulfilled all the established requirements and were studied in depth, the selected games being: *Fragments of Him*⁵ e *GRIS*⁶. After the comment's analysis and comparing with literature definitions, De Melo Pinheiro *et al.* [2021] managed to highlight 4 key components that distinguish empathetic games from the rest:

1. **Cognitive component** - Capacity to infer, with accuracy, the feelings and thoughts of others, without, necessarily, experiencing the same feelings that they do. Such perspective requires neutrality and impartiality of those who are empathizing with another;
2. **Affective component** - That expresses a genuine interest in attending to the needs of the other. Not necessarily in attempting to feel what the other is feeling; but to experience, as closely as possible, what they might be feeling and going through;
3. **Behavioral component** - That explains the feelings of the other without judgment; by accepting and legitimizing them, alongside the other's point of view, helping them to understand, explain, and find a reason for their emotions;
4. **Perceptive component** - Relativize all the other components as to how the involved parties perceived the situations and scenarios they face, rather than how they occurred.

Upon reflection of their findings, De Melo Pinheiro *et al.* [2021] managed to identify elements that are impactful in empathetic games from the user's perspective, these being:

1. **Intention of it being an artistic work** - Different technical aspects need to be well integrated, meaning that; beyond narrative, the art direction is a category that needs particular attention;
2. **Offer the player the expression of feelings** - Via narrative, related to the game's universe that can emotionally resonate with the player; the game must trigger in them the will to care for the needs of the characters they control and genuine compassion with others in an effective and perceptive level;
3. **Generate reflexive action** - Narratives that can generate relatability with the player and the game's themes must be sought, and with them instigate the will for players to act in their lives outside the game's context.

Complementing the studies of Santos *et al.* [2020] and De Melo Pinheiro *et al.* [2021], Rodrigues *et al.* [2021] widened their study's scope by employing a 3 stage methodology:

1. Literature review focusing on the technical, esthetical, narrative, character types, game genres, game design, and other relevant elements;
2. The analysis of empathetic games had 3 volunteer designers. They analyzed this study's game sample via immersion, and they reported each game's technical aspects and how they are used or contribute to fostering empathy in the player;
3. Analysis of player's comments posted on Steam about each game.

Rodrigues *et al.* [2021] work analyzed five (5) games. While the games sample was composed of all the aforementioned games in both Santos *et al.* [2020] and De Melo Pinheiro *et al.* [2021] works (*GRIS*, *Fragments of Him*, *That Dragon, Cancer*, and *Valiant Hearts*), they added the following game to their research sample: *LIMBO*⁷. By looking at the previous works, the results of the volunteers' analysis, and the players comments in each of these games in the Steam *platform*, they culminated in 14 useful directives for the design of empathetic games, which can be seen in **Table 2**.

Rodrigues *et al.* [2021] work also highlights that they could not establish directives for the following 4 elements identified in the literature: *age rating*, *character's controls*, *archetypes*, and *games' ending*. The main reasons are that these elements are related to the creative decisions inherent to the game's creative process, the themes they wish to tackle, and the market goals they seek to accomplish [Rodrigues *et al.*, 2021].

Presenting a different approach from the other aforementioned works in this section, Blot [2017], sought to define how "empathy" is presented in games, it is defined as: **1) Cognitive** - The capacity to understand the other's life experience via their point of view, and **2) Emotional** - this one being subdivided in: 2.1) Parallel (aka emotional) where a person's emotional reaction is similar to another, and 2.2) Reactive (aka complimentary) where the emotional reaction is different from what the other expects.

Blot [2017], using concepts of empathy and emotional engagement that originate in psychology, analyzed 4 distinct games: A board game (*Feelings*⁸); a video game (*Papers, please!*⁹); an exercise dynamic (*The Three Figures Game*¹⁰); and a Nordic Live Action RPG¹¹ (*Ground Zero*¹²).

After analyzing these games and testing a self-built prototype, Blot [2017] concluded that for generating empathy, the elements of *immersion* and *role-play* are key to emotionally engaging with the player. However, according to the author, if the game elements are used carelessly, the player's immersion can be broken easily. Also, the author points out that empathy is an emotion, by nature, it's also subjective - different individuals can react differently or equally intensely

⁷LIMBO — Available at: <https://store.steampowered.com/app/48000/LIMBO/> — Last Accessed in August 2024.

⁸Actingames, © 2015

⁹3909 LLC, © 2013

¹⁰Tisseron *et al.* [2015]

¹¹An art form where the essence is character representation and improvisation, that can be transformed into a game-like experience between participants [Harviainen *et al.*, 2018].

¹²Hopeametsä [2014]

⁵Fragments of Him — Available at: https://store.steampowered.com/app/428540/Fragments_of_Him/ — Last Accessed in May 2023.

⁶GRIS — Available at: <https://store.steampowered.com/app/683320/GRIS/> — Last Accessed in May 2023.

Table 2. 14 guidelines useful to the design of empathetic games, according to Rodrigues *et al.* [2021].

1) Platform	The physical device that runs the game. Consoles or PCs are preferable; in multiplatform games, the game's experience must be consistent between them.
2) Narrative	Being preferable linear plots, with changes and alterations only appearing when necessary.
3) Genre	Platform and adventure puzzle games are efficient to dialogue with players, especially with children.
4) Time and Strategy Intervals	Emphasis should be placed on the order of events happening in real-time, rather than the turn-based time abstraction.
5) Game mode	Single player games offer individual experiences that are narrative focused on the player's role in it.
6) Collaboration (CO-OP)	Narratives that do not depend on co-op based games, (where players work together to complete stages and advance in the game's plot), are recommended so that the player is capable to express their emotions without judgment or pressure from other people.
7) Collaboration	Preference for fictional characters, this way the game's narrative is not stuck to an inflexible time period.
8) Point of view	Both 1st and 3rd Person perspectives are efficient to discuss the empathetic themes with the target demographic. This choice must be considered with the needs of the game's design.
9) Characters verbal development	Both narration and dialogues are viable means to elicit empathy in the player, this factor must always be in a way that the narrative design is coherent with the game's design
10) Challenges and Goals	Via the empathetic game is possible to explore themes such as: Conflict, problem-solving etc. It is recommended to avoid competitive elements, item collection, checklists in excess and employ them in a manner common to other games.
11) Game's color pallet	Vibrant colors, colors that evoke feelings of joy, calm, tranquility and other positive feelings are recommended.
12) Audio and Soundtrack	Preference for calm sounds that collaborate with the game's narrative and its objectives
13) Game's dimension	Preference for 2D games, since they are least likely to cause nausea, games of this dimension demand less machine/device resources, allowing for the game to be more accessible to a greater number of players.
14) Topics that present divergent perspectives	Avoid focusing on them (e.g: religious topics), in a manner to appeal to a greater public and not deal with delicate questions that is unrelated to the game's themes, and/or deal with individual beliefs

when facing the same situation. Blot [2017] also calls attention to the ethical question involved in these games, which requires deep research and understanding of the themes that these games are approaching.

The found works are significant for understanding how engagement and interaction can foster the feeling of empathy in the player. Despite the different contexts, there are interesting knowledge intersections between technology, psychology, art, accessibility, music, history, and many others that are needed to create an empathetic game.

Due to these diverse elements that make up the creation of a game, and the focus of this work, in particular, being dedicated to digital games, it is necessary to analyze how the game elements promote empathy in the player, if there are outliers, and important nuances to consider. Such as whether their union of these elements provides empathetic experiences for the player, and whether there are elements that are more important for this particular gaming experience. The processes chosen to explore this question will be detailed in the methodology section.

2.2 A brief critical overview of empathic games

Scholars support that video games can be a viable vehicle to explore sensitive subjects, and according to Sarmet and Pilati [2016] they have real effects in diminishing aggressiveness and even increasing prosocial behavior in both adults

and children. Academics, however, are still divided on how much this empathic effect is real, or how effective games can really be, as well as how relevant and significant they can be to the player's lives [Sarmet and Pilati, 2016].

However, how this empathy is presented can be sometimes, not enough or even troubling if painted in an over positive light, according to Ruberg [2020]: *"In many ways, the discourse of empathy has served to straighten queer games, reimagining them as serving straight players. It is ironic then that from the very same network of discourse have emerged instances in which "empathy" takes on unexpected or counter-hegemonic meanings, including an instance in which empathy describes a kind of intimate queer entanglement."*

Ruberg [2020]'s work critique of empathy is contextualized over how the game's industry at large use empathy as a selling point, and often whatever themes and representations are within the game, they are made with intent to please and entertain the largest demographic possible. Thus, sanitizing, appropriating, and even misrepresenting real world issues and their complexities, which is against the goal of an empathic game, making them to become sympathetic (i.e. the player can understand the feeling, but not feel what their characters are feeling).

In part, Ruberg's critic is explained by Blanco [2019]'s work, that, especially marginalized representations in the gaming industry's current cultural trends are not enough to rectify this notion, especially for the most popular games

[Oliver *et al.*, 2015; Blanco, 2019]. This is a problem that is also persistent alongside movies and TV shows, where only now in the 2020s, representations and realities of both queer identities and minorities are getting attention, however the resistances to these changes are still present, where the media that was supposed to tackle hard hitting questions, becomes more watered down an acceptable product to the market [Blanco, 2019; Todd, 2015].

The authors of the present work believe that this scenario is slowly changing despite world trends and the current political division that has permeated the many different aspects of modern human life, it also affects the entertainment industry and its representations.

However, as pointed out by Chesler [2022], this is complicated, as the author points out, both academics and the industry are begging to understand that games have the power to evoke competencies such as empathy and compassion, but a present misconception about games is that the player may have empathy about the characters (and other people), but not onto themselves.

Chesler [2022] also adds that the subjective dimension of games makes it difficult to be certain of what works in some instances, and not in others. Due to the very human experience being a murky, abstract, and not always rational, there are doubts whether this can really affect people or even how much should be shown without feeling misused or gratuitous. In this matter, we, the authors, believe in the potential of empathetic games for exploring sensitive themes and their capacity to raise awareness in the player and allowing them to be agents of positive changes in their social contexts.

In our present work we hope to contribute how to foster empathetic games by examining both the gaming industry trends and independent game creators, to point out *how* their works managed to achieve and foster empathy in the player, rather than becoming sympathy. Which, due to empathy's elusive nature, is not always guaranteed, yet we still think it is possible to create tools to support how empathy works and how game creators, can generate empathy games more successful

2.3 Empathy and Accessibility

In computer related areas, the topic of accessibility is commonly understood as how to allow users who are not an average user¹³, to use the both hardware and software devices in a way that accommodates their conditions and supports their inclusion in these systems Hott and Fraz [2020].

In HCI areas, as mentioned in the introduction, is a constant research challenge Baranauskas *et al.* [2014]. As technology progresses, more care is needed in its design so that it is usable and comfortable, for the greatest amount possible of users.

While guidelines for general accessibility in games exists¹⁵, to the present work, accessibility, besides supporting people with disabilities to also be capable of playing the games,

we also consider how interface, aesthetic and language elements can be used to also foster the empathic experience with the player. As pointed out by the works of Siqueira da Silva [2019]; Cairns *et al.* [2019], by taking care of the usability in games, it's possible to better convey feelings via how text, image alignments, screen elements sizes and colors can be used to support how empathy can be fostered in the player.

Alongside these, the present work also includes the subjective perception of empathy, as described by Wilde and Evans [2019]: *"Empathy has therefore been used as one analytic for how posthuman subjectivity has arisen from/out of the relationship between the player and avatar in World of Warcraft. (...) empathy helps to conceptualize the connection between a human and non-human other; in a way that shares perspectives and bodies along channels of affective feeling. The experience is one that shows how human and machine are undeniably fused, retaining emotional and embodied feelings in a permeable way. As such, we have shown how 'being posthuman' is as complex as being 'human' ever was."*

In an abstract sense, games can also allow accessibility via immersive experiences, for players understand human relationships and their daily challenges, such as people without disabilities to understand the perspective the people with visual impairments [Siqueira da Silva, 2019], or medical students to understand the challenges of elderly people with medical systems [Geier *et al.*, 2022].

Considering this particular characteristic regarding accessibility allows some insight over how other people are feeling, it is also a goal of the present work to understand insights on how games can foster empathic feelings in the players, and what are common issues with them in games such as the ones pointed in Blot [2017]'s work.

2.4 Frameworks - a brief understanding

In academia, frameworks take a more abstract and open nature. As they are a useful tool that can be "molded" to explore, work, and deal with common problems in many knowledge areas; be it in a systematic, theoretical, or methodological approach [University, 2021]. Due to their abstract and open-ended nature; these tools are open to modifications for their usage in more specific contexts that were not originally considered during their creation; be their application or even knowledge area [Tormey, 2014; Shanahan *et al.*, 2018; Payne, 2005].

For academic research, frameworks are classified into the following two large categories [Kivunja, 2018]:

- **Theoretical** - Via a set of theories expressed by specialists in a particular knowledge field, this framework is a synthesis of how scholars' works are related to the proposed research topic or thesis. This type of framework seeks to guide, via specialized lenses, the understanding of the research question(s), data collection and analysis procedures, interpretation of the study's findings, results discussion, and even propose recommendations and conclusions to the examined question;
- **Conceptual** - By gathering all the elements that form a

¹³an abstraction that describes the users that do not have any mental or physical distinctive characteristic¹⁴

¹⁵Game Accessibility Guidelines - <https://gameaccessibilityguidelines.com/> — Last Accessed in August 2024.

research project (structures, plans, practices, implementations, and other studies), this framework is the logical orientation of this study, and it contains: The researcher's thoughts about the study's subject; the investigated problem; the objectives to be accomplished; the study's scope; methodologies, instruments, procedures, means to analyze and interpret data, and the pertinent recommendations and conclusions of the study. This type of framework serves as a master plan for the entire research project.

For this work, a conceptual framework for empathetic games was elaborated. This type of framework seeks to establish, in visual or written form, the mapping between the many variables present in a study's subject. By analyzing how they are inter-related, and finding out how they lead to the expected result [Swaen, 2015]. Due to the transdisciplinary nature of game creation, it requires knowledge in technical aspects [Lloyd *et al.*, 2011; Menache, 2011; Trujillo and Garcia-Sucerquia, 2011], as well as human and emotional ones [Trucker, 2019; Elson *et al.*, 2014; Schwartz, 2006].

The use of frameworks in a game's creation, according to Pereira *et al.* [2017] allows for an overall better development experience, by expediting solutions to common problems alongside games, allowing the development team to better focus their priorities and creative goals.

3 Methods

For this work, we combined 4 different methods: Literature review, analysis of the games found during the literature review via immersion [Ermi and Mäyrä, 2005] (i.e.: playing the games and documenting aspects that were key to the empathetic experience), the framework's visual interpretation, and artifact generation. On **Figure 1**, shows the methodological course the present work has adopted.

3.1 Literature overview method

During initial studies, it was not possible to identify works that document frameworks that were specific to empathetic games. Therefore, a literature review was conducted to understand *how* games generate empathy in the player. For this step, it has opted to conduct the *overview* technique that is defined in the work of Grant and Booth [2009] as:

“An overview is a generic term used for ‘any summary of the [medical] literature that attempts to survey the literature and describe its characteristics. As such, it can be used for many different types of literature review, with differing degrees of systematical depth. [...] Overviews can provide a broad and often comprehensive summation of a topic area and, as such, have value for those coming to a subject for the first time.’ [...]”

While such methodology does not require a systematic approach, it was chosen with the intent to gather information on how the game industry employs empathetic elements, how

they are manifested in the market trends, and what games are considered empathetic to be later analyzed.

Such a method was also chosen due to the variety of knowledge fields that are required, like computer graphics, physics, cinematography, music theory, HCI, and many others; and we consulted sources both in academia and specialized in the game industry. Our search was conducted in May 2022, for academic bases we consulted the following: *ACM Digital Library*, *IEEE Electronic Library*, *Elsevier*, e *Google Scholar*. *Google Scholar* and *Elsevier* were chosen for their overall coverage of academic works from a wide range of sources and knowledge areas. While *IEEE* and *ACM* were chosen due to them being knowledge bases more specific to computer science and technology research. In them, we considered papers and books that presented methods, theories, discussions, and other related contributions that were focused on the development of empathetic games. We made our search in the aforementioned bases using the following keywords both in English and Portuguese: “**jogos empáticos**”, “**empathetic games**”, “**framework para jogos empáticos**”, e “**empathetic games framework**”.

