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# 12 Years of LUDES



# Twelve Years of LUDES: the Ludology, Engineering and Simulation Laboratory

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## Abstract

This document presents an overview of the LUDES laboratory, a center for research and development focusing on Ludology, Game Science, and Game Engineering. We present the main results of the laboratory, collaborations, recent awards, and some games developed by the lab and its former students.

# 1 Introduction

The Ludology, Engineering, and Simulation Laboratory (LUDES) is a research lab led by Geraldo Xexéo, which focuses on Ludology - the study of games, game science, and game engineering. As a part of Information Systems, the laboratory aims to contribute to the understanding and development of games, investigating various aspects such as design, aesthetics, development processes, and their applications.

LUDES has come a long way since its early work in the field, with its first two articles on games published around twelve years ago [1, 2], and a defining technical report released about six years ago [3]. The laboratory has now become a well-established research entity, collaborating with researchers and institutions from various backgrounds.

The research conducted at LUDES covers a wide range of topics in the domain of games and their interdisciplinary connections. Some of the key achievements and contributions of the laboratory include:

- Advancing the understanding of game design and development processes, with a focus on identifying best practices and methodologies for creating engaging and effective games.
- Investigating the role of emotions and other psychological factors in player experiences, which helps designers create more immersive and impactful games.
- Examining the use of games in education, healthcare, and other non-entertainment contexts, and assessing their effectiveness as tools for learning, behavior change, or therapy.
- Exploring the aesthetic aspects of games, including visual design, sound design, and narrative, and how these elements contribute to the overall experience of playing a game.
- Studying the social and cultural impact of games, including their role in shaping attitudes, values, and behaviors, both within and beyond gaming communities.

Overall, the work conducted at LUDES is crucial for advancing the understanding of games and their potential applications in various fields, ultimately contributing to the growth and development of the gaming industry as a whole.

# 2 Who We Are

LUDES is a Laboratory at the Computing and Systems Engineering Graduate Program at COPPE. It is a collaborative group comprised of professors and students from UFRJ and other institutions. This diverse group of individuals works together to share knowledge, conduct research, and develop projects in various fields. By bringing together expertise from different academic backgrounds and institutions, LUDES fosters an environment of interdisciplinary

collaboration and innovation, ultimately benefiting both the participants and the broader academic community.

## 2.1 Our Logo

The logo of our organization comprises various elements that are typically found in games. It features an image of a person who represents the player, along with a meeple, a game piece with a human-like shape. Additionally, a puzzle piece and arrows pointing in different directions are also present, which indicate movement. The empty spaces within the logo represent the points on a die, while its symmetry is symbolic of the balance that is essential in a game. Notably, the font used in the logo is known as Circo and adds a playful element to its overall design.

## 2.2 PESC, COPPE and UFRJ

The Programa de Engenharia de Sistemas e Computação (Computing and Systems Engineering)(PESC) at COPPE, founded in 1970, is a pioneer in the development of technology in Brazil. It has achieved several national and international accomplishments, such as the first parallel computer in Brazil, the first relational database in Brazil, the first Brazilian patent for a computer researcher, and the first Brazilian website. The program covers several research areas, including Computer Architecture, Database, Optimization, Software Engineering, Computer Graphics, Artificial Intelligence, and Computing and Society. It has also created interdisciplinary and multi-institutional research groups to study new trends in computing, such as Computational Biology, Data Mining, Medical Informatics, and more. PESC has the mission of being recognized as the best graduate program in computing in Latin America and one of the bests in the world.

COPPE - The Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering at the Federal University of Rio de Janeiro is one of the largest centers for teaching and research in engineering in Latin America. Founded in 1963, it has graduated 12,647 masters and 4,700 doctoral students in its 13 stricto sensu graduate programs, which have 348 PhD professors, 131 laboratories, and approximately 2,500 students annually. Furthermore, COPPE interacts strongly with Brazilian society and industry. Since 1994, the institution has maintained the COPPE/UFRJ Business Incubator, which has already supported the entry of more than a hundred innovative services and products into the market and stimulated the creation of the UFRJ Technology Park, located on the University City campus. Furthermore, through the COPPEtec Foundation, it has already served 14,141 contracts with companies and the government.

Finally, the history of UFRJ dates back to the beginning of the 19th century and is filled with remarkable scientific, cultural, and artistic accomplishments. It is currently one of the

three best university in Brazil and the seventh best university in Latin America (QS Rankings – 2018). The university has partnerships with several national and multinational companies, some of which have facilities on campus. Following a global trend, UFRJ creates and maintains cooperative relationships with institutions from all continents. It currently has partnerships with over 200 international institutions around the world.

### 3 Games, Six Years Later

In our first technical report, we stated our goal as “to study serious and entertaining games and their applications, focusing on the use of typical techniques of engineering, mainly the software and computing engineering” [3]. After six years, in 2023, our calling has been shown to be working with educational and scientific dissemination games, with examples such as “Mapa do Tesouro” (Treasure Map) [4] and “Screener” [5].

Although our definition of games [3] has been adopted by different authors in Brazil [6, 7, 8, 9, 10, 11], we also believe it should be reviewed to avoid demanding games to be nonproductive, which allows serious games to fit it. Therefore, our new definition is as follows.

Games are voluntary social and cultural activities that are meaningful and highly absorbing, making use of an abstract world, with effects negotiated in the real world, and whose development and final outcomes are uncertain, where one or more players, or teams of players, interactively and quantifiably modify the state of an artificial system, possibly in pursuit of conflicting objectives, through decisions and actions, some with the ability to hinder the opponent, with the whole process being regulated, guided, and limited by accepted rules, and thereby obtaining a psychological reward, usually in the form of fun, entertainment, or a sense of victory over an opponent or challenge.

