

Diegetic interfaces and evaluating their User Experience: a systematic mapping

Guilherme Lopes da Cruz¹, João Luiz Bernardes Júnior¹

¹Universidade de São Paulo (USP)
São Paulo – SP – Brasil

{glcruz, jbernardes}@usp.br

Abstract. Introduction: User experience and immersion in digital games can be impacted by several factors, including the user interface itself and the way its elements are distributed or adapted for the experience. Diegetic interfaces provide players with greater immersion by adapting to the game's narrative universe. **Objective:** It is relevant to identify how diegetic user interfaces are created, how they impact UX, and which methods are used to evaluate this impact. **Methodology or Steps:** To identify methods for evaluating and creating diegetic interfaces, a systematic literature mapping was conducted to map artifacts involving the theme of diegesis in the context of games. **Results:** A total of 94 articles were analyzed, and a subset of studies that develop interfaces uses the Galloway model. Traditional usability evaluation methods in the context of digital games, such as the Game Experience Questionnaire and the Immersion Experience Questionnaire, are commonly used to evaluate interfaces. This analysis contributes by mapping knowledge about diegetic interfaces in the academic context, focusing on methods for evaluating usability, immersion, and enjoyment.

Keywords Diegetic Interface, Usability, Games, Immersion, Enjoyment, Presence

1. Introduction

In 2025, the global gaming industry generated a total revenue of 197 billion dollars, an increase of 7.5% year-over-year [Gu 2025]. For a cultural product with market relevance, there is a need for innovations and improvements in the user experience, ranging from accessibility features to aspects that impact player immersion and enjoyment.

Immersion, in the context of digital games, can be understood as a set of sensations and characteristics experienced by a player, which may involve a loss of awareness of time and physical space, as well as the sensation of being within the environment of that experience [Brown e Cairns 2004]. Because it is influenced by many variables, some authors have developed questionnaires to allow users to evaluate various aspects that may impact their experience [Jennett et al. 2008].

Different elements of a game can contribute to the construction of an immersive experience [Marques e Miranda 2022], from plot, narrative, and game mechanics to the elements that make up the interface. One approach to altering user immersion is the use of diegetic interfaces, which aim to adapt interface elements to the narrative universe of the experience. For example, by turning information such as energy, health, and map location into interface elements that are organic to that environment, a diegetic interface

is created in which the user also engages their imagination to maintain immersion [Thiago Ladislau 2025]. Because of this, the adoption of a first-person perspective is common, in which the player assumes the character's viewpoint.

Even so, it is necessary to understand how these interfaces are created and how they are evaluated. After all, there are guidelines for building traditional application interfaces [Nielsen 1994] as well as for digital game interfaces [Desurvire e Wiberg 2009]. Therefore, this systematic mapping aims to identify: (1) methods, theories, or guidelines that support the construction or planning of diegetic interfaces or elements in digital games; (2) methods for measuring the impact of diegetic interfaces on user experience, engagement, presence, and enjoyment.

2. Methodology

To conduct this review, the work is based on the Systematic Literature Review (SLR) method [Kitchenham e Charters 2007] to perform a systematic mapping. The method consists of: planning the review through its protocol; conducting the review; and presenting and briefly discussing the results.

The general objective of the mapping was: (1) to identify methods, theories, or guidelines that support the planning of diegetic interfaces in games; (2) to identify methods for evaluating these interfaces, considering metrics such as engagement, presence, and enjoyment. This mapping was conducted by only one researcher.

2.1. Research Questions

Q1 - What methods are defined to evaluate interaction through diegetic interfaces?

It is important to verify which methods and specific metrics are used to evaluate user experience, usability, and immersiveness in games with diegetic elements, given that usability evaluation may differ across systems with different objectives. For example, in systems such as applications or websites, it is common to evaluate the effort or time required for a user to complete a task, whereas in games, hedonic factors (those related to user emotions and enjoyment) often have greater importance than efficiency in task completion. Since this work specifically studies diegetic interfaces in games, it is relevant to understand whether there are dedicated tools to evaluate this form of experience or how other tools can be adapted for this purpose.