For the knowledge bases that were specialized in the game's industry, also classified as gray literature, [Bonato, 2018] we considered:

- Websites dedicated to covering news related to the gaming industry and market (ex: Kotaku¹⁶, Polygon¹⁷, Destructoid¹⁸ etc.);
- Websites dedicated to cover technical aspects of interest to game designers and developers (ex: Game Developer¹⁹, International Game Developers Association²⁰, Gamedev.net²¹ etc.);
- Magazines, newspapers, journals, journals, and dedicated periodicals on the game's industry - (ex: Electronic Game Monthly²², Game Informer²³, PC Gamer²⁴ etc.);
- Independent *YouTube* channels that are dedicated to covering diverse aspects of the game's industry like their success cases, failures, experiments, and historical events that influenced the current state of the industry - (ex: Super Bunnyhop²⁵, Ahoy²⁶, Gaming Historian²⁷

¹⁶Kotaku - Available at: <https://kotaku.com/> - Last accessed in March 2022

¹⁷Polygon - Available at: <https://www.polygon.com/> - Last accessed in March 2022

¹⁸Destructoid - Available at: <https://www.destructoid.com/> - Last accessed in March 2022

¹⁹Game Developer - Available at: <https://www.gamedeveloper.com/> - Last accessed in March 2022

²⁰International Game Developers Association (IGDA) - Available at: <https://igda.org/> - Last accessed in March 2022

²¹Gamedev.net - Available at: <https://gamedev.net/> - Last accessed in March 2022

²²Electronic Game Monthly (EGM) - Available at: <https://egmnow.com/> - Last accessed in March 2022

²³Game Informer - Available at: <https://www.gameinformer.com/> - Last accessed in March 2022

²⁴PC Gamer - Available at: <https://www.pcgamer.com/uk/> - Last accessed in March 2022

²⁵Super Bunnyhop - Available at: <https://www.youtube.com/c/bunnyhopshow> - Last accessed in March 2022

²⁶Ahoy - Available at: <https://www.youtube.com/user/XboxAhoy> - Last accessed in March 2022

²⁷Gaming Historian - Available at: <https://www.youtube.com/c/>

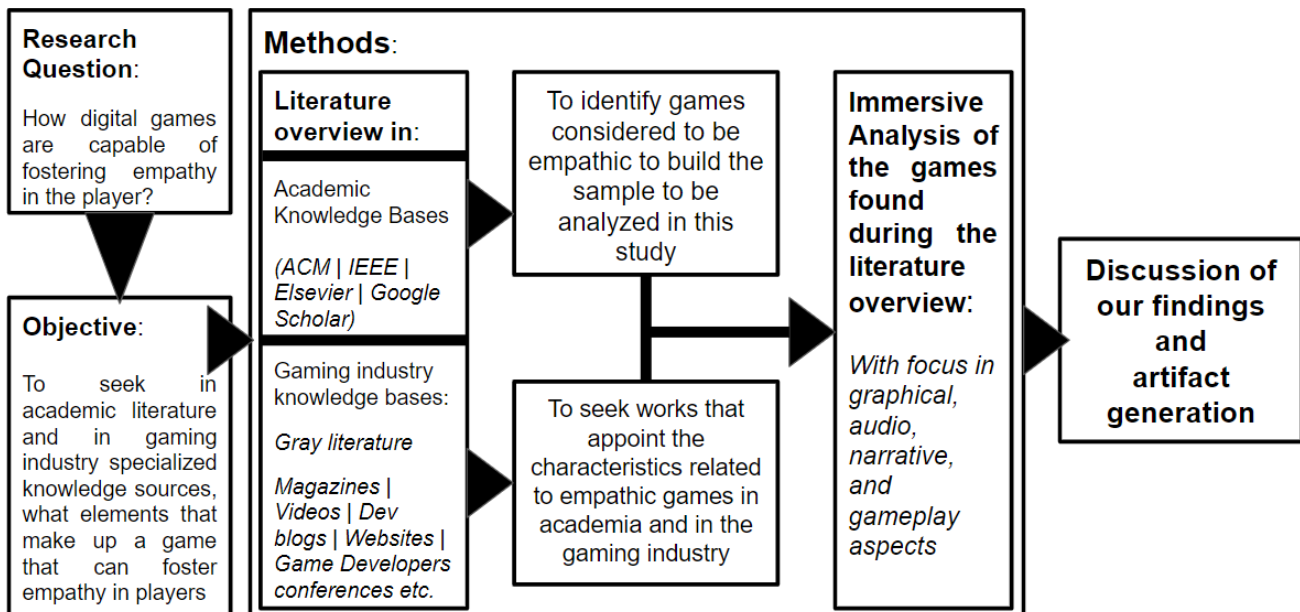


Figure 1. The present work's methodological course.

etc.);

- Independent *YouTube* channels that are dedicated to covering specific game elements such as their animation, narrative, music, and others that provoke empathy in the players - (ex: Daryl Talks Games²⁸, Game Maker's Toolkit²⁹, Game Developer's Conference³⁰ etc.)

Some video materials survived the passage of time, like Ralph Bear, creator of the first gaming console prototype, demonstrating his brown box in action [Baer, 2005]; or conference presentations and speeches by key industry figures detailing the lessons they learned during the game's development process [Walsh, 2021].

The industry-related knowledge bases were chosen due to the recent origin of the gaming industry and its impact on popular culture and thus demanded the investigation of its history, cultural, and technical aspects in non-academic sources. The results of this step helped to formulate this study's artifacts, to detect games that interest analysis later.

3.2 Analysis of the games that were found in the literature review

With the results of the overview, we found games and works of interest for the analysis and the artifacts. For the games, we analyzed via their content, by playing the games selected in the sample and taking notes of their characteristics following these authors guidelines: (1) psycho-structural structural characteristics common to video games (graphics, narratives, game mechanics, music etc.) [Wood *et al.*, 2004]; (2) effects that empathy has on players when engaging with anti and

prosocial video games anti [Happ *et al.*, 2015]; (3) characteristics that elevate the player's moral sensibilities for empathetic engagement [Katsarov *et al.*, 2019]; (4) empathetic media objectives: verisimilitude, emotion capture, and justifiable actions under emotion [McStay, 2018].

To help the selection of games for this study's sample, the following criteria were elaborated.

1. Must be published and have available digital or physical distribution;
2. The game's narrative element must be predominant or be as important as the others, mainly gameplay, graphics, and audio (*gameplay*);
3. The technical elements must be congruent and contribute to the narrative to generate player immersion and the fostering of the empathy element in them;
4. The game's influence must be noticeable to inspire future games, or it must be the central topic in deep discussions promoted by specialists and scholars in the industry via published papers, videos, presentations, and other kinds of promotions.

During the game's selection process, we sought to keep a balance between indies and A.A.A³¹ game titles, this was done to find similarities and differences between games made for the general public and specific niches.

The selected games, alongside attending the above defined criteria, they were selected as parts of the results of the literature overview. The first author is a games' collector, and due to limited financial resources, preference was also given to games that were already in his possession. Some games that attended the criteria were possible to be studied due to cost of purchase, needing extensive time investment (from

²⁸gaminghistorian/videos - Last accessed in March 2022

²⁹Daryl Talks Games - Available at: <https://www.youtube.com/c/DarylTalksGames/videos> - Last accessed in March 2022

³⁰Game Maker's Toolkit - Available at: <https://www.youtube.com/c/MarkBrownGMT/videos> - Last accessed in March 2022

³¹Game Developer's Conference (GDC) - Available at: <https://www.youtube.com/c/Gdconf> - Last accessed in March 2022

³²In the video game industry, A.A.A is a classification used, for both games and companies that have the largest budgets and their products have the highest amounts of polish³². A.A.A is not an acronym, but a way of classifying games (like in the American grade system, where "A" is a high grade), in some cases referring to them as an equivalent to a blockbuster film Keogh [2015]

30 to more than 60 hours of gameplay) to make a significant analysis, or they were unavailable to be legally obtained at the time of the study. In each selected game, the following analysis criteria were adopted:

1. The game's official synopsis, collected directly from the physical box or online webpages where the game is sold;
2. The predominant game genres (like action, adventure, platform, etc.);
3. A general overview of the game's main narrative and which are the main mechanics employed to foster the feeling of empathy in the player;
4. The narrative outcome, some games can have more than a single ending, depending on the player's interaction in the game's context. Often the game's ending can contextualize the actions the player took throughout the game, or is a materialization of the consequences due to the player's actions;
5. Other notable aspects that foster empathy in the player such as: minor mechanics, language and dialogs, interfaces employed, etc.

The results of this analysis were used to generate artifacts of empathetic game examples and also for additional guidelines; more specialized to specific elements of games. The author needed to play and explore the content of these games at least once, until the completion of the main mode, to document the main empathetic aspects

3.3 Framework's visual representation

The framework's graphical structure was created with inspiration in Kivunja [2018], Martins [2019], and Miranda [2021] works³. To understand the definitions and nuances regarding conceptual frameworks and their visual representations, the analogies used to explain the visuals, and the framework's readability. The CERCO framework proposal considered the works from Santos *et al.* [2020], De Melo Pinheiro *et al.* [2021], and Rodrigues *et al.* [2021], as well as our findings in the synthesis of game analyses.

This conceptual framework also made strides to include *Domain-Driven Design* (DDD) [Millett and Tune, 2015], an approach to software development that seeks to correspond technological solutions to a domain, knowledge field, activity, etc.

Succinctly, DDD is used to assimilate real-world problems into the Object-Oriented Programming paradigm. For example. considering a situation like a bank loan, the software processes will possess classes related to the domain relating to finances, like *Client* and *LoanApplication*, and with it, methods described as: *AcceptOffer*, *MensualBalance*, *Withdrawal* and many others. DDD is predicated on the following objectives:

Often the initial result of this DDD approach is a conceptual framework for both developers, designers, and stakeholders to be aware of the necessary elements for this application, their functions, and other relevant details for the solution under construction [Noguera and Duchien, 2008].

The main reason for the present study to opt for a conceptual framework was due to their capability to help researchers

organize their thoughts and understand the complexities, in detail, regarding their study topic [Bordage, 2009]. Considering the many knowledge areas involved in developing a game, it is needed "locate" where empathetic games are in the general games' domain, the elements responsible for generating this meeting on the player, and how they interact and operate to achieve this goal. Due to this and other aforementioned reasons, is what makes DDD principles appropriate to guide the framework's creation and the resulting artifacts.

To sketch the *framework* the online prototyping platform *Figma*³³ was used. Each graphic version of the *framework* received *feedback* from the advisor of this study for improvements and corrections to be made. After obtaining a more polished version, the current version with higher quality was generated, using *Illustrator*³⁴.

3.4 Artifact generation

To better explain the framework's operation and its elements, diverse artifacts were generated with basis on the literature review and the analyzed games.

3.4.1 Glossary

A glossary is an alphabetic list containing terms and their meanings that can be hard to understand or specific to a knowledge field [Dictionary, 2022]. The game industry, similar to many areas, does have many jargon and expressions that are particular to this field.

Terms that can confuse lay people, or they can not be immediately intuitive. Especially if they are keywords or acronyms that are similar to other knowledge areas, for example: HP is often an acronym in vehicle mechanics, often referring to the *Horsepower* of a motor - referring to how much power they can generate [Harington, 1967]. However, in games, HP is an acronym for *Health Points* - An abstraction that originates from Role Playing Games (RPG), that is used to measure how close a character is to being defeated. Often, when the value reaches 0, the player, object, or enemy is knocked out, destroyed, or defeated [Fonseca, 2008].

The glossary was separated into two main sections: *Specific terms to empathetic games*, and Terms that are general knowledge in the game industry. Each term was researched and referenced, for the one or several meanings the term may contain. And whenever possible, with images that better illustrate the definition. This artifact was generated using *Google Doc*, and it can be accessed via the following link³⁵

3.4.2 Synthesis of examples of empathetic games

In the interest of registering the findings of our analyzed games, we elaborated a synthesis containing the aforementioned game elements in **Sections 1 and 2** of this paper, with attention to our findings during the literature review. Our findings were documented in text form, containing details of

³³Figma — Available at: <https://www.figma.com/> — Accessed Mar. 2022

³⁴Illustrator — Available at: <https://www.adobe.com/products/illustrator.html> — Accessed in Mar. 2022

³⁵Glossary - <https://drive.google.com/file/d/1gD8vcPcxnQIxfuS9zG0z6Zb0wnFMZkak/view>

each game's content, how they foster and maintain the sense of empathy in the player, possible problems in this process during gameplay, and other aspects detailed in **Section 3.2** of this paper. This artifact was generated using *Google Doc*. The full synthesis results can be accessed via the following link³⁶.

3.4.3 Gaming Industry Background Focusing on Empathetic Elements

To document the advancements in the games' industry, on the use of empathetic elements, we opted to use the convention of *console generations*. The origins of this classification are still debated among historians and scholars. The first few uses were meant to define some sense regarding the chronology and evolution of the gaming industry via marketing materials from each period. Video game companies, whenever advertising their products to consumers, treated empathy as a form to represent the advancements in games with every new launch Murphy [2020].

The lack of a universal and definitive classification system is justified by the industry prioritizes the market situation and profits. Any other needs and definitions, formalities, questions, and issues are secondary, if not tertiary [Ruffino and Woodcock, 2021; Sotamaa and Svelch, 2021; Švelch, 2017; Wolf, 2008; Wright, 2021]. This makes the formalization of these categories something akin to a generalized grouping of the consoles and common trends of each era.

Most of these generations' accompanying advancements were realized in the Western market, mainly, in the USA, at least during the first few generations. Via this convention, it is possible to better detail the main highlights of each generation, with a focus on the elements that eventually originated and contributed to the establishment and consolidation of empathetic games. We also considered the main console and personal computers (PC) markets, this was because they often drive the main innovations that influence the other industry sectors, like the mobile gaming industry. The partial results of this artifact were published in the SBGames 2022 [Galvão et al., 2022]. The document resulting from this historical exploration was generated via *Google Doc*, and it can be accessed via the following link³⁷.

3.4.4 Additional aspects and guidelines

Each category of aspects has specific guidelines, with recommendations to developers and designers to understand the many ways their games can bring to light the empathetic feelings in the players, as well as make them aware of common traps and challenges during the design process, technical considerations, and among other findings related to our findings in the literature and the analyzed games.

These directives were generated with basis on the works of Santos et al. [2020] and De Melo Pinheiro et al. [2021] that analyzed players' emotional responses and elaborated;

and Rodrigues et al. [2021] that elaborated guidelines regarding empathetic games with basis in their genre, perspective, control type, etc. The present study took the aforementioned works as inspiration and presented an ordered guideline list with the following general elements that compose a game: Narrative, Graphics, Audio, and Gameplay. This document was generated with *Google Doc*. These guidelines can be accessed via the following link³⁸.

3.4.5 Videos

Due to the dynamic nature of games, it is necessary for a medium that is also equally dynamic and capable of capturing the explicit and subtle changes that can occur during gameplay and in its systems. This makes videos an adequate option to explain the empathetic effects in the player in action, via the animation, music, cinematography, game mechanics, controller schemes, and other elements. The games were scripted, narrated, produced, and edited, by the first author's own volition, with the assistance of the following tools:

- *Google Doc*³⁹ — For scripting and organization of the video's contents;
- *Audacity*⁴⁰ — For recording the narrations and the audio adjustments;
- *Open Broadcast Software (OBS)*⁴¹ — For screen capture and obtaining the game's scenes, audio, and visual sequences in question;
- *Premiere Pro*⁴² — For video editing, scene organization, and employment of primary audio and video effects;
- *After Effects*⁴³ — For polish and additional visual animations;
- *Photoshop*⁴⁴ — For creation and adjustment of secondary visual elements.

