A Taxonomy of Game Balancing Elements

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Abstract. *This study constructs a comprehensive taxonomy of game balancing elements using the Grounded Theory methodology. The taxonomy aims to aid game developers in understanding the factors influencing game balance, thereby informing design decisions. The research contributes to game studies by providing a theoretical foundation for further exploration and has potential implications for the development of industry guidelines and best practices.*
Keywords. *Game Balance, Taxonomy, Balancing Elements, Game Engineering*

1. Introduction

This study aims to contribute to the field of game design and academic research by providing a comprehensive taxonomy of game balancing elements, created based on the Grounded Theory methodology. The proposed taxonomy can serve as a valuable resource for game developers, helping them better understand the elements that influence game balance and make more informed decisions during the design process. Additionally, it is expected that this taxonomy will contribute to the advancement of knowledge in the field of game studies, providing a solid theoretical foundation and opening up new research possibilities. The potential impact of this taxonomy ranges from the development of more balanced and engaging games to the creation of guidelines and best practices for the game industry as a whole.

Video games have become a popular form of entertainment, offering engaging and challenging experiences to players. To maintain players' interest over time, it is crucial for games to be balanced. Game balancing involves the implementation of elements that ensure fun, challenge, and fairness in gameplay.

In this context, the main objective of this study is to use the Grounded Theory methodology [Hook 2015] to create a comprehensive taxonomy of game balancing elements. The Grounded Theory methodology is a widely used qualitative approach in social studies, which relies on data collection and analysis to develop theories grounded in the data itself, rather than starting from pre-existing theoretical assumptions [Hook 2015].

Furthermore, creating a taxonomy of balancing elements is crucial for game research and development as it provides a means of classification and understanding of these elements, allowing for in-depth analysis and a solid foundation for future research. This paper aims to examine the benefits and challenges of this approach, as well as explore the potential of this taxonomy to enhance game design.

This article will be divided into sections, each addressing important aspects for the proposal of a taxonomy for game balancing elements: Section 2 details the methodology used; Section 3 describe the application process of the grounded theory methodology; Section 4 presents the resulting taxonomy; Section 5 explains how the resulting model relates to the literature; finally, in Section 6, the conclusion of the work is presented, with comments on future work.

2. Methodology

Our methodology was based on the principles of Grounded Theory (GT), a qualitative research method [Stol et al. 2016, Hook 2015]. Following GT, we conducted data coding. Our stopping criterion was to achieve saturation of game balancing elements, where additional mechanics do not provide new information [Hook 2015].

The data was obtained from playing the games, reading their wikis and manuals, watching streaming sessions, and participating in brainstorming meetings, where relevant characteristics of game balancing mechanics were analyzed. Through iterative analysis, we developed theoretical constructs that offered insights into the dynamics of the gameplay experience. Following the structure of GT, related works were studied and discussed after the final coding phase. The following stages of GT were adopted: Initial Coding, Focused Coding, Axial Coding and Theoretical Coding.

3. Grounded Theory Application

When analyzing the elements of game balancing, it was identified that there was no comprehensive and complete database that encompassed all the mechanics present in games. Therefore, it was necessary to adopt an adapted approach of Grounded Theory, with an additional step to collect and structure this information. Since our database consists of game mechanics and dynamics, some adaptations were made in each stage. In the following paragraphs, we detail the decisions used in the research.

In the **Initial Coding** stage, instead of directly analyzing the raw data collected, such as interviews or observations, we used different sources of information about the games, such as fragments of wikis, gameplay videos, and our own memory of experiences with the games. These sources were meticulously explored to identify the main balancing mechanics present in the games under study.

Once the balancing mechanics were identified, we proceeded to analyze each of them in their context within the game. In the **Focused Coding** stage, we assigned a balancing element to each mechanic, using more generic names that represented what could be balanced in the game, that is, what could be modified to make the game easier or more difficult. These balancing elements were noted and organized for further analysis.

