A Theoretical Model for Game Mechanics: Bridging Design Practice and Education

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Abstract: Game design decision-making involves navigating a complex space of possible mechanics, which presents a significant challenge both for professional designers and for educators seeking to teach the discipline effectively. While existing theoretical models frequently offer high-level conceptual frameworks, these often lack the granularity necessary to support the practical needs of designers who must identify, understand, and apply specific mechanics in diverse game development contexts. This research addresses that gap by outlining the utility of a structured theoretical model that compiles and organises hundreds of individual game mechanics, not only describing them but also demonstrating a practice-oriented rationale. The model has two primary aims: to assist designers in conceptualising and navigating the broad array of mechanical possibilities, thereby supporting creative ideation and analytical problem-solving; and to provide a robust and pedagogically effective foundation for game design education. A theoretical model could bridge the gap between abstract theoretical models and the practical demands of game design practice. A model such as the one described here would enable a more direct and effective translation of theory into practice, equipping designers with a more precise vocabulary and educators with a clearer pedagogical structure for explaining complex gameplay systems. By refining the connection between gameplay theory and design implementation, this research contributes to the evolving body of knowledge in game studies and design education, offering a new perspective on how mechanical complexity can be better understood, taught, and applied in creative contexts. The framework also opens new avenues for further research into game design patterns, player experience, and curriculum development, reinforcing the central role of mechanics in shaping both game systems and player engagement.

Keywords: Game design, Game mechanics, Digital games, Gameplay

1. Introduction

Digital games are complex artefacts whose development involves a range of disciplinary fields, including art, technology, and usability. Among these, game design occupies a central position. Professionals working in this area are responsible for formulating the game's overarching vision, often in close collaboration with experts from other disciplines. However, their most fundamental responsibility (and the one over which they exert the greatest control) relates to the game's rules. The quintessential act of game design is the formulation of these rules (Schell, 2011).

From an academic perspective, it is useful to conceptualise game design as comprising two interrelated subfields. The first concerns the design process itself, encompassing activities such as prototyping, playtesting, and documentation (Novak, 2011). This subfield investigates how a game concept is developed. The second relates to knowledge about the game as an object and its relationship with the player: its properties, functions, meanings, and, most importantly, the experiences it enables. Comparatively, this second domain addresses what the game is intended to become. Lankoski and Holopainen (2017) describe this distinction using the terms design praxeology (the study of design practices) and design phenomenology (the study of the experiences elicited by designed artefacts). This study aligns with the latter: it constitutes an in-depth investigation into the knowledge surrounding the experiences that emerge from player-game interaction, with the aim of informing the most iconic function of the game designer — deciding which rules, or mechanics, are to be implemented.

The term game rules applies to all types of games, such as chess or football. In traditional games, adherence to rules is typically ensured by an external agent, such as a referee or the players themselves. In digital games, however, rules are generally pre-programmed and operate akin to physical laws within the virtual environment, being enforced automatically by the system. In this context, rules are frequently referred to as mechanics, a term that highlights the intrinsic and typically immutable functioning of the system. For the purposes of this study, the definition of mechanics follows that proposed by Hunicke, LeBlanc, and Zubek: "Mechanics are the various actions, behaviors and control mechanisms afforded to the player within a game context. Together with the game's content (levels, assets and so on) the mechanics support overall gameplay dynamics." (2004, p. 3).

A central responsibility of the game designer, then, is to determine which mechanics should be implemented. Designers are presented with a vast array of options. Would a game benefit more if the protagonist could fly, or

teleport? A key challenge in game design lies in navigating this extensive design space. This challenge invites us to reflect on what game designers know to make such decisions, highlighting the importance of maps and frameworks in organising knowledge for practical application. In this sense, investigating how to structure the knowledge that game designers need and use becomes an enquiry into the epistemology of game design. According to Lankoski and Holopainen (2017),

> *The game design epistemology is concerned with what kinds of knowledge game designers have and employ in their design practice. Investigations of explicit and implicit conceptual design frameworks and studies of how designers use examples from existing games to frame design situations are part of game design epistemology.*

This research is situated within the broader challenge of organising knowledge in game design, aiming to integrate diverse perspectives. However, the knowledge that requires structuring lies at the intersection of two other dimensions of design: praxeology and phenomenology. In this regard, the study aligns with a phenomenological approach, insofar as the knowledge under examination pertains not to the design process itself (e.g., prototyping or creative workflows), but rather to the nature of the game object and its interaction with the player—in other words, the player experience.