Each video aims to explain a topic, aspect, or collection of elements related to the empathetic gaming framework, and examples of what to avoid doing during the design process and other related topics. The video production process involved the following activities, in sequence:

1. **Scripting**
2. **Narration**
3. **Obtaining game footage**
4. **Image editing**
5. **Video editing**
6. **Supervisor's video review**

³⁸Additional guidelines - https://drive.google.com/file/d/1bzDWQtqoveCDU_3UJd_MG_yjc6miVoVu/view?usp=drivesdk

³⁹Google Doc — Available at: <https://workspace.google.com/intl/pt-BR/products/docs/> — Accessed in March 2022

⁴⁰Audacity — Available at: <https://www.audacityteam.org/download/> — Accessed in March 2022

⁴¹OBS — Available at: <https://obsproject.com/pt-br/download> — Accessed in March 2022

⁴²Premiere Pro — Available at: <https://www.adobe.com/au/products/premiere.html> — Accessed in March 2022

⁴³After Effects — Available at: <https://www.adobe.com/products/aftereffects.html> — Accessed in March 2022

⁴⁴Photoshop — Available at: <https://www.adobe.com/products/photoshop.html> — Accessed in March 2022

³⁶Synthesis of examples for empathetic games - <https://drive.google.com/file/d/1gD8vcPcxnQIxfuS9zG0z6Zb0wnFMZkak/view>

³⁷Gaming Industry Background Focusing on Empathetic Elements https://docs.google.com/document/d/1M_6P8d_gLRZ-95bQqJW0oCB7L8kzbg-da1VdwWmXUcY/edit?usp=drive_link

7. Publication, subtitling, and Sharing

It is important to highlight that the videos on the functioning of the conceptual framework and empathetic elements/examples are the first author's productions, being based on the findings of the methodologies used in this work. The style of videos sought a balance between being informative and engaging; taking inspiration from the works of Weidman [2017]; Brown [2015a]; Wozniak [2019] and other content creators. Such an artifact was created with the intent to share our findings of this study with the HCI community, the international games' community, and other individuals and communities that are interested in knowing more about this study's themes. The language used for narration was English, while subtitles were both in Portuguese and English. The first video made can be seen in the following link⁴⁵, as well as

4 Results and Discussion

Initially, the first few subsections will be dedicated to the literature overview findings and the games' analysis. After this, the framework and its operation are detailed, as well as the artifacts and a summary of their contents; and at the end of this section, the results and insights found during this process are further discussed.

4.1 Literature overview findings

The overview was carried out in May 2022 and, during its initial stages, it was dedicated to exploring the academic knowledge bases. In total, we had about 8618 papers during our overview, below are the following results with each respective keywords and knowledge bases.

- *Jogos empáticos*
 - **ACM Digital Library** — 4 studies found;
 - **IEEE Electronic Library** — No studies found;
 - **Elsevier** — 5 studies found;
 - **Google Scholar** — 13 studies found.
- *empathetic games*
 - **ACM Digital Library** — 4 studies found;
 - **IEEE Electronic Library** — 44 studies found;
 - **Elsevier** — 694 studies found;
 - **Google Scholar** — 28 studies found.
- *Framework para jogos empáticos*
 - **ACM Digital Library** — No studies found;
 - **IEEE Electronic Library** — No studies found;
 - **Elsevier** — 4.113 studies found;
 - **Google Scholar** — No studies found.
- *empathetic games framework*
 - **ACM Digital Library** — No studies found;
 - **IEEE Electronic Library** — 5 studies found;
 - **Elsevier** — 3.715 studies found;
 - **Google Scholar** — No studies found.

The works found at the *ACM* base presented an equal number of results, both in English and Portuguese. Of the found studies, attention was given to Santos *et al.* [2020], De Melo Pinheiro *et al.* [2021], and Rodrigues *et al.* [2021] - these, in particular, were from the “*Dados Além da Vida*” - DAVI⁴⁶. These works in particular were the key to forming the theoretical basis of the present study, beyond the aforementioned, there were no other papers that were aligned with the present study's objectives in this knowledge base.

In the *IEEE* repository, the found works were related to the importance of empathy in most contexts, some of these are: The role this feeling plays in robotic agents, in the experiences that involve augmented/virtual reality, chatbots, and serious games. However, the great majority of the found works only focused on the *importance of empathy*, not on *how* empathy is generated, specifically, in the context of games. There were no works found in this knowledge base that could be useful to the present study.

On *Elsevier's*, despite having the greatest number of results, there were not any relevant results for empathetic games. Term “game”, regardless of what language was used in our search, we had results that were related to the principles of game theory, math games, games to support medical patients' mental/physical health treatments, and other games applications in a diversity of knowledge fields. In contrast, for the term “empathy” we found works reading the importance of this feeling to the medical field, affective design, computing, HCI, etc.; but no works regarding the fostering of this feeling on the player via games.

Lastly, our findings in *Google Scholar*, the repository, allows access to other knowledge bases that were not initially considered. Even though we had a low number of results with tangentially interesting works for our study, however, the great majority of works were repeats that were found in *ACM's* repository. Some works that were better aligned with the present study's objectives were: Games that work with the themes of romantic love can be a potential gateway to empathetic games McDonald [2013]; the use of text mining to analyze the emotional profile of empathetic games users Martins and Araújo [2021]; and the design goals of empathetic games by Blot [2017] that were aforementioned in Section 2.1 of the present work.

In general, academic knowledge bases, despite the consulted repositories, except the aforesaid works of Santos *et al.* [2020], De Melo Pinheiro *et al.* [2021], Rodrigues *et al.* [2021] and Blot [2017]; we have not found works that directly discuss how to generate empathy in the player/user via an empathetic game. This demonstrates the relative newness of the present study's subject in the academic community and the need for in-depth discussions regarding its application and the means to design and produce them. We also reemphasize that works related to empathetic games *frameworks* were also not found.

⁴⁵empathetic Dive | Episode 1 - Empathy and narrative in early video games - <https://www.youtube.com/watch?v=2v-6gfbgP20>

⁴⁶(“Data beyond life”) - Available at: <https://lavi.ic.ufmt.br/davi/>

4.2 Regarding empathetic games in industry-specialized knowledge bases

In the specialized gaming industry, knowledge bases were used to identify the empathetic elements that have existed throughout its inception.

To categorize the gaming industry advancements in chronological order is relatively problematic, mainly, because diverse types of games and hardware for them have existed simultaneously and in different forms all around the world [Weidman, 2017; Brown, 2015b]. To better capture the gaming market priorities, we made use of the aforementioned console generations convention, as explained in Section 3.4.3.

In these bases, the found works described that throughout the gaming industry history, there always was a search to make games more exciting, to approach the players to the feelings and sensations of their avatar character(s) they control, consequently, making the games more empathetic with each generation. Such progression was gradual and always adjusted to deal with the technical limitations of each period. The following items bring a summary of the findings:

- **(1st Generation 1972–1984)** — Video games were seen mostly as a toy. Games at the time were primarily based on sports, pre-established board/tabletop game (like chess, yahtzee, domino, etc). Empathy was only mechanical between player and avatar via *joysticks* [Brown, 2015a; Wolf, 2008; Hansen, 2016];
- **(2nd Generation 1984–1990)** — Introduction of the narrative element in games, useful in allowing the player to understand the game's plot, mechanics, and avatar character motivations [Arsenault, 2017; Kent, 2010; Hansen, 2016; Ivory, 2015];
- **(3rd Generation 1987–2004)** — Evolution of the narrative elements in games with character dynamics, temporary manipulation/breaking of the game's systems to represent characters' individual traits or even for dramatic effects during in-game cutscenes, moments of 4th wall breaks⁴⁷, the use of diegetic audio design for the player to listen and understand the perspective of the avatar character they control, and the world live in [Stone, 2019; Hourigan, 2006; Elson et al., 2014; Kring-Schreifels, 2021];
- **(4th Generation 1993–2006)** — This period marks the start of the popularization of 3D games, the increase in computational capabilities of consoles and computers allowed games to mimic techniques that originated in cinema, such as camera movements and angles, voice acting, subtle acting (via the characters body language). In this period games started to tackle games that deal with themes that are deserving of social attention (the nuclear question, corporatism, environmentalism, etc.) in an interactive manner [Hansen, 2016; Burelli, 2016; Denham et al., 2021; Cussan, 2019; Brown, 2015a];
- **(5th Generation 1998–2013)** — 3D environments are enhanced, being possible to represent an open world in

which the player can explore as they please, the introduction of kinesthetic feedback for games (controllers now can rumble and have pressure sensitive triggers, allowing for some intensity of the game's actions to be felt by the player), lyrical soundtracks are more prominent, making the player to better assimilate the psychological state of the avatar characters they control [Hansen, 2016; Goodlander and Mansfield, 2013; Berger, 2017; Usher et al., 2013];

- **(6th, 7th, 8th, and 9th Generation 2013 — until present)** — Games are consolidating areas with practices and studies beyond entertainment. They are available in both digital and physical formats. The field, at present, has popularized independent developers, that work in specific and experimental niches, this is due to the greater accessibility of game development tools to the public. The market is also investing resources to further enhance sensorial and visual experiences via virtual reality. Games are also used as a form of protest, art, education, and other purposes beyond entertainment [Cussan, 2019; Crogan, 2018; Ferreira, 2014; Pallavicini et al., 2019; TechRules, 2020; Macák et al., 2020].

It was noted that big gaming companies, much like independent ones; both seek with great interest to instill in the player the sense of kinesthetic immersion to make them feel empowered, frustrated, relieved, and access a vast emotional spectrum; needed for an empathetic experience.

Regarding the found games, during the period between 1972 and 1990, we did not find games that aligned with the definitions of empathetic games. But in games from 1998 until the present, we identified about 124 commercially available that were adequate to our established criteria; Due to the time and budget limits that considered the purchase and analysis of the selected games for the conclusion of this study, the number of studied games were reduced to 8

4.3 Analysis results of the found games

The selected games are classified considering their diverse genres, game mechanics, themes, target audience, and many other characteristics. A summarized view of each game and their characteristics can be seen in table 3. The studied games are as follows:

- **A.A.A games** - *Silent Hill*⁴⁸; *Fire Emblem 3 Houses*⁴⁹; *Shadow of the Colossus*⁵⁰; *The Walking Dead: Season One*⁵¹;
- **Indie games** - *Hellblade: Senua's Sacrifice*⁵²; *To the Moon*⁵³; *Papers, Please!*; *VA-11 Hall-A*⁵⁴.

The studied sample had distinctions between them regarding their genres, age rating, narrative structures, character perspectives, and many different forms to foster empathy in

⁴⁷A theatrical convention that implies the existence of an imaginary wall between the actors in a scene and the public, this wall does not allow the characters to recognize that they are being watched by an external audience [Conway, 2010].

⁴⁸KONAMI, © 2001

⁴⁹INTELLIGENT SYSTEMS & KOEI TECMO, ©2019

⁵⁰SCE JAPAN STUDIO, © 2005

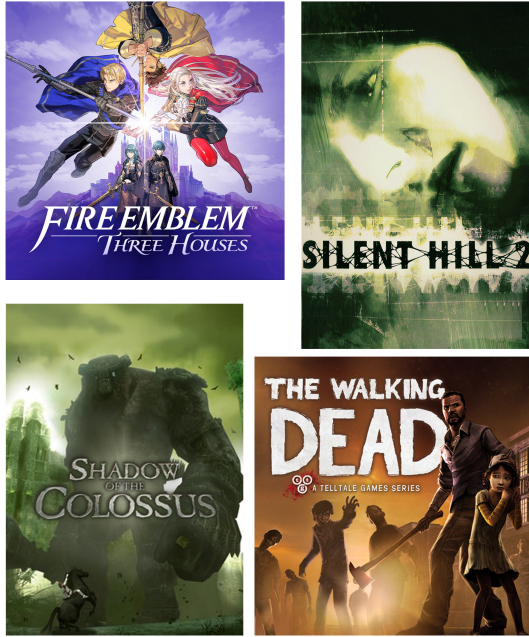
⁵¹TELLTALE GAMES, ©2012

⁵²NINJA THEORY, ©2017

⁵³FREEBIRD GAMES, ©2011

⁵⁴SUKEBAN GAMES, ©2016

A. A. A Games



Indie Games

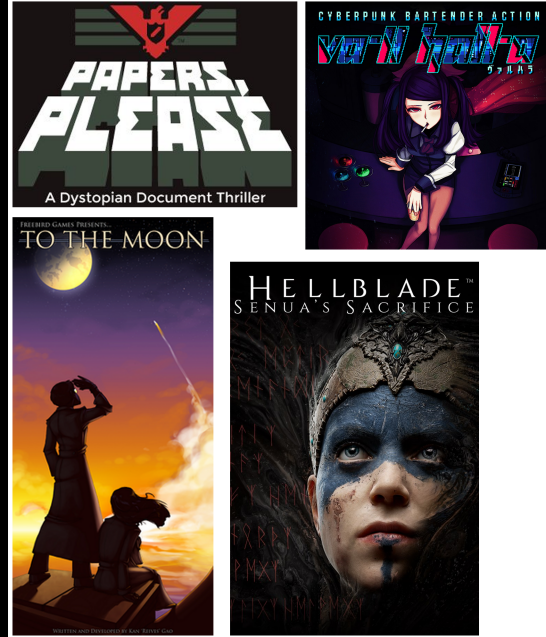


Figure 2. Cover art of the games that made up the sample.

the player. Besides these differences, there are some similarities; the games from the sample are, predominantly, single-player, non-cooperative, and combine similar progression elements (mainly, combat, exploration, and puzzle solving).

Facing this empirical investigation, the final sample list also highlights the narrative element as the reining one over the games' systems, graphics, audio, visual elements, etc. Some of these games also present narrative endings that reflect the actions the player took during the story; such as in *Silent Hill 2*, if the player acted more recklessly with a key character during the story, it is possible to have an ending that is more melancholic than optimistic.

The analyzed games also exhibited care in making the player feel like part of the game's world via *game feel*⁵⁵ to make the effort that their avatar characters are making, to be also palpable to the players via the movements they make on their game controllers, the graphics on screen, and the sound effects emitted. These elements are employed to contribute to the player's overall immersion and make them feel they are "present" in the game's world.

Based on our literature overview findings, the performed synthesis, and generated artifacts; it was possible to ascertain notable distinctions for the domain of empathetic games, mainly, concerning the *intentional* use of elements that make up the game to foster empathy in the players, and the *game's external aspects* relating to elements like folklore, psychol-

ogy, philosophy, and even the game creators' life experience. The following are our main findings regarding an empathetic game's graphical, audio, narrative, and mechanical elements. A summarization of each game and their elements can be seen in **Tables 3 and 4**.

4.3.1 Visual Elements

Every A.A.A game analyzed sought to have the most realistic graphics possible for their time (such as in *Silent Hill 2* and *Shadow of The Colossus*), or they sought a level of polishment in their visuals that evoke animated cartoons and medieval art (such as in *The Walking Dead: Season One* e *Fire Emblem 3 Houses*). This polish is also noticeable in the animations, backgrounds, and animated particles (like leaves, dust, sparks, etc.). Such movements and visual details have clear readability for intuitive gameplay and don't interfere with the understanding of game states.

Except for *Hellblade*, which used an advanced 3D graphical style like the games produced by A.A.A companies, *To the Moon*; *Papers, Please!*; and *VA-11 Hall-A* worked with 2D environments, making prominent use of *pixel art*. Every indie game prioritized color and effects that better reflect the emotional state of the characters they control. The portrayal of environments in indie games is somewhat limited, where the environments the players explore and the transition between them are done via menus, or simple movement through the backgrounds. Indie games also make use of limited animations and simple poses. The lack of visual fluidity is on purpose to evoke the nostalgia of older games, and it is something these games took advantage of the limitations of this model. The graphical styles and their differences can be

⁵⁵Refers to the connection synesthetic between game control actions, audio design, and animations that help moves have a convincing, usually satisfying, tactile sensation. e.g., : When pressing the accelerator button, the sound of the game car's engine increases, the view becomes more blurred to imitate the speed of movement, and when cornering it becomes more difficult to maintain the speed without overturning or crashing, etc. [Swink, 2008].