In the **Axial Coding** stage, we grouped the identified balancing elements into categories. These categories were established based on the relationships and similarities between the elements, allowing for a more structured organization of the data. The categories were created to facilitate understanding of the different dimensions and aspects of game balancing.

Finally, in the **Theoretical Coding** stage, we observed and described the relationship between the established categories. We analyzed how different balancing elements interconnect and influence each other in the context of games. This analysis allowed us to gain a deeper understanding of the dynamics of game balancing and describe the relationships among the identified categories.

For the purposes of analysis, the games selected for this study were predominantly progression-based and belonged to the action or adventure genres. These games are known to feature a continuous narrative and progressive enhancements for the characters, allowing players to advance through challenges and achievements. The progression in these games is intrinsically linked to the balance of game mechanics. As players progress, they face increasingly difficult challenges, requiring careful adjustments to the balancing elements to keep the game challenging and enjoyable.

3.1. Grounded Theory Results

We initially began with a comprehensive list of 20 games to ensure that we had a substantial pool to work with. Our objective was to analyze approximately 15 mechanics per game, focusing on the core flow of each title. This approach allowed us to delve into the essential aspects of gameplay that contribute to game balance.

Since we employed the Grounded Theory methodology, our stopping criterion was reaching saturation, the point at which exploring new mechanics no longer yielded novel elements of balance. This occurred around the 120th mechanic, during the analysis of the seventh game, Ghost Recon Wildlands. We decided to continue analyzing an eighth game, Dicey Dungeon, and discovered a single new element. Continuing with the analysis, we examined a ninth game, but no new elements emerged. Finally, when analyzing the tenth game, no new elements were found, leading us to conclude our analysis.

Table 1 provides a clear representation of the ten games analyzed, along with the number of mechanics analyzed and the number of new elements discovered in each game. Notably, as the number of mechanics increased, the number of new elements decreased, indicating a saturation point in our analysis.

This systematic and exhaustive approach allowed us to establish a comprehensive understanding of game mechanics and their contribution to balance. The resulting taxonomy, comprising 24 distinct elements of balance, serves as a structured framework for further exploration and analysis. It provides valuable insights into the intricate relationships and dependencies among these elements, shedding light on how they collectively shape the equilibrium of a game.

Game	**Genre**	**Observed Mechanics**	**New Elements**
Final Fantasy Tactics	Tactical RPG	15	7
New Super Mario Bros.	Platformer	18	6
Captain Commando	Beat ’em up	13	4
Metal Slug X	Run and Gun	18	1
Pokémon Black 2	Adventure RPG	15	2
Diablo 2	Action RPG	19	3
Ghost Recon Wildlands	Third-Person Shooter	15	0
Dicey Dungeons	Roguelike	16	1
Nine Parchments	Action and Magic	15	0
Dragon Age Origins	Action RPG	13	0

Table 1. Selected Games and their respective result contribution

3.2. Theorical Coding

In this subsection, we present the results of the Theoretical Coding phase of our Grounded Theory analysis, where we systematically compared and analyzed the seven groups of balancing elements identified in game design. By examining the interconnections and relationships among these groups, we aim to gain a deeper understanding of how they contribute to the overall balance and gameplay experience in a game.

Strategy Development and **Decision Planning** are closely linked, as the availability of diverse strategies allows players to make informed decisions. By providing players with multiple strategic options, the game accommodates different playstyles and encourages creative thinking. Thoughtful decision-making, in turn, leverages the strategic options available, enhancing the depth and complexity of the gameplay.

Event Simulation and **Gameplay Constraints** create a delicate balance between unpredictability and structure. **Event Simulation** introduces dynamic elements that keep players engaged and excited, while **Gameplay Constraints** define the boundaries within which players must navigate. This combination prevents the game from feeling excessively random or overly restrictive, maintaining a balanced and fair experience.