Q2 - Are there guidelines or recommendations for building diegetic interfaces or elements in games?

Given that diegetic resources aim to provide greater immersion and enjoyment to the player, it is important to identify best practices for designing this type of interface, or at least recommendations or guidelines for their effective design.

2.2. Keywords

The study applied the following keywords, and their variations, to construct the search string in databases:

- game: games, digital games, video games;
- interface: user interface, UI;
- experience: user experience, UX;

- hci: human computer interface, computer interface;
- diegetic: diegesis, diegetic.

2.3. Search string

At the beginning, search string was created and applied based on the main keywords:

(diegetic or diegesis) and (hci or human computer interface or computer interface) and (game or games or digital games or video games) and (user experience or ux) and (user interface or ui).

It was observed that applying the term “diegetic” ,or its variants, drastically reduces the volume of returned articles; therefore, to increase coverage, the final string was generalized, mainly reducing the other terms. The final string used in databases was:

(diegetic or diegesis) and (hci or interface or experience) and (game).

This search string was applied to title, abstract, and keyword in the search engines of two databases (Scopus and Web of Science) between August 2024 and March 2025, to identify studies covering the entire period available in the database; the search was conducted at least once a month during the selected period. Databases such as IEEE Xplore were also used in the search; however, no articles were returned during the research period.

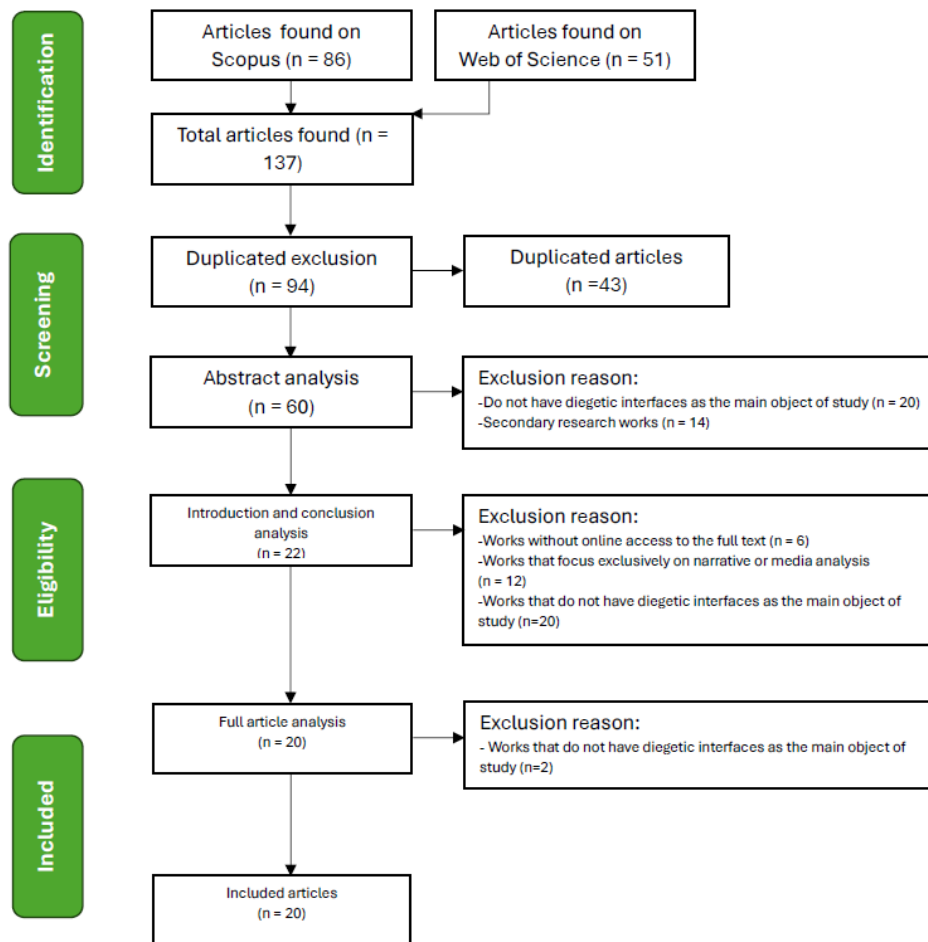
2.4. Inclusion criteria and exclusion criteria