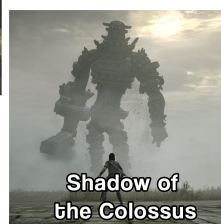
Table 3. Summarization of the game’s sample high concepts and their empathic elements (A.A.A games)

Name	Main Concept	Visual Elements	Audio Elements	Mechanical Elements	Narrative Elements
Silent Hill 2	A survival horror game where the players control James Sunderland, who is looking for his deceased wife after receiving a letter from her. To go to their special place in the abandoned town of Silent Hill.	High-end 3D graphics for the era (2001). Foggy, abandoned, gritty, otherworldly, and haunting. Sometimes, the game employs visual illusions to enhance the horror or mystery of the environments.	The sounds the player hears mostly are environmental or sound effects by the player and creatures. Sometimes during cutscenes or special places music is used to accompany the feelings intent by the visuals	Puzzle solving Combat Environment Exploration Resource Management	The game is an exploration of grief, loss, and guilt. As the narrative progresses, more details about his protagonist and the supporting cast’s past, are revealed. The player can get an idea of how people deal with trauma and an insight of how there is no easy answer to deal with it. Which can reflect in the many possible endings.
Fire Emblem: 3 Houses	A tactical RPG where the players control Byleth, a mercenary turned into a combat teacher at the Garreg Mach Monastery. The heirs of each nation are students in each of the titular 3 houses. The player makes alliances that can affect a war and shape the future of the continent, where all the connections between the player and the characters are tested	A mixture of Japanese animation with ancient medieval and Nordic art. With vibrant colors, and detailed line work. The compositions are vibrant, and stylized, both in cutscenes and in gameplay, for a wide variety of places, such as villages, mountains, churches etc.	The audio design combines both classical music pieces, with electronic music. And it is often employed to set the mood for the narrative as well as having multiple tracks for the combat scenes.	Tactical combat (resembling chess, with the characters). Resource Management (Disguised as giving classes to the students) Environment Exploration Creating bonds with the students Ensemble cast Permadeath (death is permanent)	The player, as a newly appointed professor, must choose to lead one of three noble houses. This choice determines the path of the story takes. The plot intertwines personal relationships, political intrigue, and epic conflicts as players guide their chosen house through a complex narrative involving ancient secrets, power struggles, and the looming threat of war. The game features multiple story routes and endings based on the player’s decisions, allowing for a rich and varied exploration of its themes and characters.
Shadow of the Colossus	An action adventure game, where the players control the Wanderer, Who travels to the forbidden lands, and makes a deal with the pagan entity Dormin, in order to bring his lover back to life. The players are tasked to defeat the 16 guardians called the colossus, and take on an arduous task, for the sake of a loved one.	High-end 3D graphics for the era (2005). Vast, naturalistic, otherworldly, and ancient. The game employs a great use of wide spaces for battles and exploration. Places in the forbidden lands have their own mysteries implying that once a civilization has inhabited this place long ago. Allowing for the player to be introspective and take the journey at their own pace.	The game for the most part is silent, only sound effects of the player, the animals, and their actions permeate most of the soundscape. Often when music is used is whenever the player is at Dormin’s Shrine, or when in combat against the colossus. Classical music is often used for these moments, sometimes music is used to subvert victory to tragedy.	Real time Puzzle solving (both finding and fighting the colossi are framed as puzzles) Combat Environment Exploration Resource Management Limited character Control	The games main themes are love and sacrifice, told in a minimalist manner. The Wander is attempting to bring his loved one back to life. For such task, he is willing to take a grueling task and break any laws by going to the forbidden lands of his tribe and making an unwilling Faustian deal with Dormin. This by relying on visuals and music to convey its themes, and keeping the dialogue to the minimum. The player can make their own theories and take on the scenery. As well as making a point with the ending about the the nature of sacrifice and costs of one’s pursuit of desires.
The Walking Dead: Season One	A narrative point and click game based on the famous comic franchise. The players take the role of Lee, a convict that, during the transport to another prison, gets into a car crash, and attacked by zombies. Wandering through a cul-de-sac, he meets and saves a little girl, Clementine. Together they escape the zombie infested neighborhood, and join a small group of survivors. All with their skills and issues, that must work together to survive. The player will often need to solve simple puzzles and make decisions that will affect the plot throughout the episodes.	Stylized comic book art in 3D, trying to emulate the look and feel of the comic series it’s based upon. Colors are often muted and contrasted with harsh shadows and lighting. Often cinematic angles are used to frame and communicate objects of interest to the player Environments are often small and scenario like. As to better encapsulate each episode’s narrative.	The game’s soundtrack is often permeated with banjos, guitars, pianos, and violins. As to capture the dire situations the story takes place, as well as the feeling of the American rural setting. Most of the sounds are used in an evocative manner to a TV show, where some music is recycled in case of an action scene, or when a shocking event is unfolding.	Light puzzle solving Dialogue based on the decisions the player takes during a set period of time Environment Exploration Quick Time Events (Cinematic cut scenes where the player gets to participate. Such as needing to press a button repeatedly to run and escape a hord of zombies)	The story focuses a lot on the relationship of Lee and Clementine. The player becomes a surrogate father figure, where each episode presents a moral dilemma; both for the survival of the supporting characters, as well as how this father-daughter relationship is perceived. Such as who to trust, who to feed, who to save etc. While most decisions have cosmetic differences and little consequences in future episodes, the game’s ending is particularly key to contextualize, all the choices that the player took thus far and how will Clementine remember Lee (and the player by proxy).

Table 4. Summarization of the game’s sample high concepts and their empathic elements (Indie games)

Name	Main Concept	Visual Elements	Audio Elements	Mechanical Elements	Narrative Elements
Hellblade: Senua’s Sacrifice	<p>An action-adventure game that explores themes of mental illness, mythology, and personal struggle. the game follows Senua, a Pict warrior who embarks on a harrowing journey to the Norse underworld, Helheim, to rescue the soul of her deceased lover, Dillion.</p> <p>The players get to know Senua’s mental condition, (schizophrenia). This condition is also a key part of the game mechanics, where the player will solve puzzles of the gods, combat trials, and face ghosts of Senua’s past that will both guide and hinder her quest.</p>	<p>High-end 3D graphics for the era (2017).</p> <p>Abstract, mythical, medieval, and gritty</p> <p>The game employs the use of both 3D graphics and real life actor to capture their motions, and sometimes they are presented as ghosts.</p> <p>Gameplay often tries to hide classical video game staples such as as health bars in order to make an “organic” story to be front and center.</p>	<p>The game’s soundtrack employs many folkloric and medieval instruments to capture the ancient and mystical Norse mythology journey the player is embarking.</p> <p>Most of the game is filled with environmental sounds such as footsteps, the wind, the sea, animals etc.</p> <p>Whenever music is used is to elevate a dramatic moment. One key highlight that Senua’s condition also is enhanced with the voices in her head that often give insight to what she is thinking.</p>	<p>Puzzle solving</p> <p>Combat</p> <p>Environment Exploration</p> <p>Resource Management</p> <p>Senua’s Voices (in her head)</p> <p>Fake mechanics to instill urgency in the player</p> <p>Lack of traditional game elements making the player infer via body language on the state of the characters</p>	<p>The narrative journey, while it takes a lot of inspiration in Nordic mythology the story presents a tale of love and grief. With an uncommon perspective via Senua’s mental state</p> <p>The introspective nature of the plot, where the main character’s turmoil and resilience are experienced via myths and the knowledge that these people had at that point in history. They also serve as metaphors for real life mental health issues, allowing the player to experience this perspective through the voices and hallucinations of Senua’s mind. As well as gain an understanding of her struggles and triumphs.</p>
To the Moon	<p>An adventure game that explores the themes of memories and regret. Dr. Rosalene and Dr. Watts are specialists in memory altering technology. They meet their client, Johnny, an old man who has about 48h to live, and his final request is to go to the moon.</p> <p>The player, in the role of the doctors, will delve into John’s memories, understand his client, and fulfil his wish, but at along the way dealing with issues over privacy, love, loss, and what proves that one’s existence if not for the memories.</p>	<p>Top down 2D visuals reminiscent of the 4^o generation RPG games.</p> <p>Animations are often simple and stiff, but colors, emotions, and body language, while subtle, are conveyed via the characters limited set of poses, their emoticons, and speech bubbles sometimes have text animated or in different sizes to both emulate tone and volume of their voices</p>	<p>Often used in a cinematic manner, with heavy use of piano, flute, and string instruments.</p> <p>The music is often more for enhancing the background scenes, and also to help to convey the emotions during gameplay, as the game does not have voice acting.</p> <p>The mood can go from somber, to silly, to dramatic, to joyfull in a beat with the soundtrack.</p>	<p>Light puzzle solving</p> <p>Environment Exploration</p> <p>Different perspectives,</p>	<p>The game is structured around the explorations of the Johnny’s memories.</p> <p>While exploring his life, questions over this job of rewriting a life, of people who were precious, of regrets and even the privacy are brought, both to the characters and to the player.</p> <p>The meaning behind these explorations contextualize the main question of the game: What is life? And this reflection of Johnny’s memories is also present to the player</p>
Paper’s Please	<p>A self-described “dystopian document thriller”, the game simulates the job of an immigration official in the fictional country of Arstotzka. (who is based on the old USRR).</p> <p>The player must process the paperwork of people who are coming to the country after years of closed borders. People come to Arstotzka for a variety of reasons, during gameplay, the player can understand the human drama of immigration and how the laws, geopolitics and corruption can affect everyone. Including the player and their in-game family, where they depend on the money the player makes to survive.</p>	<p>2D pixel art that depicts, simultaneously, both 1st and a top down perspective.</p> <p>Colors are often muted and somber, trying to capture the old real-life soviet aesthetics. Animations are often simple, stiff, and slide in and out of frame.</p> <p>The data and paperwork are full of detail, especially from the 1st person. Where the player must keep an eye and interrogate immigrants whenever their documents do not comply with the current protocol</p>	<p>The game does not have an extensive soundtrack. While the main theme is used in menus, and reflects the industrial brass and string based soundscape of its real life inspirations.</p> <p>For the most part, the sound effects the player hears are grunts, paper folds, stamps, and sometimes, due to certain events, gunshots and explosions.</p> <p>The sounds often are designed to make the player feel the seriousness of their role, and the country they are in.</p>	<p>Simulation of paperwork</p> <p>Interrogation</p> <p>Player’s implicit choices, player’s choices via their actions</p> <p>Resource management</p>	<p>The player does not have a role that is traditional in games. Usually, the player is put into a protagonist role, or one of great importance to the game’s world and plot.</p> <p>However, in Papers, Please!, the player is just another cog in the bureaucratic machine. The human drama of immigration is constant as people may bribe, beg, threat, and do whatever they can. Sometimes is to meet their loved ones, sometimes to work, sometimes to evade international authorities.</p> <p>Even if the player is not a hero, his decisions have Consequences in both a macro and microscale, depending on how the player has acted throughout the game, it is possible to achieve 1 out 23 endings.</p>
Va-11 Hall-A	<p>Self entitled as “cyberpunk bartender action”, it is a visual novel game where the player is takes the role of Jullianne Stingray, a bartender who is making ends meet on a small bar located at sector Va-11 Hall-A (nicknamed: Valhalla).</p> <p>Every day in game, the player can interact with the clients and serve them drinks. Each patron has their own personal life, and preferences, but by observing their answers it’s possible to serve drinks that can change their lives.</p> <p>Where the bar, becomes a moment of rest and therapy in the dystopic cyberpunk reality of the game.</p>	<p>2D pixel art that employs details to emulate classic PC games.</p> <p>The art if often infused with bright, saturated, neon colors, and very minimalistic animations for the characters emoting and talking. Environments are also bright but limited.</p> <p>The game aims to create a relaxing atmosphere and an overarching story where there are no heroes or villains, just people who are trying to get by.</p>	<p>The game employs an array of electronic music genres in order to better capture the futuristic setting of the world. The player is free to set the music at the bar’s jukebox.</p> <p>While the game does not feature voice acting, there are some electronic notes used to illustrate the voices of the characters. Sound effects of glass clinking, ice breaking, drink shaking are also used for immersion. As well as electronic beeps for the menus.</p>	<p>Bartending simulation</p> <p>Decisions via player actions</p> <p>Resource management</p>	<p>This game is neither about victory or defeat, but creating a space to relax and talk about life.</p> <p>While each side character’s story is unique, so is the avatar’s character. Who is also, being questioned about how they are surviving each day in the cyberpunk dystopia, where dreams are made but everyone feels lonely, disconnected, are all struggling with family, rent, or where they belong. Topics that also invite reflection on the player</p>

A. A. A Games



Indie Games



Figure 3. Examples of the graphical differences in the sampled games.

seen in Figure 2 and Figure 3.

4.3.2 Audio Elements

Each game also presented distinct soundtracks and their usage. In *Silent Hill 2*, the game has a cinematic soundtrack, used for cutscenes, and the characters are fully dubbed. The game uses these aspects in its soundscape to instigate curiosity, fear, and doubt in the player, while most of the game is played in silence with occasional environmental sounds (like wind, water bodies, flickering lights, etc), whenever there is a sound effect (like glass shattering, distant footsteps, TV static, and other types of sounds) are designed to catch the player's attention and even to get them by surprise.

In *Shadow of the Colossus*, and *Hellblade*, the musical element shows up for cinematic moments and combat situations, with instrumentation that mixes classical music and folkloric instruments. The most common sound the player will find are environmental sounds of the environments they are in (like birds chirping, horse gallops, the wind hitting the leaves, etc.). *Hellblade* in particular, has the voices in Senua's head as an element, that whisper and move in different directions and distances, giving the impression they are talking to the player from the front, behind, left, or right directions; as well as moving between positions while they speak.

Fire Emblem 3 Houses, *The Walking Dead*, of all analyzed games in this category, they use music most traditionally. As in, the songs and sound effects are employed to create an emotional atmosphere for the events the player witnesses and finds themselves in; sometimes, it can be calm and routine; depending on the narrative moment the player is in, it can

be even melancholic. In battles or tense moments, it can be grandiose, upbeat, or depending on the nature of the conflict; for example, friends must fight for their ideals to survive, the soundtrack becomes tense and tragic. The key moment is voice acting, which further enhances the emotional impact on the player.

To The Moon, and *Papers, Please!* also use their sound elements traditionally, where each level presents a different music to accompany and enhance the atmosphere of the moments the player participates and witnesses. In these games, there is a lack of voice acting, and in its place, there are repetitive sound effects that represent the voices of the characters on screen. *VA-11 Hall-A* also does something similar, however, the soundtrack is used in two moments: in the protagonist's residence, where the player can rest before going to work; and at work, in the bar where the player can customize the jukebox and place the background songs they want in any order they like during the work day; simulating an aspect of bar culture. In certain key moments, the music is turned off in favor of songs that are more adequate to the gravity of the situations they may find themselves in, like someone injured asking for help.

4.3.3 Mechanical Elements

In this aspect, the games presented necessary diversions, due to the diverse genres they cover. *Silent Hill 2* is a horror game, the player must explore the abandoned town populated with aggressive and abstract monsters; obtain information via documents, notes, and memos; obtain key items to solve puzzles, and simultaneously ration important resources for their survival (such as ammo, health items, weapons, etc.).

Shadow of The Colossus, aims to make the player always feel small during their journey through the forbidden lands. He is free to explore the ruins and landscapes on horse or by foot, and the player is equipped with a bow, arrows, and a sword; to traverse and overcome obstacles, as well as to hunt and defeat the gigantic colossi. Most of the exploration is done by the player, while they have a goal and a dedicated button to show them the way to the next colossus; they can explore the lands at their own pace, solve environmental/exploration puzzles, and find secrets hidden in the game's world.

In *Fire Emblem 3 Houses*, the player acts as a teacher of a medieval military academy, in which the game is divided into 2 halves. The first one is that at the start of each in-game month; the player is free to plan their lessons, help their students, and participate in campus activities (training, sharing meals, choir, etc.). This first half is dedicated to fostering the relationship with the player and the students, to know them better, and to form bonds with them and other secondary characters. The other half is the final mission of each month, where the player directs their students, similarly to chess pieces on the battlefield; taking care in what battles they might face, the player needs to be careful if any of their students are defeated they will die and the game's story will proceed without them.

For *The Walking Dead*, the player must make decisions throughout the story, as if they are in a "choose your adventure book". Some decisions are made under pressure, others there are no time limits. The decisions the player makes can affect further developments in the narrative. There is some light puzzle solving that can affect how secondary characters may behave towards the player, or even if they survive the scenarios they may find themselves in.

Distinguishing a bit from the other games in the sample, *Hellblade* is an action exploration game, where the player must explore Vikings ruins, solve navigational, visual/auditory perception puzzles, and combat trials. While there is a more traditional gaming element in the combat scenes (where they proceed after all or a key enemy is defeated), in important fights they may have cinematographic moments and even puzzles the player must deal with on the fly. The game also has the "voices in the head" mechanic, due to the protagonist's mental condition, Senua, who suffers from schizophrenia. The voices and their lines are designed to question, dialogue, comment, and provoke both Senua and the player. Sometimes they are helpful, others not as much, or sometimes they give voice to the fears and doubts inside Senua's mind. The game also asks the player to act in the scenarios as if "their own life depended on them", in case Senua is defeated enough times, a black mark on her arm will grow and make her way into her head, incapacitating her, permanently; leading to the player's save file to be lost alongside with the progress they made.

To the Moon, is a 2D game that stylistically emulates a classic video game RPG, however, the player does not face any enemies in-game. The player is in control of the doctors Rosalene and Watts. And with them, the player travels to the memories of a patient that has, at best, 48 hours to live. In each level, the player is reliving the patient's memories, trying to get to the oldest one. During this process, they relive

her/his memories, and each memory is treated as a life period, where the doctors are making their way from the patient's old age until their youth. Throughout each memory, they must find key items that are associated with the patient's most important memories, and by finding them all they can solve a simple panel puzzle to get to the next memory (in-game this process is called "memory defragmentation"). During the exploration of each memory, more aspects of the patient and the narrative are revealed in dialogues and cutscenes.