The relationship between **Players' Performance** and **Player Punishment** ensures a fair challenge for players. **Players' Performance** refers to their skill and effectiveness in interacting with the game mechanics, while **Player Punishment** introduces consequences for actions or decisions. By balancing these two elements, the game rewards skillful play and holds players accountable for their choices, fostering a sense of accomplishment and promoting a fair and balanced experience.

Pressure Management influences all other groups by modulating the intensity of gameplay. It provides moments of relief and relaxation to counterbalance challenging or stressful situations. By effectively managing pressure, the game ensures that players can enjoy the experience without feeling overwhelmed or frustrated, contributing to a balanced and enjoyable gameplay experience.

When all these groups of elements work together, they create a synergistic balance that enhances the overall gameplay. **Strategy Development** and **Decision Planning** empower players to make meaningful choices, while **Event Simulation** and **Gameplay Constraints** introduce excitement and structure. **Players' Performance** and **Player Punishment** maintain fairness and accountability, while **Pressure Management** ensures a comfortable and enjoyable experience.

4. Introducing the Taxonomy of Game Balancing Elements

In this section, our focus is on presenting the taxonomy that has been developed by consolidating all the 24 identified elements pertaining to game balance. As anticipated during the coding process, these elements have been meticulously categorized, resulting in the creation of a hierarchical model illustrated in Figure 1. By employing this model, we can capture the intricate relationships and dependencies among the different elements of game balance. It allows us to explore the interplay between various factors and gain a deeper understanding of how they contribute to the overall equilibrium of a game.

The 24 elements were grouped in seven categories: Player Punishment, Gameplay Constraints, Player's Performance, Decision Planning, Pressure Management and Strategy Development. In the following subsections, we will provide a detailed description of each category within the taxonomy. To facilitate comprehension, we will accompany each category with a few illustrative examples that help to further elucidate the concepts involved.

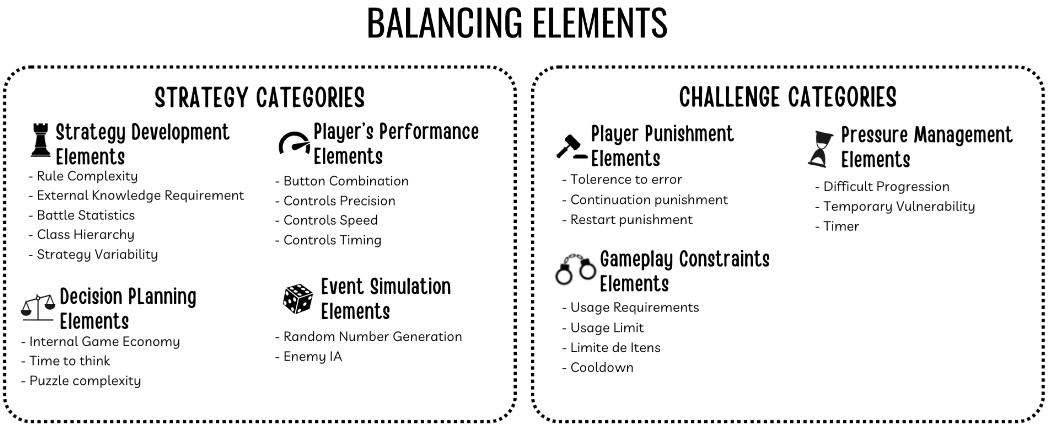

Figure 1. Visual Diagram of the Taxonony

4.1. Strategy Categories

The strategy categories within the taxonomy of game balancing focus on enhancing the depth and complexity of gameplay by offering players a range of strategic choices and options.

Strategy development involves the depth and complexity of the game's rules, mechanics, and interactions, as well as the strategic choices available to players. It encompasses aspects such as the complexity of rules and systems, the need for external knowledge to gain a strategic advantage, and the variability of strategies and approaches.

4.1.1. Strategy Development Elements

These elements focus on the depth and complexity of the game's rules, mechanics, and interactions, as well as the strategic choices available to players. By providing a range of options and requiring players to think strategically, these mechanics enhance the depth and replayability of the game.