To evaluate the articles found in the search engines, the following inclusion (i) and exclusion (e) criteria were defined:

- i1 - Works that cite or develop usability evaluation methods
- i2 - Works that cite or develop methods for diegetic interface design
- i3 - Works focused on diegesis in the interface
- i4 - Works presenting comparisons between diegetic and less diegetic scenarios
- i5 - Works that present how they measure user experience, usability, immersion, hedonism, or similar aspects
- e1 - Works that do not have diegetic interfaces as the main object of study
- e2 - Works without online access to the full text
- e3 - Works that focus exclusively on narrative or media analysis
- e4 - Secondary research works

2.5. Strategies for selecting studies and extracting data

After applying the search string in the databases, three rounds of article reading were conducted: the first considering only the abstract; the second considering introduction and conclusion; and the third involving full-text reading. The first and second rounds were mainly used to apply the inclusion and exclusion criteria. To be selected, an article had to meet at least one inclusion criterion and not violate any exclusion criterion. In the final stage, data necessary to answer each research question were extracted from the selected articles, when available, along with publication date and research location.

Figure 1. Flowchart of scope review conduction

3. Results

The search in Scopus and Web of Science (WoS), without additional filters, returned a total of 137 articles, 51 from WoS and 86 from Scopus. After an initial analysis, 43 duplicates were identified and removed, leaving 94 articles for review as seen in Figure 1.

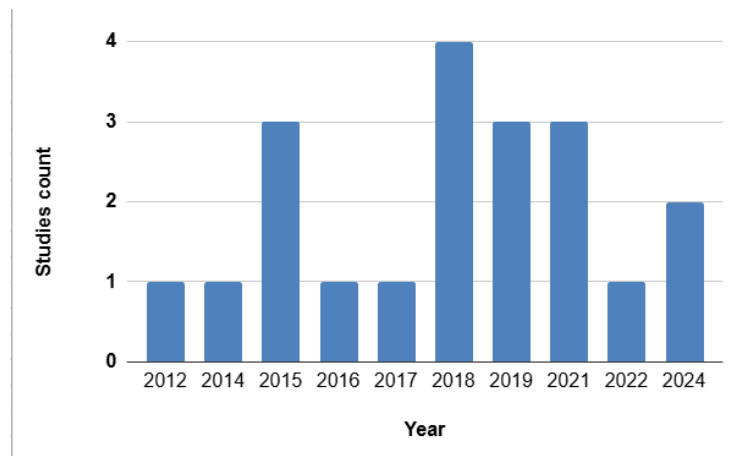
During the first reading stage, 34 articles were excluded: 20 for not having diegetic interfaces as the study object and 14 for being secondary studies, leaving 60 articles. The second stage resulted in the exclusion of 38 articles: 6 without full-text access, 12 addressing diegetic themes from a media/narrative analysis perspective, 14 outside the scope, and 6 not focusing primarily on diegetic interfaces. Thus, 22 articles remained for the final stage, among which 2 were excluded for having a different study object. In total, 20 articles were selected, distributed among inclusion criteria as shown on Table 1.¹

Preliminary results include demographic data. It was observed that publication peaks occurred in 2015, 2018, 2019, and 2021, while most other years had an average of one article per year as seen in Figure 2. Despite a decrease in 2022 and no publications in 2023, 2024 had two publications.