Papers, please!, in its turn, tries to create an immersive simulation. The player acts as an *Arstotzkan* immigration officer; in a fictional country, similar to the old Soviet Union. On each in-game workday, the player must process paperwork of every immigrant. Initially, the process is very simple, just a simple comparison between the immigrant's documents and the government's guidebook, in case of any discrepancies the player may question the immigrant and with a stamp either accept or reject their entry. The interactions with immigrants are also relatively simple, or complex, some have/lack obligatory documents that they will simply accept the player's decision, while others will bribe with money or favors for later; some will beg for their family members to pass, or even you will need to obey contradictory orders from your superiors (one case in particular, has you accepting a married general's lover without any documents).

The player must process the paperwork as fast as they can, and as efficiently as they can. since their salary at the end of the day depends on how many right calls they have made. This salary is what will pay the player's family food, and rent, and attend to their needs such as medicine, gifts, and repairs on where they live, etc. During the whole time, the player is under pressure to give in to the bribes, the harsh orders, or the protocols that change arbitrarily during each in-game day; and depending on the player's performance, the in-game family's survival as well.

Finally, in *VA-11 Hall-A*, the player acts as a *bartender*; and for each client, the player can either attend each request to the letter, without deviating from the main story, or by noticing certain hints in their dialogue they can offer better or stronger drinks, by knowing more about them and their lives, they can even serve the right drink that may change their lives for the better and even help deal with the problems they got. leading to new narrative routes and alternative endings that reflect the actions taken by the player during the game.

4.3.4 Narrative Elements

As aforementioned in the present work, the narrative element was seen as the most important for the player's empathetic experience. Below, the narratives and themes of each analyzed game are going to be described, and how they immerse the player with their mechanics and themes.

In *Silent Hill 2* the premise is that the protagonist, James, gets a letter from his deceased wife, Mary. She says that she is alive and waiting for him in their special place, located in the town of *Silent Hill*. Considering this absurd scenario, the player also meets with other characters that are drawn to the city with similar sensitive motives. In the town's surreal environment, the player stumbles upon Maria, a woman who could be Maria's twin.

During the adventure, Mary dies in front of James several times, and mysteriously comes back to life; and both James (and the player by proxy) can't do anything about this. At the end of the narrative, despite the love they had, James is unhappy with their marriage, and the last 3 years of Mary's disease slowly killing her were the ones he felt impotent, frustrated, and stuck in misery. In one of the game's final cutscenes, it is revealed that Mary did not die due to her sickness, but James killed her as an act of mercy, knowing that she had no chance to recover. The game makes use of symbolic elements to allude to James' guilt and frustration via the environments, the puzzles, the enemies, and the key items in the journey. All of them pointing that he desires some form of punishment for the sin he committed. Depending on how the player acts in the game, some endings can represent his redemption, or his downfall.

In *Shadow of The Colossus*, the player's avatar (AKA "Vagrant"), wishes to bring this loved one back to life, and to accomplish such feat he goes to the *forbidden lands* where the god Dormin resides. In a Faustian deal, Dormin demands that the Vagrant defeat the 16 colossi, giants that guard the land and each holds a part of Dormin's power.

This is the condition imposed to revive the Vagrant's loved one. Despite the plot evoking a classical and emotional story, the player is not the hero. The giants are portrayed as animals and are peaceful until the player starts to attack them. After each giant is defeated, the music, initially triumphant, in the face of the player's victory, is soon subverted into the giant's tragedy. In the end, the Vagrant, after several sacrifices, is successful in bringing his loved one back to life, however, Dormin takes the Vagrant's life and is reborn as a child, during this process, implying that great changes will occur in the world, leaving open to interpretation if these will be positive or not.

In *Fire Emblem 3 Houses*, the player can choose up to 4 narrative paths, each aligned with a key character: *Edelgard* — who desires revolution through a war to break the castes imposed by the game's world religion; *Dimitri* — who seeks vengeance against his family's killers; *Claude* — who wants a world that is more inclusive with different creeds, nations, and points of view; and *Rhea* - who wishes to keep the peace and the game's world *status quo*.

Naturally, depending on whoever the player may pick to side with, in the game's first half, the player can meet the other characters in the academy, go on adventures with them, form friendships, and get to know them better during the academy arc. In the second half, due to the war, Edelgard declares, the player is forced to fight (and sometimes eliminate) the friends that they made; a complex and appropriate with the game's themes of friendship and conflict; each route also has its distinct ending, and possibilities to even reconciliation with former allies.

In *The Walking Dead* the player assumes the role of Lee, a convict, that during the process of transferring to another prison the police car crashes. Lee, after waking up from the accident, is attacked by a zombie. After defending himself using the deceased cop's gun, he notices that the living dead are wandering the streets. Upon exploring the suburban neighborhood, he manages to rescue Clementine, an 8-year-old girl who was left behind.

Throughout the game, the player manages to unite with a group of survivors and has to deal with issues like: food rationing, which member of the group should be trusted with what task, who to attend to in tense situations, etc. The player, in each moment, has 4 possible answers to each situation (in most cases); 3 are dialogues (one agreeing, one disagreeing, and another response somewhat neutral) and the final option is to keep quiet. The secondary characters will react, respond, and evolve the game's plot depending on how the player acts and reacts. The game, independent of the player takes, will always have the same ending: Lee slowly dies after being bitten by a zombie, and he manages to rescue Clementine one last time. Each decision made up to this point will affect how the player is remembered by the other characters, and it will influence key aspects in the franchise's sequel games.

With the Viking folklore as a background; *Hellblade* tells the journey of Senua to the realm of the dead, *Helheim*, where she plans to bargain and gain favor with the god of the dead, *Hel*, and bring back the soul of her beloved. For such a task, *Hel* demands that she defeats the flames giant *Surtr* and the god of illusions, *Valravn*. During the narrative, there are flashbacks and ghostly apparitions of important people in Senua's life; the levels are also based on Senua's life experiences. Every combat and every puzzle are plot-relevant, being examples of her fears and insecurities, with both the player and her conquering them. The player can understand her trauma being filtered by *Viking* folklore analogs.

To the Moon, in its turn, puts the player in the roles of Drs. Watts and Rosalene, who work for a company specialize in granting the last wish of patients with life-threatening diseases. John, an elderly man with only his last 48 hours remaining, has a wish: *To go to the moon*. The doctors are specialists in rewriting the memories of these patients and creating a version of their lives, inside their minds, that they believe is their reality in their last moments.

For such wishes, the doctors navigate through the patient's memories, and at every moment while they get to understand their patient's wishes; they also are constantly questioning where they can explore the privacy and life of their clients, and even what memories should they rewrite and erase (erasing the memories of people who are dear to them, for example). Such questions are also presented, directly, to the player, while they journey through John's life and memories until his wish is granted. The game also questions what would the players do if they were in the roles of the doctors and their decisions.

Some of the *Papers, Please!* narrative, has already been aforementioned in the mechanics subsection. The player acts as an immigration officer in *Arstotzka*, and they should process the paperwork of every immigrant to guarantee the money needed to support their in-game family. Besides the mechanics, in case some particular immigrants get into the country, they can affect the following day's news. The player can let an international criminal flee to *Arstotzka* for a quick bountiful bribe, or can let a family with irregular documents reunite after so many years while risking getting a pay cut. The game keeps reinforcing the "butterfly effect" of their choices, which for as simple as they seem can have significant ramifications in the game's progression and the game's world. The player also can align themselves with a covert

revolutionary group that issues secret extra missions, targeting specific immigrants; that can change the fate of the entire country. Depending on how the player acts, he can get 1 out of 23 narrative endings, in which he can have success in this career, be locked up/executed, help revolutionaries to topple the government, or even flee from *Arstotzka* with the entire in-game family (or alone).

Last but not least, *VA-11 Hall-A* puts the player in the role of Julianne Stingray, a bartender; who has abandoned her academic career after a traumatic experience, and since she needed a job as quickly as possible this was the path she landed on. The game makes Julianne's work akin to a therapy session for her clients. The player can serve the requested drinks by each client as usual, but from time to time, certain clients can imply that they are not always asking what they want directly, by understanding these hints, it is possible to serve different drinks that are more aligned to their feelings, and this can also lead to their clients telling more information about them and also different endings to their stories. The player also understands how Julianne deals with her past, and adult life, that even in this *cyberpunk* (alá *Blade Runner*), there are still many daily problems like: paying rent and living on a tight budget, form real friendships in a world permeated by technology and addictions, etc.

4.4 Reflections regarding our findings

Upon observing the analyzed games, it was detected that the narrative element is the basis for the development of the game mechanics, adopted visual style, employed soundtrack, and many other characteristics. The narrative helps to justify the game mechanics used and the role of the player in the game's world, helping them to "get into the character". It was noticed that the important aspects of empathetic games that emerged from the literature review, specifically from Blot [2017], were: *Intent* and *External Aspects*.

Intent is the fact that empathetic games, deliberately, use every single one of their elements to conduct the player into being more receptive/understanding to the perspectives of the characters they control. For example, games like *Silent Hill 2* and *Hellblade* employ audiovisual illusion, subtly, to make the player understand the immoral perspective of the avatar characters they control, both in visuals and their psychological state. In cases that a more introspective approach is not possible nor efficient, *VA-11 Hall-A* and *Papers, Please!* seek to revisit the world, the circumstances of their protagonists' careers, and the world they inhabit are also another way to gain this perspective. There is also a care with what sound effects are used and game feels, from the dialogues and words used, and even the small interactions with the world.

The time and quality of these character's relationships with the player, and the narrative beats that involve the player (or not), affect the empathetic experience similarly to the narratives in movies or TV series. The difference here is that in games, the player is closer to these characters than in other media; being possible to help them or harm them, all this is dependent upon the interpretation and individual feelings of each player. Such interaction and the resources employed in its craft are intentional by the game creators.

Regarding the question of External Aspects, it was noticeable that every game of the studied sample, involved themes and situations that took inspiration from concepts that originate from folklore, psychology, philosophy, history, science-fiction, and even in some cases the game creator's own life experiences. The scenarios and challenges faced by the player are filtered by the present cultural analogies in other knowledge fields, and even in the lives and memories of the game creators.

The game creators researched deeply about cultures and countries around the world, and consulted experts regarding how mental disorders can occur; or even their own experiences with such disorders; using fiction and game systems to filter questions and experiences, thus generating metaphors, archetypes, the environments, and context where the game takes place. This allows the player to have an "experience out of their bodies" while playing.

The player may not have first-hand knowledge of, for example, how it is to be clinically depressed. However, the quality of interactions the game offers can transform the mechanics into metaphors that are, capable of encapsulating the reality of people who live in this situation daily. This allows the experience in the game to be remembered in contexts outside the game.

Another aspect of note in the analyzed sample, is the games made by A.A.A companies, despite the high level of polish and production values, the games tend to have mechanics and plots that are broadly appealing to the public. However, this approach can make the discussion and narratives of sensitive topics, sometimes, feel somewhat "hollow". Like in *The Walking Dead*, in which many of the decisions the player makes look visually distinct but, their plot relevance, and their consequences, are usually the same both visually and for narrative.

Independent games, in contrast, do not have the same budget nor technical capabilities as A.A.A companies, they distinguish themselves by tackling sensitive topics more deeply. These games also use mechanics that are, often, not standard to the media; they sacrifice some appeal to the public to find a niche, angle, or put forward questions that are seldom explored in popular culture.

4.5 CERCO Framework

Upon uniting the findings of the literature review and other results, it was possible to elaborate the *empathetic CERCO Framework*. **Figure 4** illustrates the **CERCO**.

In the base of the illustration (see **Figure 4**), the game's conceptual stage is found, that is, the beginning of the game's creation. In this stage, the game's ideas and concepts are not defined. The artifacts available are meant to help game creators, both experts and amateurs, better understand the nature of empathetic games and trace the objectives in the production they intend to develop. At the level above the base, we have the functional and non-functional requirements for software development.

For empathetic games, it's the step in which designers and developers evaluate the tools and resources needed to achieve their objectives, both in the technical and subjective

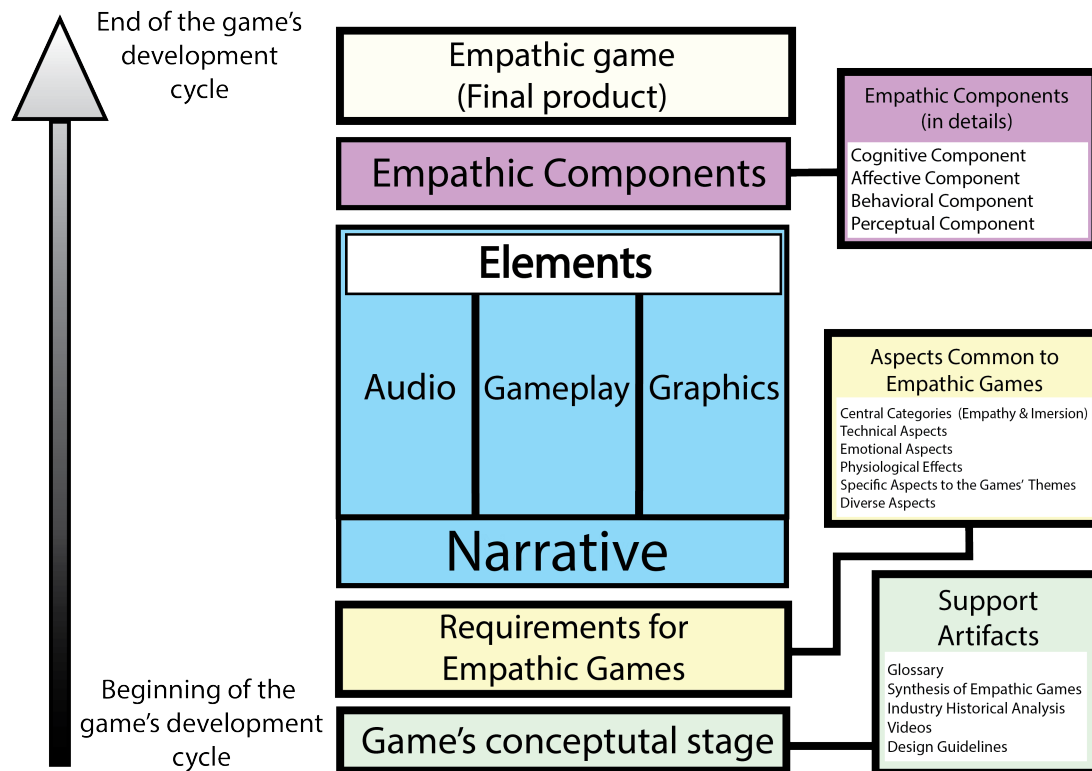


Figure 4. Empathetic CERCO Framework's visual representation — Source: Galvão [2022].

quality sense. Both these qualities work together to make the players behave and interact as intended by the game's creators. To support this step in particular, the **CERCO** framework details the technical, functional, and others with basis in the literature overview findings, the artifacts and supplemental material were written and designed to allow every professional involved in the game's creation "to be on the same page"; so that they can understand how empathy can be fostered in the player without harming the necessary creative process from the start to the end of the game's production.

In the center of the **Figure 4**, there is the audio, graphical, gameplay, and narrative elements. Such elements vary from production to production, and there is no solution nor uniform style that an empathetic game should adopt. In the present study, it was possible to observe that the narrative element is what has the most influence in generating empathy in the players. Such an element must be the base that contextualizes and guides the other game elements to help foster the feeling of empathy in the player with the backgrounds and characters that are presented in the game. Guidelines were generated to help game creators how to use each element.

CERCO itself does not contain a step-by-step guide, since it does not have an intermediate product during each of its phases, nor it is intended to have such products that contribute to the next step. The nature of empathy is subjective, it cannot be guaranteed that at the end of the game's development cycle the final product will be successful.

Alongside this, game development can also be fluid, both adopting and rejecting software engineering conventions. What technical tools and how they'll be applied are up to the parties involved. CERCO is made to be flexible and its artifacts helpful to achieve the goal of creating an empathetic game, and so it can be applied with a variety of different

frameworks and development cycles or techniques. It can be consumed in its entirety or partially, depending on the needs of the project, and it can also support projects of many different sizes and scopes.

The game elements are the base for empathetic components (**Cognition, Affectivity, Behavioral and Perceptual**), highlighted in the Rodrigues *et al.* [2021] study. To support the explanation of the *framework* in the following subsection, the generated artifacts are detailed.