- **Rule Complexity**: Refers to the degree of complexity of the game's rules and systems, including mechanics, interactions, and limitations, which may require a deeper understanding for success. Examples are spell combinations (Diablo 2) and crafting system (Dragon Age Origins).
- **External Knowledge Requirement**: Requires players to obtain information or knowledge external to the game to gain a strategic advantage, such as consulting guides or online communities. Examples are hidden items locations (Metal Slug X) and secret areas (New Super Mario Bros.).
- **Battle Statistics**: Attributes and characteristics that influence the performance of characters or enemies in combat, such as strength, agility, endurance, etc. Examples are weapon power (Captain Commando) and move power (Pokémon Black 2).

- **Class Hierarchy**: Determines how different classes or characters in the game interact with each other, influencing strategy and the balance of abilities and roles in the game. Examples are job system (Final Fantasy Tactics) and class synergy effects (Dragon Age Origins).
- **Strategy Variability**: Offers players different options and approaches to overcome challenges in the game, allowing adaptation to different situations and playstyles. Exemples are different weapon types (Metal Slug X) and branching quests (Dragon Age Origins).

4.1.2. Decision Planning Elements

In the context of game balance, "Decision Planning" refers to the concept of strategizing and carefully considering the game's rules and mechanics in order to make informed decisions. It involves analyzing the available options, evaluating potential outcomes, and formulating a plan of action based on the player's goals and the constraints of the game.

- **Internal Game Economy**: Involves the game's economic system, where players can exchange points, money, or resources for items that offer advantages, creating a balance between progression and available resources. Examples are item trading (Diablo 2) and resource management (Ghost Recon Wildlands).
- **Time to Think**: Determines the time that the player has to make decisions during the game, especially in turn-based combat situations or events with limited time, requiring quick and efficient decision-making. Examples are Turn-based combat (Final Fantasy Tactics) and timed puzzles (New Super Mario Bros.).
- **Puzzle Complexity**: Refers to the intellectual challenges and puzzles presented to players in the game, which require logical reasoning, problem-solving skills, and knowledge of the game to find solutions and advance in the story. Examples are Riddle-solving (Diablo 2) and sequence puzzles (Nine Parchments).

4.1.3. Event Simulation Elements

Event simulation in the context of game balance refers to the incorporation of random or simulated events within the game mechanics to create unpredictability and challenge for the players. These events can have a significant impact on gameplay and contribute to the overall balance of the game.

- **Random Number Generation**: Introduces random elements into the game, such as combat outcomes, loot, or events, that can affect the progress and challenges faced by players. Examples are random loot drops (Diablo 2) and treasure chest contents (Nine Parchments).
- **Enemy AI**: Defines the artificial intelligence of computer-controlled enemies, determining their behavior, strategies, and difficulty. Examples are flanking maneuvers (Ghost Recon Wildlands) and adaptive difficulty (Pokémon Black 2)

4.1.4. Player's Performance Elements

Player performance in the context of game balance refers to the skill, ability, and effectiveness of players in interacting with and mastering the game mechanics. It encompasses various aspects that can impact gameplay, challenge, and overall balance.

- **Button Combination**: Involves performing specific button sequences or combinations to execute special moves or abilities in the game. The only example in the observed mechanics are special moves (Captain Commando).
- **Controls Precision**: Requires players to hit precisely commands to achieve desired results. Examples are platforming jumps (New Super Mario Bros.) and aiming accuracy (Ghost Recon Wildlands). Note that time is not involved.
- **Controls Speed**: Demands players to be fast and agile in executing commands to respond to the game's challenges. Examples are time-based challenges (New Super Mario Bros.) and quick reflexes (Metal Slug X).
- **Controls Timing**: Involves the a precise reaction and execution in terms of time. Games can use these elements in attacking, dodging, or blocking at the precise moment. Examples are parrying attacks (Captain Commando) and dodging projectiles (Metal Slug X).