Moreover, we also adopted an alternative, naïve definition aimed at settling the discussion of whether a borderline game is a game: “Whatever you want to call a game that will be reasonably accepted as it by your peers”.

Currently, our work aims to bring together theory and practice from games and simulations, processes, and methods, with a deep background in Computer Science and Software Engineering. We also explore different application areas that provide a purpose for our games (Figure 1).

To guide our work, we defined a contextual framework that visually describes our main areas of contribution, described in Figure 2. In this framework, Game Designers Model Games, which also can be generated by automatic processes, possibly AI-driven. These models can be simulated and also played automatically by our tools. Some of these tools provide telemetry,

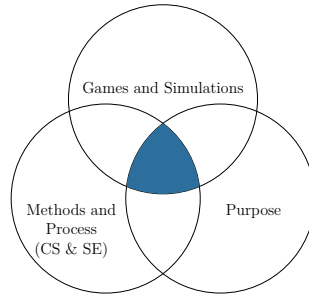


Figure 1: Ludes aims to bring together theory and practice from Computer Science and Software Engineering to improve methods and processes to develop games with a purpose.

traceability and provenance [12], allowing game mining and automatic game evolution. Meanwhile, we also discuss how humans evaluate games [13] and how to procedurally generate games [14].

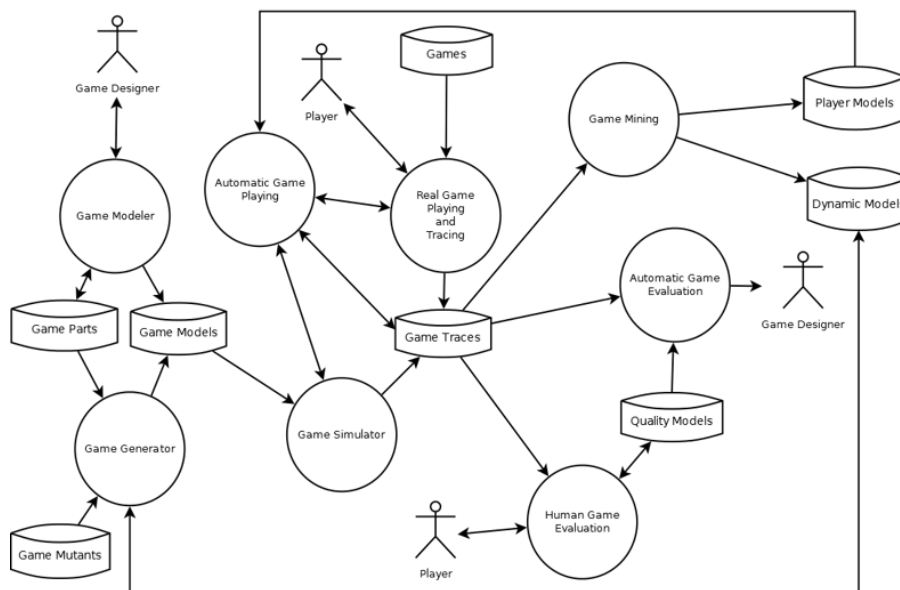


Figure 2: A Framework that describes LUDES' work.

## 4 Main Results

Among many subjects related to game design and development, one of the main research outcomes of LUDES is the development of Game Development Processes, based on a deep understanding of Software Engineering and Game Design Theory.

We also develop tools for game design, such as Pegasus [15], a tool to simulate games of progression, or used in game development, testing, and monitoring. Another important contribution are ontologies [16] created for specific types of games.

## 4.1 Game Development Processes

In our laboratory, we conducted an in-depth analysis of ten serious game design methods from the perspective of Design Science Research (DSR). Our research objective was to pinpoint gaps and recommend improvements for serious game design methods, ultimately enhancing their impact and effectiveness. Through this analysis, we identified two missing steps and eight steps that are only partially covered by the methods examined. We concluded that this incomplete coverage of DSR steps may act as a barrier to the growth and dissemination of serious games' state-of-the-art. To address these gaps, our laboratory suggests several solutions, including using DSR as a foundation for creating new serious game design methods, conducting empirical research to validate existing methods and develop novel techniques, and fostering collaboration among researchers, developers, and end-users to improve serious game design methods and ensure that they meet user requirements [17].

LUDES has also worked on game development processes, resulting in the creation of the Play Your Process PYP), ENDO-GDC, Medieval and Ludes-GD methodologies. These methodologies have been applied in various projects, including in the development of an educational games focused on sustainability, which was presented at the Annual ABSEL conference in 2023.

### 4.1.1 LUDES-GD

The Ludes Game Development Process (LUDES-GD) [18] was established based on the experience of laboratory members in game creation and encompasses five stages: Conception, Design, Production, Evaluation, and Packaging. The LUDES-GD is an integral component of the Ludes development methodology and not only combines well-known game creation processes with the perspective of games as Information Systems, but also employs iterative cycles, is tool-agnostic, evolutionary, dynamic, collaborative, and exploratory.

### 4.1.2 MEDIEVAL

MEDIEVAL [19] is a method for designing educational video games that covers the entire process from conception to publication, including production, development, and testing. It aims to support game designers in clarifying all the key points and presenting useful theories and tools for each part of the process in order to create video games that are successful both in terms of education and entertainment. MEDIEVAL is made up of ten steps and is presented in a linear framework, although it is an incremental and iterative process. The initial steps focus on creativity and conceptualization, followed by the articulation of learning theories, and then

planning and design. The final steps involve testing and evaluation, with the ability to revisit earlier stages if necessary. The framework is presented in a logical and visual way, reminiscent of a game board (Figure 3).