4.6 Generated artifacts

Below, the generated artifacts are described with a brief presentation and description of their contents.

4.6.1 Glossary

With the systematic review findings, we cataloged 212 terms of interest for this artifact; 30 of them being dedicated to use in empathetic games and 182 terms for general use in games. 95 pages were generated, containing terms found in both academic and those dedicated to the game industry. Some examples of terms contained in the glossary are:

- **HUD** — Acronym for *Heads-Up Display*, it refers to the user interface elements, such as life points, inventory, radar, mini-map, etc. [Caroux and Isbister, 2016];
- **RNG** — Acronym for *Random Number Generator*. Used, mainly, to determine "luck" in games, such as the chances of an action succeeding or failing, or the player to obtain special items after defeating an enemy, and other factors that are meant to seem random [Warnock, 1987];

- **Physiological Effects** — In the context of empathetic games they refer to the capacity of an empathetic game to provoke sensations like “tears”, “shivers”, “dizziness” and other bodily sensations on the player Santos *et al.* [2020].

The terms were organized in alphabetical order and two distinct categories: specific terms for the gaming industry, and specific terms for empathetic games. For both categories the terms are explained, their references cited, and when possible images were used to illustrate the terms presented.

4.6.2 Synthesis of examples for empathetic games

With the results of the analysis of empathetic games, it was generated 92 pages detailing how the games of the studied sample use and combine the narrative, graphics, audio, and gameplay elements; fostering the player’s empathetic experience. The games analyzed took the following format [Theory, 2017]:

- **Hellblade: Senua’s Sacrifice**
- **Available platforms:** Consoles e PCs;
- **Type of narrative:** Linear;
- **Predominant Genres:** *Hack n’ Slash*, Psychological Horror, and Third-Person Exploration;
- **Time interval:** In real-time;
- **Player modes:** Single-player;
- **Age Rating:** M (Mature);
- **Collaboration:** Non-collaborative;
- **Types of characters:** licensed, fictitious, and mythological;
- **Point of view:** Third person;
- **Character control:** Avatar: a single character controlled by the player;
- **Archetypes:** Hero, Divine, Historical;
- **Characters verbal development:** dialog;
- **Ending:** Narrative, where Senua recognizes her delirium and understands that she needs to learn to deal with her grief to move on with her life;
- **Challenges and goals of the game:** Exploration of environments, puzzle solving, character interactions, and fights against enemies and bosses;
- **Color pallet:** Vibrant and dark;
- **Audio:** Booming and vibrant sounds to add tension in combat scenes; environmental sounds according to the environment Senua is exploring, with some calm soundtracks during puzzle-solving segments;
- **Immersion type:** 3D.

In sequence, to contextualize, every game had its official synopsis brought to the artifact [Theory, 2017]: “*From the makers of Heavenly Sword, Enslaved: Odyssey to the West, and DmC: Devil May Cry, comes a warrior’s brutal journey into myth and madness. Set in the Viking age, a broken Celtic warrior embarks on a haunting vision quest into Viking Hell to fight for the soul of her dead lover.*”

In sequence, each game had a brief explanation of its mechanics that help with the empathetic engagement. Each significant mechanic received a brief title and an explanation. In the case of *Hellblade: Senua’s Sacrifice* the following mechanics were detected:

- **Trials and Tribulations** — Senua’s trip is composed of a series of trials and tribulations put forth by the Viking gods, that both submit the player and the avatar character with physical trials through combat, psychological trials that need both survival instinct and wits to understand the signs and visions sent by the gods. Both Senua and the player experience the events of the story externally, exploring the world around them; and internally, the player must pay attention to the thoughts and voices inside Senua’s mind;
- **Uncommon perspectives** — Alongside the mystical element, the game is explicit to the player about Senua’s schizophrenia. During the game creation process, doctors and mental health specialists aided the creators to better highlight Senua’s condition as convincingly as possible in the pre-technological era the game depicts. Capturing the feelings, mentality, as well as societal misunderstanding of this condition during this period. The many voices in Senua’s mind will, simultaneously, critique, cheer, aid, question, and comment; in lines that are directed to both the player and Senua; permeating and giving life to the protagonist’s fears and anxieties, making them palpable to the player;
- **“Organic” user interface** — The game does not contain characteristics like bars, gauges, number values, and other numerical HUD elements that are common in video games. Via the voices, the player is also able to learn how to move and use Senua’s skills. Enemies, during combat, will manifest if they are close to being defeated via their body language, how quickly they move, and the amount and depth of their wounds across their body. Such elements force the player to see the game’s world, both under the real and supernatural paradigms, as they are Senua’s reality. Engaging the players in a similar mindset to the protagonist, making them act and make decisions in a fashion similar to how Senua would act in these situations.

The analysis ends with the narrative’s ending(s) and other key aspects that the game employs to generate empathy in the player. Whenever possible, the mechanical aspects were illustrated with images captured in-game and edited whenever necessary by the first author to highlight certain image elements, or event the progression of game elements using image sequences.

4.6.3 Historical exploration of games with a focus on empathy-promoting elements

To detail our findings in the literature review related to the game’s industry history using empathetic elements, a document with 60 pages was elaborated with sections separated based upon the console generations, as aforementioned in Subsection 4.2. Its creation counted with 225 reference works, combining traditional academic productions (books, academic papers, journals, etc.), and productions specialized in documenting video game culture and development (videos, developer blogs, video games themselves, among others),

Alongside the information regarding each generation, there are discussions over influent historical moments that

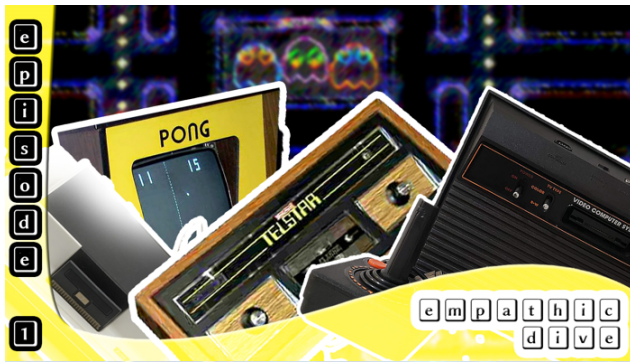


Figure 5. Thumbnail illustrating the first episode of the empathic Dive web series.

led to the creation of empathetic game elements, such as: the pre-history of the game industry, the video game crisis of 1983, the rise of gaming culture and PC exclusive games, the maturing of topics and gaming narrative techniques, and other relevant topics. A summarized version of the contents of this artifact is found in *Subsection 4.2*. The results of this analysis were also published in an academic paper named: “*Máquinas de empatia — Uma visão geral histórica da indústria sobre elementos característicos dos jogos empáticos*” that was published in the culture track of the SBGames 2022 [Galvão et al., 2022].

4.6.4 Additional aspects and guidelines

With basis in our literature overview findings, and the analyzed games; the generated guidelines were categorized according to their application, they being the aforementioned narrative, graphical, audio, and mechanical elements; Which are common to games.

These guidelines were designed to guide the game creators on how to use the aforementioned elements to generate an empathetic game. A total of 25 guidelines were generated with the methodological procedures used in this study.

Bellow, the guidelines are presented by their category and discussed on their general purpose and how they support in the creation of an empathetic game. For **narrative elements (NE)**, the following 10 guidelines were elaborated:

- **NE01** - The perspective of the avatar character must be preserved;
- **NE02** - Take care with literary mechanisms such as: Dramatic Irony, Exposition, *Deus ex machina* and others;
- **NE03** - Carefully research about the psychological, cultural, social, and others the game wishes to depict;
- **NE04** - Don't skip the journey;
- **NE05** - Actions must have consequences - real ones;
- **NE06** - Consistent in approached themes;
- **NE07** - Be careful with rewards to the player to be purely transactional;
- **NE08** - Use diegetic narrative devices in moderation;
- **NE09** - Avoid traditional game overs;
- **NE10** - Avoid ludo narrative dissonance without a satisfactory narrative reason.

The narrative guidelines are intended to help guide whatever story a game creator may want to make. They empha-

size consistency about how the story is seen, and consequentially experienced, by the player (**NE01 and NE08**). They also highlight that whatever themes and context the narrative takes place, needs careful research in order to not depict and tackle themes in a gratuitous, unnecessary, or even harmful manner (**NE03 and NE06**). Nor that literary mechanisms, that are common to other media, should be employed the same way here, the player is present in the game, so this perspective must always be considered (**NE02**).

The guidelines also warn about common video game design aspects that must be avoided, such as having story events always tied to an in-game reward (**NE04 and NE07**). Which, can diminish the game's narrative to whatever the player does to be tied to a reward, shifting the player's attention to what themes and points the plot aims to make, to instead, what does the player have to gain for engaging with the game's events. Or, in the case of the *game over* state, a staple of the failure of the players during gameplay. This state must be thought differently in the case of an empathetic game, as an empathetic game is not a binary about victory or defeat, thus if a game needs to use it, it's recommended so that it can be a not traditional one (where the player has to reset the game, or go back to the last checkpoint) (**NE04 and NE09**).

The last one, ludo narrative dissonance, is to take care that the game's systems don't contradict the narrative the game aims to set, unless if it is for a satisfactory narrative pay off later (**NE10**). This also aligns with guideline **NE05**, where the player's choices often in games are inconsequential, where no matter what is chosen, there are very little changes or consequences, to the game and its narrative progression (which is also an example of ludo narrative dissonance).

For the **graphical elements (GE)**, the following 5 guidelines were elaborated:

- **GE01** - Preference for diegetic user interface elements;
- **GE02** - The graphics should capture and represent the "mood" necessary for the narrative;
- **GE03** - Regardless of the chosen artistic style, only "break" it when necessary;
- **GE04** - Visual language and understanding of the game's state should not be sacrificed to meet cinematic needs;
- **GE05** - Always provide accessibility options.

An empathetic game can take a wide range of art styles and aesthetics. While some traditional industry games, can foster empathy in the player regardless of these guidelines, some aspects were notable in the present work game's sample. Often minimalistic, or even diegetic user interface are preferred to support the immersion of the player into the game's world (**GE01**).

Empathetic game's visual aspects are mostly for supporting the narrative mood of the game. It is possible for a game to use multiple visual styles that may clash with each other (**GE02**). Such clashes can break the feeling of immersion, so they must be used sparingly and with intent (**GE03**). The game's state and relevant visual information to the player (be it in static or dynamic scenes), must not sacrifice player usability (**GE04**). In the topic of usability, the same can be

applied to accessibility options, to support players who have visual, hearing, or even ergonomic impairments (**GE05**).

For the **audio elements (AE)**, the following 6 guidelines were elaborated:

- **AE01** - Diegetic sounds/soundtracks are preferable;
- **AE02** - Aim to harmonize the player's immersion with graphical and narrative elements of gameplay;
- **AE03** - Character avatar narrations are a useful device;
- **AE04** - Audio design should ensure that one aspect of audio does not unduly take priority over another.

Regarding a game's soundscape, in order to support the player's immersion, it is preferable if they can for most situations to use diegetic sounds, as if to imply that both the player and their avatar are in the listening and immersed in the same environment (**AE01**). This can be broken for a more cinematic soundtrack in occasions, such as in combat scenes or dramatic moments, it's key to align the narratives events perception to have an emotional effect on the player (be it happiness, sadness, bewilderment etc) (**AE02**).

Another key point for audio's role in fostering empathy is in better connecting the player's *game feel*, allowing for a synesthetic to the player connection between how the avatar moves feels and their timing (**AE02**). Besides sound effects, narration or internal monologues are interesting to give some perspective over what the avatar character is feeling, which can also give voice to what even the player might be feeling, or event with some clever dialogue, talk to both the player and the other characters on screen (**AE03**). This, however, must not be overused, as it can get tiring, especially in situations that not normally have particular relevance to the plot nor allow some insight into the game's world and characters.

The final guideline (**AE04**) is more technical, as that the game's sound design must be balanced, where the right elements take attention at the right moment. This aspect of audio, if mismanaged, can easily take player's out of the empathic experience the game aims to achieve, as they can be putting more effort into understanding what is happening, instead of feeling what the game's scenes are conveying.

For the **mechanical (gameplay) elements (ME)**, the following 6 guidelines were elaborated:

- **ME01** - Game mechanics are more effective when based on the physical and psychological actions/activities/perspective and abilities of the avatar character(s);
- **ME02** - Reference for simplicity in controls and tasks;
- **ME03** - Preference for avoiding excessively random elements or those that require an excessive amount of time spent grinding/farming;
- **ME04** - Accessibility options should also be present in control modes;
- **ME05** - Caution with potential loopholes that allow players to exploit the game systems;
- **ME06** - Breaking the system's rules is allowed to serve the narrative.

It was observed in our game's sample that, for fostering empathy in the player, the mechanical elements must reflect their avatar character's state and condition, be it physical or

psychological (**ME01**). As to better approach, the skills and limitations of the avatar character to be also felt when the player is in control. Sometimes, even the loss of control in some moments, can approach both players and their characters over their feelings, (i.e: vulnerability, anger, fear etc.) (**ME06**).

Also regarding mechanics, often simple controls work best, more complicated actions or button combinations can sometimes feel counterproductive to the aims of empathic games (**ME02**). Not that an empathic game must always be simple or minimalistic in their mechanics. Taking the game *Papers, Please*, the player must make a simple decision—either accept or reject people entering the country by clicking the stamp button and moving the mouse cursor to examine paperwork. The more people the player makes the correct decision about in a workday, the higher their salary and the better the living conditions they can provide for their family within the game. Initially, the criteria for the decision are based on the documents people present; sometimes there are discrepancies, they are forged, or they are legitimate. However, as the game progresses, the criteria and volume of documents increase, and along with these, there is an emotional dimension where immigrants will try to tell touching stories to move the player or bribe them. The game mechanics are simple, but they become more complex as the game progresses.

For empathic games mechanics that focuses on the player amassing a great number of resources, or even luck based elements must be avoided (**ME03 and ME05**). This is for two reasons: **1)** These tasks can shift focus from the game, to instead of an emotional engagement with the game, to an activity that is sometimes monotonous, and with the goal of having the player get bigger numbers of resources, (for example, money) and skip some of the obstacles related to this resource; **2)** These elements, traditionally in gaming, are used to both increase length of the game, and to make ordinary moments special with an unexpected reward that will help them make the game easier. An empathic game, is seldom about victory or defeat, and this can also open the door to exploits in the game's systems where the narrative can be just ignored or even make the emotional empathic experience negligible as the challenges and obstacles can eventually be trivialized.

Empathic games can also have mechanics that are meant to not be fair or pleasurable to the player. This allows, for the narrative's sake, to temporary breaks to the game's rules to convey and heighten an emotional moment behind the characters actions and give some sense of authenticity, that they are more than just pixels on the screen **ME06**.

Also, as general recommendation, to have different controller schemes that help players to achieve more comfortable gameplay experience, and even alternate control schemes and inputs so that the game can be enjoyed by a wide variety of players, with settings and options that are better suited for their physical conditions (**ME04**).

The guidelines created for empathic games are not meant to force a specific style of games, or let game creators not experiment with using or even subverting common trends in the industry, as a means to achieve their creative goals. Since, as pointed out by Blot [2017], empathy is subjective. Therefore, the guidelines elaborated in the present work are open-ended and support not the creativity game creators have in this pro-

cess, as well as incentivize cares with accessibility, usability, and interdisciplinary understanding of themes of the game to be created may approach and tackle them respectfully.

4.6.5 Videos

Finally, for the video, it was generated a series named *empathetic Dive*. The first episode is available on YouTube, in the channel *Vagrant Scribbler*. A thumbnail illustrating the first episode of the series can be seen in **Figure 5**. The series is dedicated to explaining diverse aspects of the gaming industry, with a focus on empathetic elements, like: The gaming industry's history and empathy-generating elements, the conceptual framework and its functionality, with both general and particular examples of the guidelines aforementioned in *Subsection 4.46* in action in games. It was also created a video that sums up the main findings and results of the present study, which was presented in the *XXX Seminário de Iniciação Científica da UFMT*⁵⁶ [Galvão and Maciel, 2022].

5 Final Remarks

In the present study, by the methods employed, it was possible to generate a conceptual *framework* that details important aspects that need to be considered in the creation of an empathetic game, the interaction between the elements that make up a game, and artifacts to support game creators - These tools were created with basis in findings from both industry and academic sources, and they were designed to help game creators of any level of expertise.