2. Game Design Patterns and Theoretical Model Structures

One of the established strategies for categorising game mechanics involves the use of game design patterns, as outlined by Björk and Holopainen (2005). The authors define game design patterns as “semiformal interdependent descriptions of commonly reoccurring parts of the design of a game that concern gameplay” (Björk & Holopainen, 2005, p. 34). These patterns are considered "semi-formal" because they are not exhaustive; rather, they are meant to be interpreted and adapted according to specific design contexts. The authors propose that each pattern be described using the following components: (i) name, (ii) definition, (iii) general description, (iv) modes of use, (v) consequences for player experience, (vi) relationships with other patterns, and (vii) references.

Their compendium includes over 160 design patterns, grouped into categories such as: (i) game elements, (ii) resource management, (iii) information, communication, and presentation, (iv) actions and events, (v) narrative and immersion, (vi) social interaction, (vii) goals, (viii) goal structures, (ix) game sessions, (x) mastery and balance, and (xi) metagame, replayability, and learning curves. While Björk and Holopainen’s contribution is notable for its breadth, the extensive list of patterns has led subsequent studies to narrow their focus to specific contexts — such as social network games (Lewis, Wardrip-Fruin, & Whitehead, 2012), first-person shooters (Hullett & Whitehead, 2010), or the analysis of so-called “dark” patterns, where design choices may conflict with player interests (Zagal, Björk, & Lewis, 2013).

This research contributes to the theoretical landscape by proposing the need of a model that foregrounds the designer’s perspective, examining the problem through the lens of mechanics while seeking conceptual bridges to the dimension of experience, which has received more extensive attention in other frameworks. Existing methods for organising mechanics include Schell’s (2011) structural approach in his chapter on game mechanics, as well as Samarasinghe et al.’s (2021) taxonomy of board game rules. This paper contends that a robust model should articulate the relationships between digital game mechanics and types of player experience, thereby supporting designers in both professional practice and educational contexts. The central research question may be framed as follows: Can a theoretical model that integrates digital game mechanics and dimensions of player experience enhance the understanding and teaching of game design?

3. Teaching the Design of Game Mechanics

The proposal of a theoretical model necessarily invites reflection on its application and utility. The value of such a model can be considered across two key dimensions: epistemological and pedagogical.

The epistemological dimension is informed by Lankoski and Holopainen’s (2017) conceptualisation of epistemology in design, referring to the ways in which knowledge is structured and evaluated in the field. In this sense, a theoretical model that organises knowledge of game design and gameplay offers scholars a new lens through which to interpret the digital game phenomenon. From this vantage point, knowledge is not direct but mediated — filtered through theoretical constructs that inform one’s perception and analysis.

Such models are instrumental to the maturation of the discipline. For instance, they can help identify which types of mechanics have been thoroughly investigated and which remain underexplored. They function as cartographic tools, enabling researchers to navigate the intellectual terrain of the field more effectively.

The pedagogical or didactic dimension of the model lies in its potential to structure how knowledge is communicated and taught. One illustrative moment in the first author's professional trajectory exemplifies this need. Following a curriculum revision of the Game Design course at Universidade do Vale do Itajaí (Brazil), a module entitled Theory of Gameplay was introduced, specifically to address the player's experience, with an emphasis on game mechanics. This module engaged with one of the four key dimensions necessary for understanding digital games, as proposed by Zagal (2008):

> *In addition to being able to able pick out elements of a game's design, it is important to understand how the interaction between these elements helps create a certain experience for the player. Understanding a game from this perspective is akin to being able to articulate why playing a game makes the player feel a certain way. From a game designer's perspective, this sort of insight and understanding is crucial when trying to map the design goals (I want the players to have this kind of experience) with a means of achieving those goals (I will use these elements, in these ways). (…) In summary, to better understand a game it is important to understanding its components, how they interact, and how they facilitate certain experiences in players.*

Since 2020, the first author has taught the module Theory of Gameplay, and this experience has underscored the challenges involved in organising scattered knowledge for pedagogical purposes. It has become apparent that this body of knowledge constitutes an emerging disciplinary field that demands greater coherence and structure. In this light, the theoretical model proposed may function as a conceptual map, delving deeply into selected areas while also indicating directions for future inquiry. Its pedagogical potential extends beyond the first author's individual teaching practice, offering a conceptual framework that could be employed in a variety of educational settings: short courses, undergraduate and postgraduate programmes, or professional development for practitioners in the games industry.