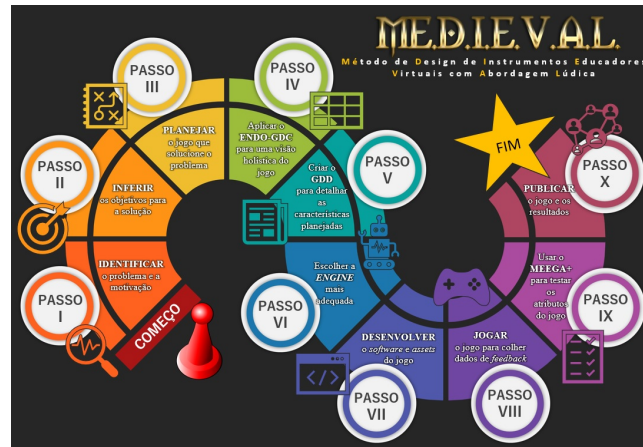


Figure 3: MEDIEVAL process as a game.

#### 4.1.3 ENDO-GDC

The ENDO-GDC (Endogenous Game Development Canvas) [20, 21], displayed in Figure 4, is a comprehensive design framework devised to facilitate the creation of endogenous educational games, incorporating both the Mechanics-Dynamics-Aesthetics (MDA) model and Bloom’s Taxonomy. By synergistically integrating these two foundational approaches, the ENDO-GDC aims to promote meaningful learning experiences while ensuring engaging and interactive gameplay. This canvas empowers game designers to align educational objectives with game mechanics and dynamics, thereby fostering an immersive environment that facilitates the achievement of cognitive learning outcomes as delineated by Bloom’s taxonomy. Consequently, the ENDO-GDC contributes to the advancement of game-based learning by providing a structured, cohesive, and pedagogically informed approach to the development of endogenous educational games.

## 4.2 Play Your Process (PYP)

The Play Your Process (PYP) [22, 23] method is a systematic approach to game design that utilizes business process models as input, maps them to game design elements, and provides guidelines for evaluating games. The article also reports the successful validation of PYP through the development and evaluation of a set of games, which showed good quality and improved the understanding of the process by players. While the PYP method is effective in creating games that provide understanding of business processes, the article suggests that



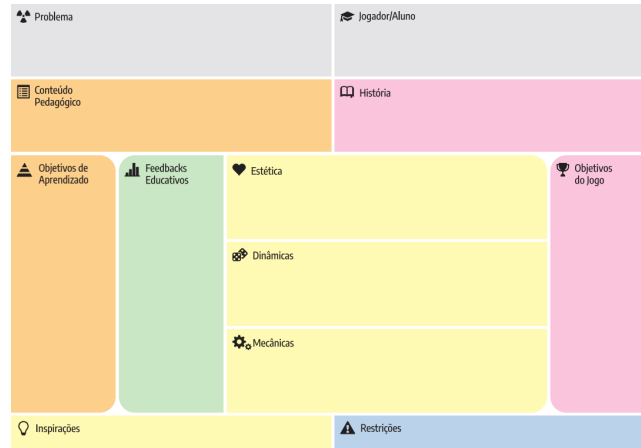


Figure 4: The ENDO-GDC Canvas

further improvement is needed in terms of making games more entertaining and enjoyable for players.

The challenge PYP tries to address is how to approach games as enablers and agents for work relations, social change, and innovation in organizations [24]. The PYP method was used to design games in the public sector [25] to provide transparency and understanding of public services. More recently, variations of the PYP method for business process training have been discussed [26]. With the support of the Brazilian National Research Council, it is expected to address a technology roadmap for PYP as a suite of innovative methods and tools for the game design and BPM markets.

### 4.3 Game Ontologies

LUDES states that games, both digital and analog, are information systems [27]. Our research uses information technology tools and techniques to analyze, describe, design, build, and evaluate information systems in game designs.

Ontologies are applied to conceptual models to gather knowledge about a particular subject or system and produce a good representation of that phenomenon. LUDES proposed some ontologies to analyze game elements or broad game themes.

LUDES built a Game Mechanics Ontology [28] based on the mechanics category presented in BoardGameGeek.com in relation to the formal concepts from the MDA framework. The first level of the game ontology (Fig. 5) is composed of two very general mechanics: Algorithm and Data Representation. They are divided into Action, Ruleset and Goal, and Component and Resource. Each of these five elements further unfolds into its own ontology branch.

An ontology analyzed the game space [29] in relation to spatiality, perspective, and possibility of manipulation (Fig. 6). Spatiality examines gameworld and gameplay. Perspective

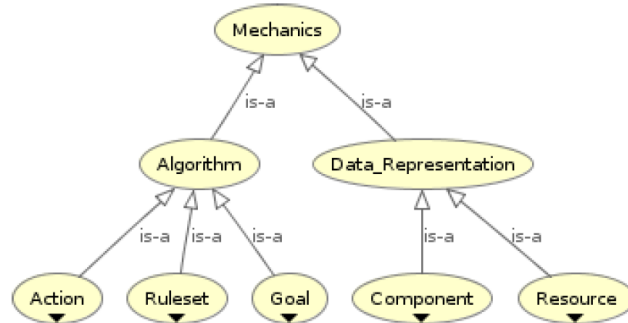


Figure 5: Top concepts in the Game Mechanics Ontology [28]

involves player perspective and game view. Manipulation is related to the game space itself, rather than the objects in the game space.