¹Articles information: https://docs.google.com/spreadsheets/d/1kkbOmm06e3PgPQQXIffYVy_XmuD2l7jwdJ02xFAyQqFA/edit?usp=sharing

Table 1. Selected articles and matched criteria

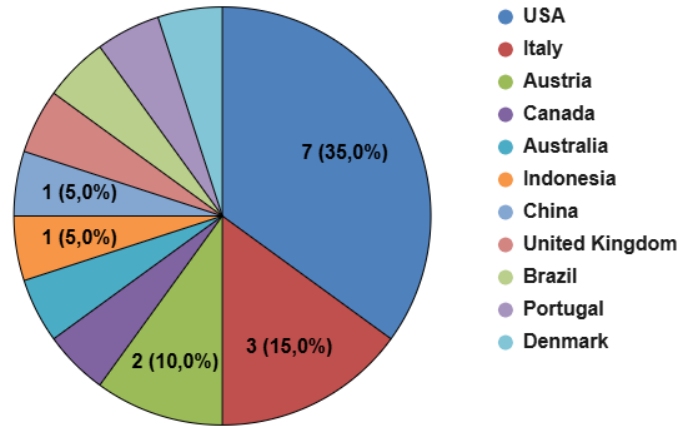
I1	I2	I3	I4	Authors	Year
0	1	1	1	Pfister, L; Ghellal, S	2018
0	0	1	0	Marre, Q; Caroux, L; Sakdavong, JC	2021
1	0	0	0	Kleinman, E; Carstensdottir, E; El-Nasr, MS	2019
0	1	0	1	Salomoni, P et al.	2016
0	1	0	1	Köhle, K et al.	2021
0	0	1	1	Rosyid, HA; Pangestu, AY; Akbar, MI	2021
0	0	0	1	Zhan, Y; Sun, YM; Nakajima, T	2024
0	1	0	1	Salomoni, P et al.	2017
0	0	1	0	Li, JY; van der Spek, E; Hu, J; Feijs, L	2019
1	0	0	1	Peng, XB; Li, JJ; Tang, HC; Luo, Q	2024
0	1	0	0	Peacocke, M et al	2018
1	0	0	0	Gomez, AR; Lankes, M	2019
0	1	0	1	Mariani I.; Mattiassi A.	2018
1	1	0	1	Iacovides I. et al.	2015
0	1	0	0	Oliveira T.	2015
0	1	0	1	Lankes M.; Wagner S.	2015
1	1	0	1	Doval S.; Almeida F.; Nesi L.	2022
0	1	0	1	Wolf M.J.P.	2014
0	1	0	0	Smith K.; Shen Y.; Dean A.W.	2018
0	1	0	0	Temte B.F.; Schoenau-Fog H.	2012

Figure 2. Publications over years

It was also identified that the United States accounts for approximately one-third of publications on the topic, followed by Italy and Austria, possibly due to its strong gaming industry and technological hubs, which can be seen in Figure 3.

3.1. Q1 - What methods have been established for evaluating interaction through diegetic interfaces?

Most works apply one or more specific questionnaires to quantify metrics of interest. Few use different methods, such as heuristic or semiotic analysis [Doval Estima da Silva 2019]. Most evaluated metrics involve immersion, presence,

Figure 3. Publications volume by country

and/or enjoyment. Table 2 shows found questionnaires, number of questions, assessed categories, Likert scale and frequency cited in articles.

Excluding non-standardized questionnaires (i.e., those developed by the authors themselves for that specific study) or those not cited in the studies, the studies analyzed in this review used a set of 10 distinct standardized questionnaires, each with different focuses and components. Most of the questionnaires address immersion and presence or the overall experience.

The Immersion Experience Questionnaire (IEQ) is the most widely used questionnaire among the studies found. This questionnaire is used to investigate aspects of immersion in the player's experience through five components: emotional involvement, cognitive involvement, detachment from the real world, challenge, and controls. From an experiential perspective, the questionnaire includes more questions for analyzing immersion than the others found in the review, with two versions, each containing more than 30 questions. In some studies, the questionnaire is adapted, reducing the number of questions, modifying the user response scale, or even modifying or adding questions [Salomoni et al. 2016, Kohle et al. 2021]. This questionnaire is the only one specifically focused on immersion, while others treat it as a component, for example, the Game Experience Questionnaire (GEQ) [Kohle et al. 2021].