One of the major strengths of a model that organises knowledge lies in its capacity to structure the learning process for both educators and students. Zagal (2010) highlights the difficulties associated with learning about game design patterns in a field where knowledge remains fragmented:

> *Many game designers and professionals, noting the lack of a unified vocabulary for describing existing games and thinking through the design of new ones, have called for a design language for games (...) This calls have been answered in multiple ways. For instance, many of the proposed approaches focus on offering aid to the designer, either in the form of design patterns (...), which name and describe design elements, or in the closely-related notion of design rules, which offer advice and guidelines for specific design situations (...) The ever-growing size of collections of gameplay design patterns, design rules, or terminology can be daunting to students who may easily feel overwhelmed and not know from were to start. (Zagal, 2010, pp. 90-91)*

The challenge of teaching digital games is a relatively recent development. According to a study by Carvalho (2021), based on data from the Brazilian Ministry of Education (MEC), there are 4,116 undergraduate courses in Digital Games or Game Design in Brazil, the majority of which are offered via distance learning. The study indicates that this number reflects steady annual growth since approximately 2010, a time when such courses were still rare in the country. It is therefore evident that higher education in digital games remains in its infancy when compared to more established academic fields. Within this context, it is unsurprising that the teaching of one of digital games' most distinctive areas (gameplay) remains underdeveloped. This observation reinforces the need for robust theoretical models to support and structure the teaching and learning processes within the field.

4. Previous Models of Player Experience Possibilities

Among scholars, the analysis of experiential possibilities generated by games is notably diverse. Even when proposing more systematic frameworks for conceptual organisation, academic literature often neglects the role of specific game mechanics, focusing instead on broader constructs, referred to here as dimensions of player experience.

A seminal contribution in this domain is Caillois's Man, Play and Games (2017), originally published in 1961, well before the popularisation of digital games. Caillois identifies four dimensions of experience (which can also be

interpreted as types of games): agon (competition), alea (chance), mimicry (simulation), and ilinx (vertigo), along with a duality between ludus (discipline) and paidia (spontaneity). While Caillois offers detailed discussion of these six concepts and their interrelations, their practical application is left to the discretion of readers or game designers. Where can I find a list of mechanics that will foster the experience of competition, for instance? A significant gap remains in the literature: the absence of a theoretical model that systematically integrates digital game mechanics with dimensions of gameplay experience — one that articulates how abstract principles can be operationalised in concrete design decisions.

Another influential work, particularly within the domain of digital games and learning, is the chapter by Malone and Lepper (1987). Although focused on educational games, the authors propose a taxonomy of elements that stimulate intrinsic motivation, including challenge, goals, uncertain outcomes, self-esteem, curiosity (both sensory and cognitive), control and power, agency, choice, fantasy (endogenous and exogenous), cooperation, competition, and recognition. Their work inspired further models linking game mechanics to learning outcomes, such as that of Arnab et al. (2015), who mapped game mechanics from the literature to corresponding educational objectives.

Also within psychology, though approaching from a motivational rather than pedagogical perspective, Przybylski, Rigby, and Ryan (2010) proposed a motivation model for digital games. Drawing on self-determination theory, they argue that motivation in gameplay stems from the fulfilment of three core needs: competence, autonomy, and relatedness.

An important source of knowledge in this field comes from books authored by industry professionals. Notable examples include works by Novak (2011), Rogers (2012), Schell (2011), and Schuytema (2008), as well as the work by Martinho, Santos, and Prada (2014). These texts are meant for an audience of practitioners, thus their reflections on game mechanics are typically empirical and fragmented, lacking a consistent framework to systematise knowledge. Even Koster (2013), who sought to formulate a theory of fun in games, did little to advance the organisation of concepts and mechanics into a coherent structure.

Among professional designers, Schell (2011) stands out for proposing a clearer categorisation of design elements: (i) space, (ii) objects, attributes, and states, (iii) actions, (iv) rules, (v) skill, and (vi) probability. This classification was later developed by Wang and Huang (2021) in their model for serious game design. Schell's contribution is notable for its theoretical ambition: he presents his categories not merely as pedagogical aids, but as a taxonomical model intended to organise knowledge about games. Other authors, by contrast, use similar categories simply to structure their discussions, without proposing that these could serve as a general framework for understanding gameplay across contexts. As such, their classifications often appear arbitrary or lack internal coherence.

In similar lines, Fullerton (2008) describes formal elements of games as goals, procedures, rules, resources, conflict, boundaries, and systems—a taxonomy akin to that of Crawford (2003), who categorises elements as play, challenges, conflicts, and interaction. Schuytema (2008) introduces the concept of "atoms" as essential principles common to all game genres. These include abstract concepts such as clear goals, agency, coherent interfaces, and understandable contexts. The book offers numerous examples (e.g. nested victories, rest points, comeback mechanics, varied challenges), without establishing a systematic categorisation. Brathwaite and Schreiber (2009) adopt multiple classificatory strategies, such as "atoms" (mechanics, dynamics, goals, themes), types of challenge (e.g., puzzles, lateral thinking, spatial intelligence, strategy), but again without a cohesive taxonomy of mechanics. Rogers (2012) structures his material around the "3 Cs": character (and abilities), camera (view perspective), and control (input method), adding a chapter on HUD elements. While some mechanics are described, the classification lacks systematicity. Novak (2011) is somewhat more structured, discussing player motivations (e.g., mastery, escapism, social interaction), types of interactivity, challenge formats, and aspects of game theory, but offers only limited treatment of specific mechanics.