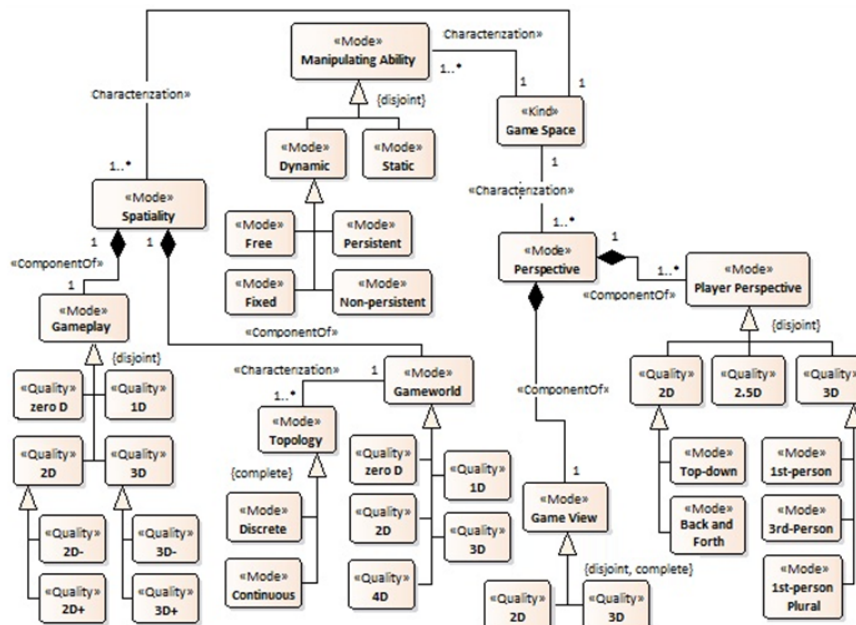


Figure 6: Game Space Ontology [29]

Games often deal with issues involving terrain control, power projection, and resource allocation. Games teach us to understand the environment, predict the consequences of decisions, analyze risks, perform simulations and manage information [30]. Games can represent many contexts: business, government, military, health, education, etc. [31]. LUDES also developed wargame ontologies that aimed to identify and correlate the main features and elements of wargames [32]. These ontologies can guide the design of new wargames considering the achievement of their educational goals. Figure 7 shows a preliminary ontology that correlates the main elements of wargames as suggested by researcher Peter Perla [33].

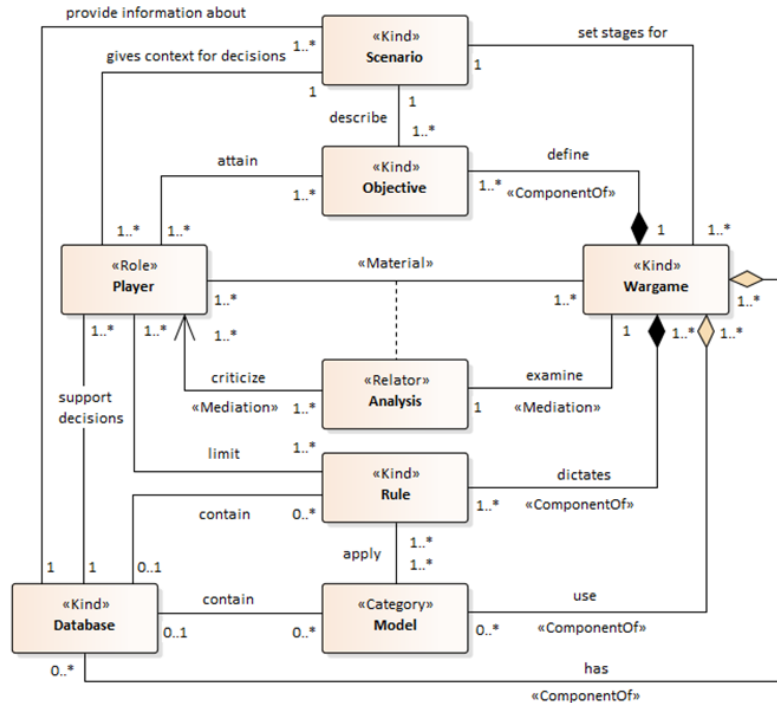


Figure 7: Preliminary Ontology of Wargame Elements [32]

#### 4.3.1 Ontology of Emotions in Colors

This master dissertation, presented by Arruda [34] aimed to facilitate the participation of game designers and artists in the preproduction stage of digital game development by formalizing the relationship between emotions and colors through an ontology and an application for analyzing game images. The ontology is based on color theory, emotion theory, and various theories related to the use of colors in games and communication. The tool created from the ontology can identify emotions present in game images based on color analysis.

### 4.4 Automatic Game Quality Assessment

The fuzzy aesthetic metric is a method to quantify the aesthetic qualities of turn-based multiplayer games. By analyzing players' moves, the metric can measure aspects of the game such as Drama, Lead Change, and Uncertainty [35]. A game has Drama if "it should be possible for a player to recover from a weaker position and still win the game". Chess is evidence of this rationale: a chess match between good players rarely unfolds till a checkmate, one of them resigns when it becomes clear that he cannot win, so when the Drama ceases. Lead Change refers to the frequency and significance of shifts in the game's momentum, where one player takes the lead over another. Uncertainty refers to the level of unpredictability and strategic depth present in the game. By combining these factors into a single metric, the fuzzy aesthetic metric can provide a comprehensive measure of a game's overall aesthetic quality. This could be

useful for game designers and developers who want to create games that are not only enjoyable to play but also visually and emotionally engaging.