The present work has found evidence that, alongside the game elements important to an empathetic experience, it is also important: the *Creators' intentions* in making such game, and the *external aspects to the game*. That is to say, how well does the game tackle its themes that can originate from psychology, philosophy, social sciences, and many others; even from non-traditional knowledge sources, like the game creators' own life experiences [Blot, 2017]. However, the generation of empathy is fragile. It needs the many parts that make up a game to work in harmony, in such a way that they immerse the player in the game's world. There is a risk for the empathy generation to be lost if the game's reality is "broken".

The Brazilian HCI community has researched the definition and categorization of empathetic games [Santos et al., 2020; De Melo Pinheiro et al., 2021]; and recommendations for their design [Rodrigues et al., 2021]. Understanding and learning how games are projected to generate empathy is of community interest, since other types of computational solutions can benefit from the strategies used in the interfaces, allowing for further creative and innovative interactions that are adequate to the context they may be employed.

Empathy in itself is a fundamental requirement for the interaction with computational systems' data. Such feeling can be materialized in many different ways, such as in the accessibility requirements - fostering inclusion [Sohaib et al., 2011], in the inclusive writing that is not online strategic [Rangel

et al., 2022; Beckwith et al., 2006], but it also seeks to satisfy usability in interfaces [Jørgensen, 2004], and/or in the promotion of positives experiences to the player [Wiemeyer et al., 2016].

Considering the impact games have on popular culture [Shliakhovchuk and Muñoz García, 2020], empathetic games allow sensible human questions to be explored in a believable and simulated manner, and open up a space of opportunity for much-needed discussions in our society. As well as, more research is still needed on the topic, from both human and technical perspectives.

Going beyond games, the principles of empathy highlighted in this work can be applied in other areas of HCI, such as: software and wearable devices that are more empathetic to users' preferences/needs; the generation of interactive experiences, via software or hardware, that better connect the user to serious topics of discussion (or taboos); and other uses that were mentioned throughout this study.

With the results obtained, which are the *CERCO* framework and its artifacts, we hope they can support game creators, of any skill level, whether amateur or professional, to achieve their creative goals in producing an empathetic game that allows people to explore social, cultural and emotional issues. As with any study, from the experience we had during the production of the present work, the following considerations and limitations are necessary:

- **Validation** — Due to limited time and available resources to carry out this work, it was not possible to apply methods that validate the *framework*;
- **Game's sample** — Some empathetic games were included in the present work, however in the face of the great variety of existing games in the market, the sample may need to be constantly updated, including games from different periods, niches, and genres;
- **Interdisciplinary aspects** — Our analysis is limited, especially concerning visual and musical aspects, in other words, it was possible to understand the emotions that the games' art and music were conveying; but it was not possible to relate them to formal knowledge in musical structure and art history, that were outside the authors skills set. For empathy generation in games, perspectives outside computer science are needed, incorporating them into the *framework*;
- **Limitations of time and resources** — The present study was originally developed as a scientific initiation work, that has expanded into a graduation thesis (the present paper is also based on this very thesis), whose duration was a school semester, which did not allow for the analysis of more games and more balanced sample, as previously declared into an item of his list.
- **Literature overview execution** — The overview literature review method favors a broad understanding of how academic research on a study subject, rather than an in-depth systematic exploration about it. Due to time and resources constraints described in the previous point, the thesis, both its writing and its methods, were performed only by the first author (with guidance from his supervisor at the time) and are subject to personal bias. The main criteria for the selected papers were if

⁵⁶Jogos empáticos e um framework para melhor desenvolvê-los <https://www.youtube.com/watch?v=2Cttmp9V2VI>

they had insight over how games, (and their aspects), can generate empathic engagement with the player, papers were screened by their title, keywords, and abstract in order to deem them of interest to the present study before any deeper reading. Also, it was necessary to supplement the low number of findings with gray literature with gaming industry knowledge bases, magazines, books, websites, conferences, video essays and presentations and others medias. Which made systematization and standardization of findings difficult (thus why a literature overview method was preferred over a systematized review, alongside the general low number of results in traditional knowledge bases during initial prospectations). While this approach resulted in the creation of the *CERCO framework* and its artifacts, however, the knowledge they contain to help game creators and designers are over general empathic engagement via a game. The current state of the framework and the artifacts it may not properly support specific cases, for example, with specific demographics (e.g. children, elderly, people not familiar with games etc.), helping people with specific physical or neurological conditions (e.g. autism, depression, arthritis, color blindness etc.); or specific hardware considerations (e.g. PCs, smartphones, tablets etc.).

The identification of these limitations forms the basis for future works, to further enhance the *CERCO framework*. A few evident future works are: the validation of the current version of the framework with both HCI and game creator specialists; create new artifacts to support specific aforementioned interaction cases; improve on existing artifacts; understanding if the framework really did help designers creating empathic games; and if players became more aware of the situations depicted in empathic games, or even if they felt compelled or took action in supporting people in circumstances similar to the games they played.

Also, through and after the validation of this framework, we hope it to be possible, in the future, to work with specific demographics such as the elderly, neurodivergent, children, and many others, to bring forth to the public their daily struggles via empathic games, and with the framework's support. to bring awareness to important social issues cited in the present work's introduction. Other issues that present possibilities for future works involving the *CERCO framework* are: the use of games to discuss grief and finitude with children [Verhalen and Rodrigues, 2024]; how other works can collaborate with the improvement, and even, the creation of new artifacts for the *CERCO framework* to better support specific contexts [Casamaximo et al., 2023; Fonseca et al., 2022]; and how it can help in gaming mediums that were not thoroughly explored in the present study such as board games [Azevedo et al., 2022] or Virtual Reality [Souza et al., 2021].

Given the entire course of the study, the methodology used, the results obtained, and the materials generated; it should be noted that the process of generating empathy through technology is still complex. In the present global society that we live in, permeated by divergent and conflicting points of view that seem perpetual, there is hope that, with this study, the empathic and interactive experiences of games will help game

developers broaden their perspectives in favor of a more empathic world with the other. And with it, so too can players and the general public also be empathic with each other's struggles and needs in a novel, playful, and humanely manner [Mendez et al., 2020].

Declarations

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Authors' Contributions

Vinicius F. G. carried out with writing, research, methodology application, data collecting, and analysis, and translated this work to English; supervised by Cristiano Maciel. Cristiano Maciel, Eunice P. S. Nunes, and Kamila R. H. Rodrigues contributed to data analysis and insights into the results; they also edited, corrected, and offered suggestions to improve this document. All authors have read and approved the final manuscript

Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

The analyzed games are commercially available. The artifacts and *CERCO framework* can be accessed at the DAVI website artifacts page, available at: <https://lavi.ic.ufmt.br/davi/artefatos/>

References

- Arsenault, D. (2017). *Super Power, Spooky Bards, and Silverware: The Super Nintendo Entertainment System (Introduction)*. DOI: <https://doi.org/10.7551/mitpress/9787.001.0001>.
- Azevedo, G. S. d., Lima, L. S., Barbosa, I. C., and Sarinho, V. T. (2022). Dengueside survival: Providing a serious board game to fight against the aedes aegypti mosquito. *Journal on Interactive Systems*, 13(1):1–14. DOI: <https://doi.org/10.5753/jis.2022.1881>.

- Baer, R. H. (2005). *Videogames: in the beginning*. Rolenta Press. ISBN: 0-9643848-1-7.
- Baranauskas, M. C., de Souza, C., and Pereira, R. (2014). *I GranDIHC-BR — Grandes Desafios de Pesquisa em Interação Humano-Computador no Brasil*. DOI: <https://doi.org/10.13140/2.1.3651.9201>.
- Bearman, M., Palermo, C., Allen, L. M., and Williams, B. (2015). Learning empathy through simulation: a systematic literature review. *Simulation in healthcare*, 10(5):308–319. DOI: <https://doi.org/10.1097/SIH.000000000000113>.
- Beckwith, L., Burnett, M., Grigoreanu, V., and Wiedenbeck, S. (2006). Gender hci: What about the software? *Computer*, 39(11):97–101. DOI: <https://doi.org/10.1109/MC.2006.382>.
- Belman, J. and Flanagan, M. (2010). Designing games to foster empathy. *International Journal of Cognitive Technology*, 15(1):11. ISSN: 1091–8388.
- Berger, A. (2017). *Video Games: A Popular Culture Phenomenon*, pages 3–28. DOI: <https://doi.org/10.4324/9781351299961-2>.
- Blanco, B. (2019). Limitações da empatia no game design. *SBGames 2019*.
- Blot, A. (2017). Exploring games to foster empathy. Master's thesis, Faculty of Culture and Society (KS). <https://www.diva-portal.org/smash/record.jsf?pid=diva2>
- Boltz, L., Henriksen, D., and Mishra, P. (2015). Rethinking technology creativity in the 21st century: Empathy through gaming – perspective taking in a complex world. *TechTrends*, 59:3–8. DOI: <https://doi.org/10.1007/s11528-015-0895-1>.
- Bonato, S. (2018). *Searching the grey literature: A handbook for searching reports, working papers, and other unpublished research*. Rowman & Littlefield. ISBN: 978-1538100646.
- Bonnechère, B. (2018). Serious games in physical rehabilitation: from theory to practice. *Serious Games in Physical Rehabilitation: From Theory to Practice*. DOI: <https://doi.org/10.1007/978-3-319-66122-3>.
- Bordage, G. (2009). Conceptual frameworks to illuminate and magnify. *Medical Education*, 43(4):312–319. DOI: <https://doi.org/10.1111/j.1365-2923.2009.03295.x>.
- Brown, S. (2015a). A brief history of graphics. In *Ahoy*. <https://www.youtube.com/watch?v=QyjjWUrhSfc>.
- Brown, S. (2015b). Nuclear fruit: How the cold war shaped video games. In *Ahoy*. <https://www.youtube.com/watch?v=15dxuAbTC0A>.
- Burelli, P. (2016). *Game Cinematography: From Camera Control to Player Emotions*, pages 181–195. Springer International Publishing, Cham. DOI: <https://doi.org/10.1007/978-3-319-41316-711>.
- Cairns, P., Power, C., Barlet, M., and Haynes, G. (2019). Future design of accessibility in games: A design vocabulary. *International Journal of Human-Computer Studies*, 131:64–71. DOI: <https://doi.org/10.1016/j.ijhcs.2019.06.010>.
- Caroux, L. and Isbister, K. (2016). Influence of head-up displays' characteristics on user experience in video games. *International Journal of Human-Computer Studies*, 87:65–79. DOI: <https://doi.org/10.1016/j.ijhcs.2015.11.001>.
- Casamaximo, R., Souza, H., Veríssimo, L., Migliorini, L., Júnior, E., and Felinto, A. (2023). Guidelines for the development of escape room genre games utilizing the emotion-based mda framework and its application on the logic gates project. *Journal on Interactive Systems*, 14:481–493. DOI: <https://doi.org/10.5753/jis.2023.3199>.
- Charmaz, K. (2009). *A construção da teoria fundamentada: guia prático para análise qualitativa*. Bookman Editora. ISSN: 978-8536319995.
- Chesler, C. (2022). Can video games teach people to be more empathetic? maybe. *The Washington Post*.
- Conway, S. (2010). A circular wall? reformulating the fourth wall for videogames. *Journal of Gaming Virtual Worlds*, 2:145–155. DOI: <https://doi.org/10.1386/jgvw.2.2.1451>.
- Crogan, P. (2018). Indie dreams: Video games, creative economy, and the hyperindustrial epoch. *Games and Culture*, 13(7):671–689. DOI: <https://doi.org/10.1177/1555412018756708>.
- Cussan (2019). Evolution of video game graphics 1958-2020 [4k]. Cussan. <https://www.youtube.com/watch?v=IsPPWWIV-T8>.
- De Gloria, A., Bellotti, F., and Berta, R. (2014). Serious games for education and training. *International Journal of Serious Games*, 1(1). DOI: <https://doi.org/10.17083/ijsg.v1i1.11>.
- De Melo Pinheiro, T. S., Valério, C. C., Maciel, C., da Hora Rodrigues, K. R., and dos Santos Nunes, E. P. (2021). Revisiting empathy games concept from user comments perspective. In *Proceedings of the XX Brazilian Symposium on Human Factors in Computing Systems*, IHC '21, New York, NY, USA. Association for Computing Machinery. DOI: <https://doi.org/10.1145/3472301.3484359>.
- Denham, J., Hirschler, S., and Spokes, M. (2021). The reification of structural violence in video games. *Crime, Media, Culture*, 17(1):85–103. DOI: <https://doi.org/10.1177/1741659019881040>.
- Dictionary, C. (© 2022). Glossary. In *Cambridge University Press*. <https://shorturl.at/lrBIL>.
- Diogo, G. V. (2016). Empathy games: Life, death, and digital narratives. In *Radboud University*. <https://shorturl.at/kwJKW>.
- Dos Santos, D. B., Maciel, C., Pereira, V. C., and dos Santos Nunes, E. P. (2019). Digital empathic games and their relation with mortality: Analysis of discussion forums. In Fang, X., editor, *HCI in Games*, pages 307–319, Cham. Springer International Publishing. ISBN: 978-3-030-22602-2.
- Elson, M., Breuer, J., Ivory, J. D., and Quandt, T. (2014). More Than Stories With Buttons: Narrative, Mechanics, and Context as Determinants of Player Experience in Digital Games. *Journal of Communication*, 64(3):521–542. DOI: <https://doi.org/10.1111/jcom.12096>.
- Ermi, L. and Mäyrä, F. (2005). Fundamental components of the gameplay experience: Analysing immersion. In *Proceedings of DiGRA 2005 Conference: Changing Views: Worlds in Play*, Tampere. DiGRA.