The User Experience Questionnaire - Short Version (UEQ-S) [Zhan et al. 2024] offers a quick user experience assessment with just 8 questions, covering appeal, ease of use, efficiency, creativity, and enthusiasm. However, it is not specifically designed for games. IEQ is the preferred choice for researchers seeking depth in immersion, while UEQ-S is often used as a faster, albeit less specialized, alternative. On the other hand, the Core Elements of the Gaming Experience (CEGE) [Iacovides et al. 2014] and the GEQ [Kohle et al. 2021] focus specifically on aspects of games. The first one provides a detailed assessment of controls, learning game mechanics, game objectives and dynamics, personal goals and ambitions, relationships with rewards, and facilitators—aspects that impact player engagement and retention in the experience. On the other hand, the second also focuses on the player's emotional aspects during and after the gaming session, encompassing themes such as immersion, competence, tension, challenge, and *flow* (a psychological state of total and pleasurable immersion in an activity, where the player

Table 2. Questionnaires found

Method	Number of Questions	Categories	Likert	Frequency
IEQ	34	Empathy, Emotional engagement, Interest, Game usability, Immersion, Effort, Sense of the passage of time	10	6
CEGE	38	Enjoyment, Frustration, Puppetry, Control, Facilitators, Ownership, Game-play and Environment	7	1
Fang et al.	11	Affect Cognition Behavior,	7	1
UEQ - Short	8	Pragmatic quality, Hedonic quality	7	1
UEQ	26	Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, Novelty	7	1
MPS	15	Physical Presence, Social Presence, Personal Presence	5	1
MEC - SPQ	64	Attention, Allocation, Spatial Situation model, Spatial Presence, Higher Cognitive Involvement, Suspension of Disbelief , Domain Specific Interest , Visual Spatial Imagery	5	1
AtrakkDiff	28	Pragmatic quality, Hedonic quality, Attractiveness	7	1
meCUE	27	Usefulness, Usability, Visual aesthetics, Status, Commitment, Positive and Negative Emotions, Intention to use, Product loyalty	7	1
GEQ	91	Immersion, Flow, Competence, Positive and Negative Affect, Tension, and Challenge	5	1

feels completely focused, unaware of the passage of time, and motivated by a challenge that perfectly matches their abilities [Ellis et al. 1994]), through various questions divided into sections such as general components, during the game, social presence, and post-game.

Regarding questionnaires on presence metrics, both the Multimodal Presence Scale (MPS) [Quentin Marre e Sakdavong 2021] and the Measure, Effects, Conditions - Spatial Presence Questionnaire (MEC-SPQ) [Lankes e Wagner 2015] overlap in measures such as physical presence, user cognition, and real-world disassociation. Despite this, the latter analyzes aspects that the former does not consider, such as attention, interest, and the user's familiarity with the subject, suspension of disbelief, and other elements, divided into 64 questions. The Slater-Usuh-Steed questionnaire [Kohle et al. 2021], with only 6 questions on the sensation of being in the environment, disassociation from reality, kinesthesia, and awareness of the virtual versus the physical, provides a more superficial analysis of immersion when compared to those mentioned previously but makes its use much faster and more practical.

Regarding the questionnaire that references *enjoyment* [Quentin Marre e Sakdavong 2021], the study assesses the player's feelings regarding certain emotional states and behaviors both within and outside the game, as well as their judgments about the game's story, characters, and actions. Although categorized as *enjoyment*, given its questions and components, it could be classified as a more general experience questionnaire and offers less depth and fewer items compared to the others already discussed.

3.2. Q2 - Are there any guidelines or recommendations for designing interfaces or diegetic elements in games?

In general, it was noted that few studies draw on theories, models, guidelines, or recommendations for the design of diegetic interfaces, which may already indicate a research gap in the field. Many studies simply adapt the context to their needs [Salomoni et al. 2016, Kohle et al. 2021, Rosyid et al. 2021, Zhan et al. 2024, Lankes e Wagner 2015], without any supporting references, and merely evaluate the impacts of these changes. The study in [Quentin Marre e Sakdavong 2021] offers a tentative design recommendation for virtual reality interfaces; furthermore, it was not properly tested, but merely proposed.