## 4.5 Tools for Game Design and Development

We used the Kano Model to identify the needs and expectations of players in relation to a game [36]. By classifying features into the five categories – Attractive, Must-Have, One-Dimensional, Indifferent, and Reverse – game developers can prioritize their efforts to deliver a satisfying gaming experience. Attractive features that enhance the gaming experience, such as engaging storylines or immersive graphics, can be prioritized over indifferent features that have little impact on player satisfaction. Meanwhile, must-have features, such as smooth gameplay and reliable servers, should be considered essential and optimized to avoid player frustration. By utilizing the Kano Model, game developers can better understand their players’ expectations and allocate their resources accordingly to deliver a game that meets and exceeds those expectations.

In “Telemetry for Arcade-Like Games: Model and Tool” [12] we present a lean model to map game events to specific provenance concepts and an open source Unity extension that gathers data through telemetry to assist independent game developers in detecting and solving design flaws. By analyzing player behavior in-game and comparing it with the design intentions behind the game level, developers can fund their products while ensuring their quality to the target audience. The proposed model was implemented as a Unity tool that triggers three kinds of predefined events to map every situation in a play-through. The simplicity of the model makes it easy to understand and even extend, allowing developers to improve the quality of their games without the need for a high budget or large QA teams.

In “Investigando o Fluxo de Conhecimento em FAQs de Jogos de Tabuleiro” [37], we track the knowledge from the game designer’s tacit knowledge to the game’s explicit rules. This work highlights the difficulties in writing game rules. As game development is multidisciplinary, conveying the necessary information in written form may not be enough. As a result of this investigation, a Knowledge Flow Model for Board Games was proposed (Figure 8), which includes the game designer, the player, FAQs, and noise channels. The model follows the flow of knowledge from the game designer’s tacit knowledge to the player’s tacit knowledge, passing through the explicit rules and the community’s knowledge. As proposed, the model can serve as a tool for game designers to better write game manuals and help players better understand the game.

## 4.6 MOBA’s Oracle

We conducted a multivocal literature mapping (accepted at IEEE Transactions on Games and to be published soon) that focuses strictly on the use of Artificial Intelligence approaches in

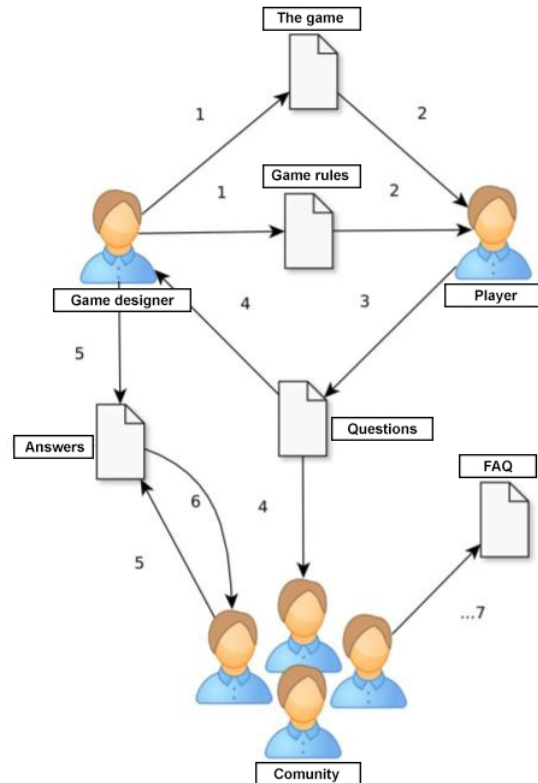


Figure 8: Knowledge Flow Model for Boardgames

Multiplayer Online Battle Arena (MOBA) games. We analyzed relevant publications published between 2011 and 2022 and systematically examined them to extract similarities, gaps, and main findings. We analyzed 124 publications to identify the topics most studied, the techniques most commonly used, and the most commonly applied evaluation methods. The results showed that League of Legends and DotA are the most studied games, with victory prediction being the most popular research topic. Finally, we provided an outlook on possible future work, considering the gaps found in the white and gray literature. Some of the gaps found were in esports, human-centered AI, and victory prediction.

Therefore, we are developing an approach to aid decision making on victory prediction in esports, specifically in MOBA games. This approach aims to (i) overcome the state of the art in correct predictions, (ii) use qualitative and quantitative baselines, and (iii) expose the results of the predictions simply and understandably for the stakeholders in question.

## 5 Fostering Educational Game Culture

LUDES has also contributed to the field of educational game design through scholarly activities, including being the author of three book chapters geared specifically at educators in formal education settings [21, 38]. These academic contributions reflect the lab's commitment to disseminating knowledge and supporting the professional development of teachers in the realm of game-based learning.

One of the most important contributions to the use of games in education in Brazil was the chapter “Introdução à Teoria de Projeto de Jogos” [38] In this chapter on game design theory, we delve into the core concepts and principles that govern how games function and the elements that designers should be aware of when crafting engaging and educational experiences for players. By understanding the foundations of game design, we can gain a clearer perspective on the significance of games in our lives and their potential to impact players on multiple levels.

## 6 Games Developed by LUDES

The laboratory has developed various games, including:

- Screener<sup>1</sup> [5][39], a board game about the drug discovery and development (DDD) process, in collaboration with Prof. François Noël. The game is being used successfully to support undergraduate and graduate courses on the subject.