The academic literature has also engaged with this issue. Salen and Zimmerman (2004) provide a comprehensive framework, categorising game systems into emergent, probabilistic, informational, cybernetic, and game-theoretical systems. They likewise examine five types of playful experience (pleasure, meaning, narrative, simulation, and sociability) and explore the cultural dimensions of games. Martinho, Santos, and Prada (2014) similarly compile frameworks from multiple authors.

Occasionally, efforts to link experiential concepts to concrete mechanics focus on specific gameplay dimensions. Research supervised by the first author includes: Faria and Albuquerque (2019) on the use of time-travel mechanics across genres; Urbainski and Albuquerque (2023) on mechanisms that evoke horror; and Germer and

Albuquerque (2022) on the role of puzzles in gameplay. Noteworthy here is the Playful Thinking Series (MIT Press), where Costikyan (2013) discusses uncertainty, Juul (2013) examines failure, and Isbister (2016) explores emotion in games. These works effectively translate design concepts into practical examples but do not constitute broader theoretical models.

One attempt to systematically map the factors contributing to fun in games was proposed by Albuquerque (2011) and later developed in Albuquerque and Fialho (2015). Based on a synthesis of the literature, their model proposes twelve elements of fun distributed across four quadrants, reflecting tensions between creative and destructive impulses, and between passive appreciation and active interaction. The model is operationalised via a questionnaire that maps player preferences, resulting in eight player profiles. Similarly, Lazzaro (2004) proposed four types of fun (hard fun, easy fun, altered states, and social fun) and identified seven emotional drivers (e.g., fear, pride, awe).

Typologies of player profiles have long been used to capture the diversity of gaming experiences. Bartle (1996) proposed one of the earliest, dividing players into killers, achievers, socialisers, and explorers, based on MUD players. A related framework is Brainhex (Nacke, Bateman, & Mandryk, 2014), which, while retaining some of Bartle's profiles, adds others (e.g., seeker, survivor, mastermind, daredevil), grounding its typology in neurophysiological responses to gameplay.

Although Bartle's and Brainhex's models are influential, a more recent and empirically grounded typology by Nick Yee has gained prominence. Drawing on extensive player data, Yee and Quantic Foundry (2022) propose six categories—Action, Social, Mastery, Achievement, Immersion, and Creativity—each subdivided into two dimensions. These combine to produce nine distinct player profiles, such as Acrobat, Architect, or Gladiator.

While such typologies offer valuable insight into user experience, they adopt a player-centred, rather than object-centred, perspective. Thus, in the context of game design, a crucial step is translating these insights into mechanics that elicit the desired experiences. Patzer, Chaparro, and Keebler (2020) take a step in this direction by proposing links between player types and experiential outcomes (e.g., "social connection", "creative freedom"), although they do not specify associated mechanics.

From this standpoint, the integrative model proposed here aims to fill this gap by linking gameplay principles to specific mechanics — viewing the latter as design solutions to elicit targeted experiences.

A rare example of a model focused on the mechanics themselves, rather than abstract concepts, is the study by Samarasinghe et al. (2021). Drawing on a board game database, they categorise dozens of mechanics into seven broad groups. While their methodology, based on statistical analysis, and object of study (board games) differ from those of the present research, their approach to clustering concrete mechanics serves as a valuable reference.

5. Final Considerations

This paper, as part of a doctoral research colloquium, aims to outline the gap that the thesis seeks to address. The intention here was not to elaborate on the methodological procedures behind the development of the model (something that is still in progress) but rather to clarify the nature of the work being undertaken and the direction in which it is heading. The argument presented thus focuses on justifying both the necessity and the utility — both epistemological and pedagogical — of a model such as the one proposed, while also demonstrating, through the literature, the challenges previous researchers have faced in establishing a connection between gameplay experiences and the mechanics capable of generating them.

Naturally, the proposed model cannot encompass every possible game mechanic, what would be an impossible task. Its aim is to compile and organise a sufficiently broad range of mechanics to offer a model capable of supporting the analysis and categorisation of those not explicitly included. In this way, a game designer or educator in the field, upon understanding the model, would be able (through critical reflection and practical experimentation) to infer where new or unclassified mechanics might be situated within the proposed framework.

In order to demonstrate the utility of the theoretical model, an educational card game is currently being developed alongside the model's ongoing refinement. The purpose of the card game is to create a learning experience focused on digital game mechanics, serving as an example of how a clearer structuring of knowledge in game design can operationalise teaching and learning experiences within a field whose pedagogical tradition is still relatively young. The expectation is that the model will act as a starting point for further initiatives within the discipline, both for practitioners, researchers and game design teachers.

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