4.2. Challenge Categories

The challenge categories in game balancing introduce constraints and pressures to create a balanced and engaging gameplay experience. They ensure fair gameplay and prevent overuse or abuse of certain mechanics.

Pressure management elements add various forms of pressure to the gameplay, challenging players to make quick decisions and strategize effectively. In contrast to the strategy elements, which focus on offering strategic choices and options, the challenge elements introduce constraints and pressures to maintain fairness and create a dynamic gameplay experience.

4.2.1. Player Punishment Elements

Game balance elements related to player punishment involve the consequences or penalties imposed on players for their actions or decisions within the game. These elements are designed to maintain fairness, challenge, and progression in the gameplay experience.

- **Tolerance to error**: Allows players to make errors without suffering penalties, without losing lives or having to restart. Examples are Health regeneration (Captain Commando) and shield skills (Nine Parchments).
- **Continuation punishment**: Allows players to make mistakes during the game, but with penalties that can lead to the loss of lives or continuation. Examples are limited lives (New Super Mario Bros.) and limited restarts to loss of progress (Ghost Recon Wildlands).
- **Restart punishment**: Requires players to perform specific actions or make certain decisions to avoid restarting a level or section of the game. Examples are failed mission restart (Ghost Recon Wildlands) and level reset (Dicey Dungeons).

4.2.2. Gameplay Constraints Elements

Game balance elements related to gameplay constraints involve limitations and restrictions placed on players' actions and abilities. These constraints are designed to add strategic depth, prevent overuse or abuse of certain mechanics, and create a balanced and fair gameplay experience.

- **Usage Requiremnts**: A necessary condition that must be met for a specific ability, item, or mechanic to be used. Examples are skill prerequisites (Final Fantasy Tactics) and equipment level requirements (Dragon Age Origins).
- **Usage Limit**: A restriction on the number of times an ability, item, or mechanic can be used within a certain period of time or in a specific situation. Examples are limited ammo (Metal Slug X) and Power Points (Pokémon Black 2).
- **Cooldown**: The waiting time required before an ability or action can be used again after being activated, limiting excessive usage and encouraging skill management strategies. Examples are ability recharge time (Dicey Dungeons) and spell cooldowns (Diablo 2)
- **Item Limit**: Establishes a restriction on the quantity of items a player can carry in the game, requiring strategic choices regarding which items are more important and should be carried. Examples are inventory space limitations (Diablo 2), and equipment-based skill system (Dicey Dungeons).

4.2.3. Pressure Management Elements

Pressure Management elements add various forms of pressure to the gameplay, challenging players to make quick decisions and strategize effectively. By introducing time constraints and temporary vulnerabilities, these mechanics enhance the sense of urgency and create a dynamic and engaging experience.

- **Difficult Progression**: Increases the game's challenge gradually over time, providing a learning curve and maintaining players' interest. Examples are increasing enemy difficulty (Diablo 2) and complex boss fights (Final Fantasy Tactics).
- **Temporary Vulnerability**: Creates moments when players are temporarily more susceptible to damage or negative effects, increasing the challenge and the need for strategy. Examples are vulnerability windows after enemy attacks (Captain Commando) and status ailment effects (Pokémon Black 2).
- **Timer**: Introduces a time limit for completing tasks, objectives, or challenges in the game, increasing pressure and requiring players to make quick decisions. Examples are time-limited quests (Diablo 2) and timer level (New Super Mario Bros.).

5. Related Work

Now that we have our proposed taxonomy in place, we can proceed to compare this work with other related studies. It's worth noting that in the Grounded Theory methodology, this step typically comes after the study's results to prevent bias, in contrast to the conventional order.

To compare our work with related studies, we present a selection of research in the field of game balancing. Schreiber (2022) conducted a study that highlights various types of balance in games, including mathematical, object and difficulty balance. He also describes balanced initial conditions, balance between strategies and balance as fairness[Schreiber and Romero 2022]. His analysis provides a comprehensive understanding of the different dimensions of the theme.