Figure 9: Partial view of Screener.

- DiscoverRx<sup>2</sup> [40], an mobile game aimed at scientific dissemination of the drug development process, in collaboration with Prof. François Noël. The game targets children and has seven minigames, each representing a phase of the DDD process.

<sup>1</sup><https://screener.com.br/>

<sup>2</sup><https://discoverx.com.br/>

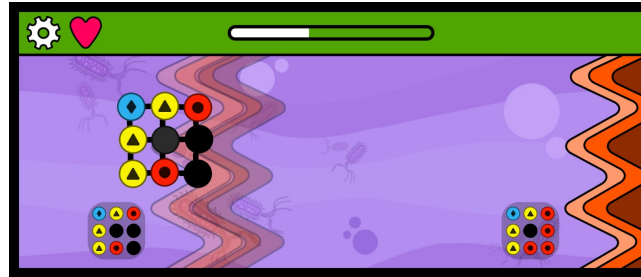


Figure 10: DiscoverX's Mini-Game 3.

- Xô Corona [41, 42]<sup>3</sup>, Figure 11, a card game that was also adapted to online playing. Its entire conception aimed to develop a game with the purpose of raising awareness about the contamination of the virus that causes COVID-19 and its ways of prevention, in view of the current global situation.
- Corona Quiz<sup>4</sup> is a question-and-answer game developed by the Graduate Program in Creative Media at the School of Communication of the Federal University of Rio de Janeiro (UFRJ) and implemented by LUDES. The project aimed to educate and inform the population about COVID-19 in a playful and interactive way, promoting awareness and prevention against the disease.
- 3E - The Game<sup>5</sup>, a board game designed for up to 5 players aged 10 and older. The game simulates an academic semester, where the challenge is to achieve good academic performance while balancing social and personal spheres;
- Mapa do Tesouro<sup>6,7</sup> [4], a mobile game created to teach algorithms and concurrent computational thinking to children. Each level has a different island with a treasure that must be found by the program controlled pirates. The player wins when they are successful in programming the pirates' steps and interactions using command blocks;
- The Boss [43], a board game that simulates aspects of the management of a software development company in a competitive market scenario. It encourages players to handle different important business functions, such as sales, development, human resources, and administration. During a game session, teams compete for clients, hire employees, control workspace availability, and deal with market variation, from blooming to recession times.
- The New Space Race [44], this classroom board game teaches students about the dynamics of new markets. "In the year 2020, the private space sector is ready for consolidate its

<sup>3</sup><https://github.com/tekpixo/xo-corona>

<sup>4</sup><https://coronaquiz.ppgmc.eco.ufrj.br/>

<sup>5</sup><http://3e.mangeli.com.br/>

<sup>6</sup><https://play.google.com/store/apps/details?id=com.LUDES.MapaTesouro>

<sup>7</sup><https://tanookihouse.itch.io/mapa-do-tesouro>



Figure 11: Card from Xô Corona

vision to take humanity beyond Earth. The game is set in four places: Earth Orbit, Moon, Mars and the Asteroid Belt between Mars and Jupiter. Each of those locations may be suitable for investments in four business types: tourism, pharmaceuticals, mining and fuel processing. Overall, a total of ten different markets are available to be invested by players. Players will evaluate investment decisions in order to have an economically sustainable company among the subset of mature companies that will win the game” [44].

- Marketing Channel Development and TIM Store Takeoff, business games developed for TIM and Intelig in Brazil, developed by Geraldo Xexéo and Claudio Dipolitto (unpublished).
- The MEI Game [45] is an educational visual novel based on the real story of Alice, a successful small entrepreneur in Nova Iguaçu, Rio de Janeiro. The game follows Alice’s path in creating and managing a cake bakery business and a MEI (Individual Micro Entrepreneur). The player faces different strategic decisions, and the game evaluates the level of success of the company at the end. The game aims to serve as a playful and attractive way to acquire or reinforce knowledge of administrative strategies, be theoretically





Figure 12: Mapa do Tesouro

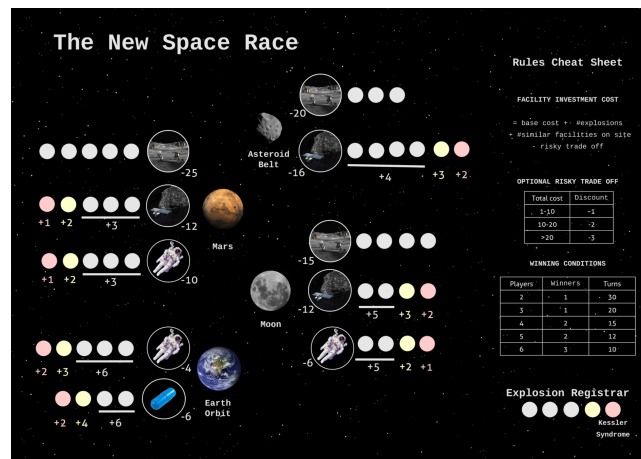


Figure 13: The New Space Race

accurate and accessible to the general public, and allow multiple endings with different levels of success, so that players can compare results and explore multiple management strategies. The game’s mechanics are based on a visual novel style, with multiple possible endings and high variability in duration depending on the player’s choices.