- Ferreira, E. (2014). Diz-me com quem andas e direi o quão 'indie'ês: relações entre gênero e mercado no cenário dos videogames independentes. In *CONGRESSO INTERNACIONAL COMUNICAÇÃO E CONSUMO*, volume 4, pages 1–15. <https://rb.gy/u3hcj8>.
- Fonseca, G., Duque, E. M., Silva, R. B., and Ishitani, L. (2022). Repertory grid technique in a participatory design of games for older people. *Journal on Interactive Systems*, 13(1):26–41. DOI: <https://doi.org/10.5753/jis.2022.2114>.
- Fonseca, W. (2008). O que é rpg? In *Tecmundo*. <https://www.tecmundo.com.br/video-game-e-jogos/243-o-que-e-rpg-htm>.
- Galvão, V. F., Maciel, C., Dos Santos Nunes, E. P., and Da Hora Rodrigues, K. R. (2024). A framework to support the development of empathic games. In *Proceedings of the XXII Brazilian Symposium on Human Factors in Computing Systems*, IHC '23, New York, NY, USA. Association for Computing Machinery. DOI: <https://doi.org/10.1145/3638067.3638104>.
- Galvão, V. F. and Maciel, C. (2022). Jogos empáticos e um framework para melhor desenvolvê-los. In *XXX Seminário de Iniciação Científica da UFMT*. <https://www.youtube.com/watch?v=2Ctmnp9V2VI>.
- Galvão, V., Rodrigues, K., Maciel, C., Nunes, E., and Trevisan, D. (2022). Máquinas de empatia - uma visão geral histórica da indústria sobre elementos característicos dos jogos empáticos. In *Anais Estendidos do XXI Simpósio Brasileiro de Jogos e Entretenimento Digital*, pages 468–477, Porto Alegre, RS, Brasil. SBC. DOI: https://doi.org/10.5753/sbgames_estendido.2022.226147.
- Geier, A.-K., Lippmann, S., Rau, A., Schrimpf, A., Bleckwenn, M., and Deutsch, T. (2022). Walking a mile in grandma's shoes - medical students' evaluation of a very simple online aging game to enhance their understanding of older patients. *BMC Geriatrics*, 22. DOI: <https://doi.org/10.1186/s12877-022-03470-0>.
- Goodlander, G. and Mansfield, M. (2013). Press start: Video games in an art museum. *Journal of Interactive Humanities*, 1(1):615–624. DOI: <https://doi.org/10.14448/jih.01.0004>.
- Goulart, L. A. (2017). Jogos vivos para pessoas vivas: composições queer-contrapúblicas nas culturas de jogo digital. Master's thesis, Universidade Federal do Rio Grande do Sul. <http://hdl.handle.net/10183/165868>.
- Grant, M. J. and Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information & Libraries Journal*, 26(2):91–108. DOI: <https://doi.org/10.1111/j.1471-1842.2009.00848.x>.
- Hansen, D. (2016). *Game on!: Video game history from Pong and Pac-Man to Mario, Minecraft, and more*, volume 1. Macmillan. ISBN: 978-1250080950.
- Happ, C., Melzer, A., and Steffgen, G. (2015). Like the good or bad guy—empathy in antisocial and prosocial games. *Psychology of Popular Media Culture*, 4(2):80. DOI: <https://doi.org/10.1037/ppm0000021>.
- Harington, R. (1967). Pumping and horsepower. *Journal of the Department of Agriculture, Western Australia, Series 4*, 8(3):119–123. ISSN: 0021–8618.
- Harviainen, J. T., Bienia, R., Brind, S., Hitchens, M., Kot, Y. I., MacCallum-Stewart, E., Simkins, D. W., Stenros, J., and Sturrock, I. (2018). Live-action role-playing games. In *Role-playing game studies*, pages 87–106. Routledge. ISBN: 9781315637532.
- Hopeametsä, H. (2014). 24 hours in a bomb shelter. *The Foundation Stone of Nordic Larp*, page 211.
- Hott, D. F. M. and Fraz, J. N. (2020). Accessibility, assistive technology and information units: links to the inclusive existence. *Perspectivas em Ciência da Informação*, 24:199–210. DOI: <https://doi.org/10.1590/1981-5344/4194>.
- Hourigan, B. (2006). "You Need Love and Friendship For This Mission!": *Final Fantasy VI, VII and VIII as counterexamples to totalizing discourses on videogames*, volume 6. Citeseer. <https://rb.gy/gmrcvl>.
- Ivory, J. D. (2015). A brief history of video games. In *The video game debate: Unravelling the physical, social, and psychological effects of digital games*, pages 1–21. Routledge. ISBN: 9781315736495.
- Jørgensen, A. H. (2004). Marrying HCI/usability and computer games: a preliminary look. In *Proceedings of the Third Nordic Conference on Human-Computer Interaction*, NordiCHI '04, page 393–396, New York, NY, USA. Association for Computing Machinery. DOI: <https://doi.org/10.1145/1028014.1028078>.
- Katsarov, J., Christen, M., Mauerhofer, R., Schmocker, D., and Tanner, C. (2019). Training moral sensitivity through video games: A review of suitable game mechanisms. *Games and Culture*, 14(4):344–366. DOI: 10.1177/1555412017719344.
- Kent, S. L. (2010). *The Ultimate History of Video Games: from Pong to Pokemon and beyond... the story behind the craze that touched our lives and changed the world*, volume 1. Crown. ISBN: 978-0761536437.
- Keogh, B. (2015). *Between Triple-A, indie, casual, and DIY: Sites of tension in the videogames cultural industries*, pages 168–178. Routledge.
- Kivunja, C. (2018). Distinguishing between theory, theoretical framework, and conceptual framework: A systematic review of lessons from the field. *International Journal of Higher Education*, 7(6):44–53.. DOI: <https://doi.org/10.5430/ijhe.v7n6p44>.
- Kring-Schreifels, J. (2021). Video games used to copy movies. now they're influencing modern action. In *The Ringer*. <https://www.theringer.com/2021/2/22/22291182/video-games-film-influence-action-movies-john-wick-hardcore-henry>.
- Lankoski, P. (2007). Goals, affects, and empathy in games. *Philosophy of computer games*, pages 1–10. <https://rb.gy/kxvzy7>.
- Lloyd, D. B., Raghuvanshi, N., and Govindaraju, N. K. (2011). Sound synthesis for impact sounds in video games. In *Symposium on Interactive 3D Graphics and Games*, I3D '11, page 55–62 PAGE@7, New York, NY, USA. Association for Computing Machinery. DOI: <https://doi.org/10.1145/1944745.1944755>.
- Macák, M. et al. (2020). The dawn of the 9th console generation: The scalpers' heaven. *Acta Ludologica*, 3(2):92–93. ISSN: 2585–8599.

- Martinez, V. C. V. (2009). "O brincar e a realidade"... virtual: videogame, assassinatos e imortalidade. *Estilos da Clínica*, 14(26):150–173. DOI: 10.11606/issn.1981-1624.v14i26p150-173.
- Martins, L. and Araújo, F. (2021). Mineração de texto para a análise do perfil emocional de usuários de jogo empático. *Anais do Computer on the Beach*, pages 370–377. DOI: <https://doi.org/10.14210/cotb.v12.p370-377>.
- Martins, S. V. (2019). Self: um framework conceitual de apoio ao ensino de engenharia de software. Master's thesis, Universidade Federal de Pernambuco. <https://repositorio.ufpe.br/handle/123456789/37909>.
- McDonald, H. (2013). Romance games: Unpopular genre or untapped market? In *Montreal International Game Summit*. <https://www.gdcvault.com/play/1019283/Romance-Games-Unpopular-Genre-or>.
- McStay, A. (2018). *Emotional AI: The Rise of Empathic Media*. Sage Publications Ltd.. DOI: <https://doi.org/10.4135/9781526451293>.
- Menache, A. (2011). *Understanding Motion Capture for Computer Animation and Video Games*. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA. ISBN: 978-0123814968.
- Mendez, D., Graziotin, D., Wagner, S., and Seibold, H. (2020). Open science in software engineering. In Felderer, M. and Travassos, G. H., editors, *Contemporary Empirical Methods in Software Engineering*, pages 477–501. Springer International Publishing, Cham. DOI: 10.1007/978-3-030-32489-6_17.
- Michaelis (© 2022). Empatia. In *Michaelis, Dicionário Brasileiro da Língua Portuguesa*. Editora Melhoramentos. <https://rb.gy/q66vj6>.
- Millett, S. and Tune, N. (2015). *Patterns, principles, and practices of domain-driven design*. John Wiley & Sons.
- Miranda, E. E. C. d. (2021). *Um framework fundamentado na engenharia de requisitos para apoiar a conformidade legal e regulatória em sistemas computacionais*. PhD thesis, Universidade Federal do Rio Grande do Norte. <https://repositorio.ufrn.br/handle/123456789/45431>.
- Murphy, S. (2020). Why do we have video game console generations where did the term console come from? In *Jenovi*. <https://www.youtube.com/watch?v=rDgPg01azX0>.
- Noguera, C. and Duchien, L. (2008). Annotation framework validation using domain models. In Schieferdecker, I. and Hartman, A., editors, *Model Driven Architecture – Foundations and Applications*, pages 48–62, Berlin, Heidelberg. Springer Berlin Heidelberg. ISBN: 978-3-540-69100-6.
- Oliver, M. B., Bowman, N., Woolley, J., Rogers, R., Sherrick, B., and Chung, M.-Y. (2015). Video games as meaningful entertainment experiences. *Psychology of Popular Media Culture*, 5. DOI: <https://doi.org/10.1037/ppm0000066>.
- Pallavicini, F., Pepe, A., and Minissi, M. E. (2019). Gaming in virtual reality: What changes in terms of usability, emotional response and sense of presence compared to non-immersive video games? *Simulation & Gaming*, 50(2):136–159. DOI: <https://doi.org/10.1177/1046878119831420>.
- Payne, R. K. (2005). *A framework for understanding poverty*. aha! Process, Inc. ISBN: 978-1929229482.
- Pereira, A. L. K., Rodrigues, A. R., Amaral, E. C., Eliney, S., Muniz, M. S. D. A., and Narumi, A. (2017). Frameworks para desenvolvimentos de jogos: Uma abordagem vantajosa no desenvolvimento de jogos eletrônicos. *Revista Gestão em Foco*, 9:575–586. <https://shorturl.at/bpLWX>.
- Rangel, M. C., de Castro Salgado, L. C., and Bim, S. A. (2022). Tradubem: Towards a text verification tool for an altruistic language. In *Proceedings of the 21st Brazilian Symposium on Human Factors in Computing Systems, IHC '22*, New York, NY, USA. Association for Computing Machinery. DOI: <https://doi.org/10.1145/3554364.3559143>.
- Rodrigues, K. R. H., Valério, C. C., Pinheiro, T. S. M., Maciel, C., and Nunes, E. P. S. (2021). Diretrizes para o design de jogos empáticos. In *Anais Estendidos do XX Simpósio Brasileiro de Jogos e Entretenimento Digital*, pages 86–95, Porto Alegre, RS, Brasil. SBC. DOI: https://doi.org/10.5753/sbgames_estendido.2021.19628.
- Ruberg, B. (2020). Empathy and Its Alternatives: Deconstructing the Rhetoric of "Empathy" in Video Games. *Communication, Culture and Critique*, 13(1):54–71. DOI: <https://doi.org/10.1093/ccc/tcz044>.
- Ruffino, P. and Woodcock, J. (2021). Game workers and the empire: Unionisation in the uk video game industry. *Games and Culture*, 16(3):317–328. DOI: <https://doi.org/10.1177/1555412020947096>.
- Santos, D. B. d., de Melo Pinheiro, T. S., Maciel, C., Rodrigues, K. R. d. H., and Nunes, E. P. d. S. (2020). Interpreting posts in empathic games: assumptions for a conceptual framework. In *Proceedings of the 19th Brazilian Symposium on Human Factors in Computing Systems, IHC '20*, New York, NY, USA. Association for Computing Machinery. DOI: <https://doi.org/10.1145/3424953.3426635>.
- Santos, D. B. d., Maciel, C., Pereira, V. C., and Nunes, E. P. d. S. (2018). Analysis of the perception of users of empathic games in discussion forums and their relation to death. In *Proceedings of the 17th Brazilian Symposium on Human Factors in Computing Systems, IHC '18*, New York, NY, USA. Association for Computing Machinery. DOI: <https://doi.org/10.1145/3274192.3274198>.
- Sarmet, M. M. and Pilati, R. (2016). Efeito dos jogos digitais no comportamento: análise do general learning model. *Temas em Psicologia*, 24(1):17–31. DOI: <https://doi.org/10.9788/TP2016.1-02>.
- Schrier, K. and Farber, M. (2021). A systematic literature review of 'empathy' and 'games'. *Journal of Gaming Virtual Worlds*, 13:195–214. DOI: 10.1386/jgvwv00361.
- Schwartz, L. (2006). Fantasy, realism, and the other in recent video games. *Space and Culture*, 9:313–325. DOI: <https://doi.org/10.1177/1206331206289019>.
- Shanahan, E. A., Jones, M. D., McBeth, M. K., and Radaelli, C. M. (2018). The narrative policy framework. In *Theories of the policy process*, pages 173–213. Routledge. ISBN: 9780429494284.
- Shliakhovchuk, E. and Muñoz García, A. (2020). Intercultural perspective on impact of video games on players: Insights from a systematic review of recent literature. *Educational*

- Sciences: Theory and Practice*, 20(1):40–58. ISSN: 2630–5984.
- Siqueira da Silva, I. C. (2019). The promotion of empathy for the experience of users with visual impairment in the game design education. In Antona, M. and Stephanidis, C., editors, *Universal Access in Human-Computer Interaction. Theory, Methods and Tools*, pages 326–341, Cham. Springer International Publishing. DOI: https://doi.org/10.1007/978-3-030-23560-4_24.
- Sohaib, O., Hussain, W., and Badini, M. K. (2011). User experience (ux) and the web accessibility standards. *International Journal of Computer Science Issues (IJCSI)*, 8(3):584.
- Sotamaa, O. and Svelch, J. (2021). *Game Production Studies*. Amsterdam University Press. DOI: <https://doi.org/10.5117/9789048551736>.
- Souza, V., Maciel, A., Nedel, L., Kopper, R., Loges, K., and Schlemmer, E. (2021). Vr neuro game: a virtual reality game to support neuroanatomy teaching and learning. *Journal on Interactive Systems*, 12(1):253–268. DOI: <https://doi.org/10.5753/jis.2021.2090>.
- Stone, C. (2019). The evolution of video games as a storytelling medium, and the role of narrative in modern games. In *Game Developer*. <https://shorturl.at/qzPW5>.
- Švelch, J. (2017). *The discourses of microtransactions' acceptance and rejection in mainstream video games*, volume 101. Lexington Books. ISBN: 978-1-4985-4342-2.
- Swaen, B. (2015). What is a conceptual framework? | tips examples. In *Scribbr*. <https://www.scribbr.com/methodology/conceptual-framework/>.
- Swink, S. (2008). *Game feel: a game designer's guide to virtual sensation*. CRC press. ISBN: 978-0123743282.
- TechRules (2020). History of vr technology, but i have to explain in vr. In *Tech Rules*. <https://www.youtube.com/watch?v=XYZZ4JfX4bU>.
- Theory, N. (©2017). *Hellblade Seuna's Sacrifice*. Microsoft Windows, Xbox One, Playstation 4, Nintendo Switch, Xbox Series X/S. <https://www.hellblade.com>.
- Tisseron, S., Clément, M.-N., and Joncour, A. (2015). Développer la capacité d'empathie des enfants porteurs de troubles du spectre autistique avec le jeu des trois figures. *Cahiers de PréAut*, (1):55–94. DOI: <https://doi.org/10.3917/capre1.012.0055>.
- Todd, C. (2015). Commentary: Gamergate and resistance to the diversification of gaming culture. *Women's Studies Journal*, 29(1):64–67.
- Tormey, R. (2014). The centre cannot hold: untangling two different trajectories of the 'approaches to learning' framework. *Teaching in Higher Education*, 19(1):1–12. DOI: <https://doi.org/10.1080/13562517.2013.827648>.
- Trucker, M. (2019). The last of us (feat. writer creative director neil druckman). In *Lessons from the Screenplay*. <https://www.youtube.com/watch?v=4FGIIGYcBos>.
- Trujillo, C. and Garcia-Sucerquia, J. (2011). Graphics processing units: more than the pathway to realistic video-games. *Dyna (Colombia)*, 78(168):164–172.
- University, Y. (©2021). Teaching and learning frameworks. In *Yale Poorvu Center for Teaching and Learning*. <https://poorvucenter.yale.edu/BackwardDesign>.
- Usher, R., Robertson, P., and Sloan, R. (2013). Physical responses (arousal) to audio in games. *The Computer Games Journal*, 2:5–13. DOI: <https://doi.org/10.1007/BF03392340>.
- Verhalen, A. E. C. and Rodrigues, K. R. d. H. (2024). The use of serious digital games to talk about grief and finitude with children: reports on the design and evaluation process of two games. *Journal on Interactive Systems*, 15(1):926–941. DOI: <https://doi.org/10.5753/jis.2024.4101>.
- Walsh, A. (2021). Press y to cry: Generating emotions in videogame narrative. Game Developers Conference. https://www.youtube.com/watch?v=_lp0libfp5M.
- Warnock, T. (1987). Random-number generators. *Los Alamos Science*, 15(1987):137–141. <https://sgp.fas.org/othergov/doe/lanl/pubs/00418729.pdf>.
- Weidman, G. (2017). Gaming beyond the iron curtain: East germany. In *Super Bunnyhop*. <https://www.youtube.com/watch?v=b7xndvitLa8>.
- Wiemeyer, J., Nacke, L., Moser, C., and 'Floyd' Mueller, F. (2016). Player experience. *Serious games: Foundations, concepts and practice*, pages 243–271. DOI: <https://doi.org/10.1007/978-3-319-40612-19>.
- Wilde, P. and Evans, A. (2019). Empathy at play: Embodying posthuman subjectivities in gaming. *Convergence*, 25(5-6):791–806. DOI: <https://doi.org/10.1177/1354856517709987>.
- Williams-Bell, F. M., Kapralos, B., Hogue, A., Murphy, B., and Weckman, E. (2015). Using serious games and virtual simulation for training in the fire service: a review. *Fire Technology*, 51:553–584. DOI: <https://doi.org/10.1007/s10694-014-0398-1>.
- Wolf, M. J. (2008). *The video game explosion: a history from PONG to Playstation and beyond*. Greenwood. ISBN: 978-0313338687.
- Wood, R. T., Griffiths, M. D., Chappell, D., and Davies, M. N. (2004). The structural characteristics of video games: A psycho-structural analysis. *CyberPsychology & behavior*, 7(1):1–10. DOI: <https://doi.org/10.1089/109493104322820057>.
- Wozniak, S. (2019). Eyetoy for the playstation 2 - scott the woz. In *Scott The Woz*. <https://www.youtube.com/watch?v=OEBSOQZd5Ec>.
- Wright, A. (2021). A precarious game: The illusion of dream jobs in the video game industry, bulut, ergin, 2020, new york, cornell university press. available for \$23.95 in paperback [book review]. DOI: <https://doi.org/10.1111/ntwe.12189>.
- Wulansari, O. D. E., Pirker, J., Kopf, J., and Guetl, C. (2020). Video games and their correlation to empathy. In Auer, M. E., Hortsch, H., and Sethakul, P., editors, *The Impact of the 4th Industrial Revolution on Engineering Education*, pages 151–163, Cham. Springer International Publishing. DOI: <https://doi.org/10.1007/978-3-030-40274-716>.