The main theory cited in interface design was Galloway's Diegetic Model [Galloway 2006]. In this model, the author identifies four moments of action: Diegetic Machine Acts, Nondiegetic Operator Acts, Diegetic Acts, and Nondiegetic Machine Acts [Pfister e Ghellal 2018]. These acts refer to moments in the game when the environment and/or player are performing actions or triggering events that may or may not be consistent with the narrative universe of that experience. This is a more traditional model and, among the selected articles, was the most cited. The most interesting aspect of this work lies in the fact that it can be used to analyze interface elements or in-game dynamics.

On the other hand, there is the work cited in [Kleinman et al. 2019], in which the authors propose a model for analyzing diegetic interfaces, with the aim of identifying usability issues or problems with narrative comprehension in a game. This work contributes by offering a framework for analyzing game design elements and their

potential impact on player progression. Unlike Galloway's work, this should be applied to the final product, evaluating the state of the imposed diegetic mechanics and resources and how this impacts the player's experience.

Finally, there is a study [Gomez e Lankes 2019] that refines a *framework* for building interfaces for game-oriented interactions that use eye-tracking controls. The guidelines are divided into three functions: social, which relates to interaction and behavior with other beings; power, related to the interactions and actions available to the player; and finally, obstacles, penalties imposed on the player through their gaze. Despite the interesting proposal, the *framework* is limited to virtual reality games that use *eye-tracking* technology.

4. Conclusion

The review identified a range of questionnaire options for assessing various aspects of immersion, experience, and presence, among others. Some of these questionnaires delve into different issues involving user enjoyment and emotions, detailing aspects of immersion and even usability features [Pfister e Ghellal 2018, Iacovides et al. 2014, Kohle et al. 2021]. On the other hand, some questionnaires delve into a specific aspect of experience, as seen in the works of [Kohle et al. 2021] and [Zhan et al. 2024]. Thus, this study contributes to mapping techniques for evaluating UX, including immersion and enjoyment, in the context of digital games, identifying the Game Experience Questionnaire (GEQ) and Immersion Experience Questionnaire (IEQ) as the most commonly used tools.

On the other hand, most studies do not rely on any theory for the proposition and development of diegetic aspects in games. Only one method found could be used in assessing, which would be Galloway's model [Pfister e Ghellal 2018], and to date, there are no studies that validate the model's effectiveness or attempt to improve it. Therefore, there is an opportunity to develop guidelines for creating elements in diegetic interfaces.

4.1. Limitation

The following limitations of the study were identified: (1) Scope of the databases; other article databases could have been used to expand the study and increase the number of references; (2) Refinement or expansion of the search terms; although the term "diegetic" narrowed the results, other words could have been included to broaden the results. Those limitations impact our conclusions and mapping itself, because with more articles it could be possible to reach more ways to assessing usability and diegetic elements in games.

4.2. Future works

The study identified an opportunity to apply or develop a method for designing games with diegetic interfaces. Based on the models identified, it is not yet clear how to apply this method to improve the variables studied. It would be worthwhile to formalize a more up-to-date model that takes user usability into account. Another possible future study would be to compare usability evaluation methods, for example, to assess the impact of each questionnaire on different game genres (in order to determine if any are more suitable for specific game genres) or even evaluate a same game through different questionnaires in order to evaluate each one impact to evaluated variables. With those works it would

be possible to create a more accurate guide to which questionnaire should be used in a specific case scenario.