- Batalha das Lendas [46] is a board game that features characters from Brazilian folklore in a fun and engaging way, using basic mechanics similar to traditional Dominó. It aims to encourage interest in Brazilian myths and legends and employs strategic battle dynamics based on the characteristics of folklore creatures. The game uses pattern building, tile placement, and pattern recognition mechanics and was developed using the Tétrade Elementar. It can be used to promote the Brazilian cultural heritage.
- Salve a Terra! [47] is a collaborative board game focused on environmental sustainability. Through its mechanics, players learn concepts related to sustainability and must use multiple strategies while cooperating with other players to win. The game’s use of procedural rhetoric, where the rules and mechanics of the game convey messages and ideas, makes it a useful tool for active teaching methodologies in environmental education. Additionally, the game helps develop skills such as problem solving, critical thinking, and organization.

## 7 Collaborations

Ludes has actively engaged in collaborations with external researchers to develop purpose-driven games within their respective fields. In this section, we discuss the various collaborative efforts undertaken by the Ludes team, highlighting the partnerships that have resulted in the creation of innovative and engaging games. Through close collaboration with experts from different disciplines, Ludes has effectively utilized their expertise in game design and development to create unique experiences that integrate education, scientific communication, and entertainment. These collaborative projects demonstrate the lab's dedication to fostering knowledge exchange and enhancing the impact of purposeful games across a range of domains.

In particular, Screener [5] and DiscoverX emerged from a collaboration with Prof. François Noël from the “Laboratório de Farmacologia Bioquímica e Molecular” (ICB/UFRJ).

Furthermore, in partnership with the “Escola de Comunicação da UFRJ”, we developed a trivia game centered on knowledge of the Coronavirus disease.

Additionally, we have participated in numerous activities with the Ludus Magisterium community. Ludus Magisterium, a network of individuals interested in tabletop games (board games, card games, RPGs, and others) in Education, was established in May 2019. Members of the Ludus Magisterium convene through online networks and in-person meetings, forming a learning community that engages in exchanges, develops studies and research, and organizes academic and outreach activities, among others. In collaboration with this community, we have developed several unpublished games currently undergoing testing.

In the past, we collaborated with telecommunications companies TIM and Intelig, as well as InoveLab, to develop business games.

Currently, we have an international collaboration with Instituto Técnico de Lisboa, where former D.Sc. candidate Luis Felipe developed his thesis.

## 8 Games and Sustainability

The use of games as a means to promote sustainability has gained significant traction in recent years, primarily due to the broad reach and immersive nature of gaming. With the growing global gaming audience, games have emerged as a powerful platform for raising awareness and educating individuals on critical sustainability issues. By leveraging procedural rhetoric as a method, game designers can create compelling and interactive experiences that drive players to think about and engage with sustainable practices.

Procedural rhetoric, a concept introduced by Ian Bogost [48], is the art of persuasion and expression through rules, systems, and mechanics in games. By employing this method, game designers can effectively communicate complex ideas related to sustainability and inspire players to adopt more sustainable behaviors. Games that incorporate procedural rhetoric can model

real-world systems, simulate various scenarios, and allow players to experience the consequences of their actions, thus fostering a deeper understanding of sustainability issues.

One notable aspect of using games as a medium to promote sustainability is their potential alignment with the Sustainable Development Goals (SDGs) of the United Nations. These 17 global goals provide a blueprint for a more sustainable future, addressing critical issues such as climate change, poverty, and inequality. Games that are designed to align with these goals can help players grasp the interconnected nature of these challenges and the role that individuals can play in creating a more sustainable world.

Innovative game designs can focus on specific UN goals or target multiple goals, presenting players with relatable and tangible scenarios that highlight the importance of sustainable actions. For example, a game focusing on SDG 12 (Responsible Consumption and Production) could employ procedural rhetoric to demonstrate the environmental impact of overconsumption and promote responsible decision making among players. By immersing players in realistic situations and providing them with a safe space to experiment and learn, games can foster a greater sense of empathy and understanding of sustainability challenges.

Our approach, guided by prof. Marcos Felipe Magalhães, extends the ESG concept to include people. LUDES has developed two games on sustainability, *Salve a Terra!*, describe in [36, 47], and a game based on ESG+P to be published.

## 8.1 People should be added to ESG

The book *Estratégias para o Desenvolvimento Sustentável ASG+P<sup>8</sup>* (Strategies for Sustainable Development ASG+P) by prof. Marcos Felipe Magalhães presents the 4 pillars of Sustainable Development in an original way: Environmental sustainability, Social Responsibility, Conscious Governance and Humanization of Work, and also addresses the commitments of the ESG+P agenda (adding the dimension People). Readers will also find a practical vision of stakeholder management and hierarchical tools, materiality, and sustainability reporting in the most diverse sectors. The book invites all stakeholders to follow this path of creating values, in order to contribute to an inclusive and regenerative system for all people, organizations, society, and the planet.

## 9 Recent Awards

The laboratory has received several awards for its work, such as the SBGames 2022 Short Paper awards, where it won both the first and second place for papers on board game FAQs [37] and a board game proposal for the cultural appreciation of Brazilian folklore [49]. Additionally,

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<sup>8</sup><https://bit.ly/estrategias-desenvolvimento-sustentavel>

LUDES received the Best Student Paper award at the ABSEL 2022 conference [50] and the D.Sc. Thesis Competition awards at the SBGames 2020 and SBSI 2020 conferences [23]

## 10 Conclusion

LUDES has made significant contributions to the study and development of games, with a focus on ludology, game science, and game engineering. The laboratory has produced valuable research results, received numerous awards, and developed several games demonstrating its expertise in the field. As LUDES continues to explore new areas of research and develop innovative games, it will undoubtedly remain a significant player in the gaming industry and academia.