Sirlin (2009) contributed to the field of game balancing by discussing balance as a feeling that players have during gameplay [Sirlin 2009]. He emphasizes the importance of achieving harmony among all parts of the game, similar to the concept of Quality Without a Name (QWAN). His work highlights the need to consider not only the mechanics of the game but also the player experience.

Koster (2013) advocates for the need for visual and graphical representations in games, comparing them to creating data models or building blueprints [Koster 2013]. He argues that these representations can facilitate understanding of the game and prediction of its characteristics. His work emphasizes the importance of more formal approaches in game development, using languages, notations, patterns, and modeling and simulation tools.

Chen et al. (2014) addressed the challenge of game balancing in esports, massively multiplayer online games (MMORPGs), and multiplayer online battle arena games (MOBAs) [Chen et al. 2014]. They emphasized the importance of balancing the game during gameplay to provide a fair and competitive experience for players. Their work highlights the need to consider different strategies and tactics used by players and seek a balance between them.

Adams et al. (2012) investigated prototyping methods used in game development [Adams and Dormans 2012]. They identified three main approaches: paper prototyping, software prototyping, and physical prototyping. Each approach has specific advantages and challenges. Their work emphasizes the importance of choosing the appropriate prototyping approach to effectively balance the game, taking into account the speed of construction, fidelity of representation, and ability to adjust game mechanics.

Van Rozen (2020) highlights the difficulty faced by designers in creating games that provide impactful interactive experiences and significant aesthetic impact [Van Rozen 2020]. He emphasizes that when this experience is achieved, games gain attractiveness, educational value, and persuasive power, becoming objects of interest to society as a whole. His work underscores the importance of game balancing to ensure a satisfying and engaging gameplay experience.

In comparison to these related works, our taxonomy offers a systematic classification of game balancing elements, providing a structured framework for understanding and analyzing the factors that contribute to game balance. While previous studies have approached game balancing from various angles, our work focuses on categorizing and organizing the specific elements that influence balance, offering a practical resource for game developers.

6. Conclusion

This study has presented a comprehensive taxonomy of game balancing elements using the Grounded Theory methodology. The taxonomy provides a structured framework for understanding the factors that influence game balance and can serve as a valuable resource for game developers in making informed design decisions. By categorizing and analyzing various elements of game balance, this research contributes to the field of game studies by providing a theoretical foundation for further exploration.

The taxonomy consists of 24 distinct elements grouped into seven categories: Player Punishment, Gameplay Constraints, Player's Performance, Decision Planning, Pressure Management, Strategy Development, and Event Simulation. Each category captures different aspects of game balance and sheds light on the interplay and dependencies among these elements. The taxonomy offers insights into how these elements collectively shape the equilibrium of a game, enhancing its depth, complexity, and replayability.

Moving forward, there are several potential directions for future research in this area. Firstly, further validation and refinement of the taxonomy can be pursued by conducting empirical studies and incorporating feedback from game developers and players. This would help strengthen the taxonomy's applicability and relevance in practical game design contexts.

Additionally, exploring the relationships between different elements and their impact on player experience could provide valuable insights. Investigating how specific combinations of balancing elements affect player engagement, satisfaction, and skill development would contribute to a deeper understanding of game balance and its implications for game design.

Furthermore, the taxonomy can be expanded to include elements specific to different game genres or target audiences. Different types of games may have unique balancing requirements and considerations, and tailoring the taxonomy accordingly would provide more targeted guidance for game developers.

Lastly, the practical application of the taxonomy can be explored through the development of industry guidelines and best practices. This would involve translating the insights from the taxonomy into actionable recommendations that can be used by game developers to create more balanced and engaging games.

This taxonomy of game balancing elements lays the foundation for further research and development in the field of game design. By providing a structured framework and insights into the dynamics of game balance, it has the potential to inform game development practices, contribute to the advancement of game studies, and enhance the overall quality of games.

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