References

- Brown, E. e Cairns, P. (2004). A grounded investigation of game immersion. In *CHI '04 Extended Abstracts on Human Factors in Computing Systems*, CHI EA '04, page 1297–1300, New York, NY, USA. Association for Computing Machinery.
- Desurvire, H. e Wiberg, C. (2009). Game usability heuristics (play) for evaluating and designing better games: The next iteration. In *On. Com. Soc. Comp. Springer Berlin Heidelberg*.
- Doval Estima da Silva, G. (2019). A semiotic and usability analysis of diegetic ui: Metro - last light. Master's thesis, IADE - Universidade Europeia.
- Ellis, G. D., Voelkl, J. E., e Morris, C. (1994). Measurement and analysis issues with explanation of variance in daily experience using the flow model. *Journal of Leisure Research*, 26(4):337–356.
- Galloway, A. R. (2006). *Gaming: Essays On Algorithmic Culture (Electronic Mediations)*. Univ Of Minnesota Press.
- Gomez, A. R. e Lankes, M. (2019). Towards designing diegetic gaze in games: The use of gaze roles and metaphors. In *Novel User Interfaces and Interaction Techniques in the Games Context*, volume 3, page 65.
- Gu, T. (2025). Year in review: 2025 to date. *newzoo*.
- Iacovides, I., Cox, A., Kennedy, R., Cairns, P., e Jennett, C. (2014). Removing the hud: The impact of non -diegetic game elements and expertise on player involvement. In *Proc. CHI Play 2014*, pages 131–140. ACM Press.
- Jennett, C., Cox, A. L., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., e Walton, A. (2008). Measuring and defining the experience of immersion in games. In *International Journal of Human-Computer Studies*, volume 66, pages 641–661.
- Kitchenham, B. e Charters, S. (2007). Guidelines for performing systematic literature reviews in software engineering. *EBSE TR-2007-01, Departments of Computer Science, Keele University and University of Durham, UK*.
- Kleinman, E., Carstensdottir, E., e Seif El-Nasr, M. (2019). A model for analyzing diegesis in digital narrative games. In Cardona-Rivera, R. E., Sullivan, A., e Young, R. M., editors, *Interactive Storytelling*, pages 8–21, Cham. Springer International Publishing.
- Kohle, K., Hoppe, M., Schmidt, A., e Makela, V. (2021). Diegetic and non-diegetic health interfaces in vr shooter games. In Ardito, C., Lanzilotti, R., Malizia, A., Petrie, H., Piccinno, A., Desolda, G., e Inkpen, K., editors, *Human-Computer Interaction – INTERACT 2021*, pages 3–11, Cham. Springer International Publishing.
- Lankes, M. e Wagner, S. (2015). Taking a look at the player's gaze : The effects of gaze visualization s on the perceived presence in games. In *Proceedings of DiGRA 2015: Diversity of play: Games – Cultures – Identities*, pages 131–140.

- Marques, F. P. R. e Miranda, L. C. d. (2022). Design de jogo e experiência de fluxo: Reflexão e desafios na perspectiva da teoria do fluxo. *Anais do XXI Simpósio Brasileiro de Jogos e Entretenimento Digital*.
- Nielsen, J. (1994). 10 usability heuristics for user interface design. *Nielsen Norman Group*.
- Pfister, L. e Ghellal, S. (2018). Exploring the influence of non-diegetic and diegetic elements on the immersion of 2d games. In *Proceedings of the 30th Australian Conference on Computer-Human Interaction, OzCHI '18*, page 490–494, New York, NY, USA. Association for Computing Machinery.
- Quentin Marre, L. C. e Sakdavong, J.-C. (2021). Video game interfaces and diegesis: The impact on experts and novices' performance and experience in virtual reality. volume 37, pages 1089–1103. Taylor & Francis.
- Rosyid, H. A., Pangestu, A. Y., e Akbar, M. I. (2021). Can diegetic user interface improves immersion in role-playing games? In *2021 7th International Conference on Electrical, Electronics and Information Engineering (ICEEIE)*, pages 200–204.
- Salomoni, P., Prandi, C., Roccetti, M., Casanova, L., e Marchetti, L. (2016). Assessing the efficacy of a diegetic game interface with oculus rift. In *2016 13th IEEE Annual Consumer Communications Networking Conference (CCNC)*, pages 387–392.
- Thiago Ladislau, M. M. F. (2025). O ator-lúdico: Presença e plausibilidade na imersão do jogador em videogames cinematográficos. *XXIV Simpósio Brasileiro de Jogos e Entretenimento Digital (SBGames 2025)*.
- Zhan, Y., Sun, Y., e Nakajima, T. (2024). Exploring the efficient and hedonic shopping: A comparative study of in-game vr stores. In *2024 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, pages 831–832.