## 11 LUDES Members

### 11.1 Professor

#### Geraldo Xexéo



- Professor at PESC/COPPE/UFRJ
- Head of LUDES, the Laboratory of Ludology, Engineering and Simulation
- Game Designer: Screener, DiscoverX, and others.
- D.Sc. in Computing and Systems Engineering – COPPE/UFRJ (1995)
- Author of more than 100 articles and one book

## 11.2 Pos-doc

### Marcos Felipe Magalhães



- D.Sc. of Production Engineering – COPPE-UFRJ
- Former COO in Brazil for The Coca-Cola Co.
- Former the president of the Brazilian Association of Advertisers (ABA)
- Author of books on marketing, strategic planning, stakeholder governance, and sustainable development.

### Marcello Paniz Giacomoni



- D.Sc in Education - FACED/UFRGS, with a focus on Teaching History and Rhetoric
- Professor at Colégio de Aplicação/UFRGS
- Game Designer: Feudal War, The Centralizator, The drum trips, Neolithic revolution, Mithistory, and others.
- Author of the book "Games and History Teaching", and other texts about games and education.
- The interaction with Ludes intends to theoretically develop the relationships between elements of game theories with History learning objectives.

## 11.3 D.Sc. Candidates

### Eduardo Mangeli



- D.Sc. Candidate
- M.Sc. in Computing and Systems Engineering - COPPE-UFRJ
- Since 1998 has been a developer, consultant, and manager in the technology services market.
- Game designer: Screener, DiscoverX, 3EGame, CoronaQuiz, and others
- Data Scientist and Team Leader at Coppetec
- Author of more than 10 articles in congresses, one in a journal, and supervised 5 bachelor's dissertations
- Professor at DCC/UFRJ and IBMEC

### Marcus Parreiras



- D.Sc. Candidate
- M.Sc. in Production Engineering - CEFET/RJ
- Lean Six Sigma Black Belt and process improvement expert consultant
- Game Designer of boardgames, videogame and RPG systems, such The MEI Game, Batalha das Lendas, Salve a Terra and others
- Author of MEDIEVAL method
- Author of more than 10 articles in congresses and three in journal
- Process analyst at Coppetec
- Head of Digital Games Research and Development group (PDJD) at CEFET/Nova Iguaçu



### **Leandro Ouriques**

- D.Sc. Candidate
- M.Sc. in Civil Engineering - Computer Systems - COPPE-UFRJ
- Civil servant at Brazilian Navy



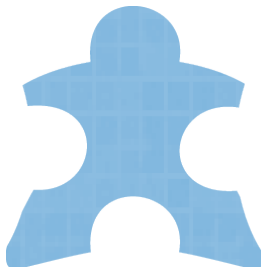
### **Lincoln Magalhães Costa**

- D.Sc. Candidate
- Software Engineering - UTFPR
- Software developer at Coppetec
- Author of more than 15 articles in congresses and one in journal



### **Rafael Studart**

- M.Sc. in Computing and System Engineering
- Stand-up Comedian, Game Designer



### **Farmy Silva**

- M.Sc. in Mental Health IPUB/UFRJ
- Neuroscientist

## 11.4 M.Sc. Candidates



**Eduardo Vale**

- B.Sc. in Computer Science - UFJF

## 11.5 Undergraduate Students



**Pedro Marques**

- Computer Science Undergraduate at UFRJ
- Game Designer: DiscoverX, Mapa do Tesouro, Relic Hunters Legend, Octobot Adventure and others.
- Project member at Coppetec, working as Data Scientist

## 11.6 External Collaborators



**Claudio Dipolitto**

- D.Sc. in Innovation Management
- Associate Instructor in the Berkeley Lean Startup Program
- Creator of user-centered practical process - Inovemus 360 - blending Lean Startup, Design Thinking, and Knowledge Management approaches.
- Author of HoPE Canvas, a tool for designing Purpose-Driven Business Models





### Luis Felipe Coimbra

- D.Sc. in Computing and Systems Engineering – COPPE-UFRJ
- Currently at Instituto Técnico de Lisboa
- Author of Heroic Journeys, a project that promotes full and equal access for girls and women in STEM.



### Tadeu Moreira de Classe

- D.Sc. in Informatics (with focus on Information Systems) – PPGI/UNIRIO
- Professor at PPGI/UNIRIO
- Head of the Research Group on Games to Complex Contexts (JoCCom)
- Author of Play Your Process (PYP) method.



### Renata Mendes Araújo

- D.Sc. in Computing and Systems Engineering – COPPE-UFRJ
- Professor at Mackenzie/SP
- Researcher at University of São Paulo and at Brazilian School on Public Administration/Brasília
- Head of the Research and Innovation Group on Cyberdemocracy



### **Joshua Kritz**

- M.Sc. in Computing and Systems Engineering – COPPE-UFRJ
- Ph.D. Candidate



### **Maya Reys Ricon**

- M.Sc. in Public Administration - FGV
- Project manager and instructional designer expert in Digital Education



### **Juliana Santos Pinheiro**

- D.Sc. in Law
- Professor at UFRRJ

## **11.7 Former Students**

- Marcelo Areas – D.Sc. in Computing and Systems Engineering – COPPE-UFRJ
- Airine Carmo – M.Sc. in Computing and Systems Engineering – COPPE-UFRJ
- Augusto Aciolly – M.Sc. in Computing and Systems Engineering – COPPE-UFRJ
- Bernardo Taucei – M.Sc. in Computing and Systems Engineering – COPPE-UFRJ
- Aimée Mothé – Scientific Initiation
- Henrique Vermelho – Scientific Initiation

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