Game Balancing – A Semantical Analysis

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Abstract. Although balancing a game is commonly considered critical to its success, there is still no consistent definition of the term "game balancing." This paper provides a review of eleven publications by renowned authors, many of them experienced game designers. It shows that these authors present different concepts of game balancing, formally analyzes and discusses these authors' concepts, definitions, and key aspects, carving out similarities and differences between them. The paper concludes that these authors propose concepts suitable for games in general, but that their concepts differ, that they focus on games made for fun and entertainment, and that there is currently no definition of "game balancing" suitable for games focusing on other goals than fun, e.g. for serious games.

Keywords: Game Balancing · Video Games · Semantics · Concepts

1 Introduction

Roughly speaking, game balancing is the activity of tuning a game's rules, difficulty, algorithms and so on to achieve certain goals such as making a game fair for all players, keeping a game challenging but winnable, etc. But although game balancing is considered an essential key feature of any successful game [2], surprisingly there is no consensus on what "game balancing" actually means.

In this paper, we review eleven publications by renowned authors, many of them experienced game designers, based upon a formal concept analysis [19] as described in [10], and modified by additional steps. More than 400 properties were grouped into 48 concepts according to the authors' descriptions. 22 concepts that were largely described by more than one author are used as the bases for a formal concept analysis. We consolidated and visualized the results with the Online Lattice Editor by [7] using its "Build Concept Lattice (AddIntent)" and "Min intersection layout (using Cenexp algorithm)" settings. The resulting structure (see Fig. 1) is used as an orientation to start a discourse, referring back to properties taken from the sources. The complete tables of objects, concepts, and properties can be found in [3].

We show that the author's definitions are diverse, focusing on different goals and key aspects of game design. Although their concepts of game balancing often

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overlap regarding central aspects, every author has a different view, a different concept, and therefore a different understanding of game balancing.

2 State of the Art

To the best of our knowledge, no extensive semantical or ontological analysis of the term "game balancing" has been published so far. There are scientific publications focusing on game balancing and especially dynamic game balancing, but they do not define the term; instead, they usually rely on definitions from practitioners. We, therefore, present those before continuing with the state of the art in scientific publications. We also could not find any publications addressing game balancing for specific types of games focusing on other goals than fun, such as, for example, serious games.

Ernest Adams has been a game designer since 1989, is a game design consultant, author of several books on game design, and founder of the International Game Developers' Association (IGDA). In [1], he names the player's skill as the focus of balancing: Skill, especially in decision-making, should be the greatest factor in determining a match's outcome. This is achieved by ensuring fairness and appropriate difficulty. Former primarily concerns player vs. player (PvP) games, so every player has an equal chance of winning at the beginning of a match; latter is crucial for player vs. environment (PvE) to provide constant challenges without frustrating the player.

Keith Burgun is an independent game designer, author, composer, visual artist, and author of two books on game design. In [4], he describes game balancing as the preservation of game elements from irrelevance. This is mainly done to keep the player's decisions impactful and prevent dominant strategies that may ruin the game. Additionally, game elements must be treated within their contexts and weighed against game elements they compete within those contexts.

James Portnow is a game designer and game design consultant, known for his theories on socially positive game design and as co-founder of the YouTube Channel "Extra Credits." His channel's episodes present, among others, the concept of perfect imbalance: By incorporating subtle power differences between game elements, players feel constantly encouraged to find slightly beneficial strategies, instead of solely having to execute proven strategies [9].

Dan Felder is Senior Game Designer at Electronic Arts, having worked previously for Blizzard Entertainment as a Game Designer on "Hearthstone." In [5], Felder locates the main task of balance in avoiding broken gameplay. A gameplay or game design "breaks" when actions or strategies render a huge portion of decisions meaningless and thereby prevent the positive user experiences games are supposed to create. Since perfect equality would also render any player's decisions meaningless, one important part of game balancing is the creation of small differences in power.

Jeannie Novak is lead author and series editor of the "Game Development Essentials" series. In [8] she describes, as do Rollings & Adams in [11], the

concept of static and dynamic game balancing. While both aspects still focus on keeping the player's skill as the most decisive factor for success, they involve different parts of a game. Rules, numbers, relations and their interactions are all part of the static game balance, while dynamic game balancing describes the real-time balancing in a running game as dependent on the players' interaction and therefore does change over time.

Richard Rouse III has worked as a design and narrative lead for Ubisoft and Microsoft Studios. Using the term "subsystem" to refer to all parts of the gameplay that interact with each other to form the game, Rouse [12] calls the dependencies within and between subsystems a major influencer of the overall balance: Changes in one system almost always affect other parts of the game.

Jesse Schell is former IGDA chairman and currently professor for game design at Carnegie Mellon University. In his award-winning book, "The Art of Game Design: A Book of Lenses" [13] he characterizes multiple concepts that commonly appear in video games and partially contrast with each other, e.g. challenge vs. success, or skill vs. luck. Balancing is concerned with hitting the right benchmarks, dependent on the target group, by adjusting combinations of and relations between game mechanics.

Ian Schreiber began programming and designing games in 2000, has written two books on games, is co-founder of the Global Game Jam and assistant professor for interactive games and media at Rochester Institute of Technology. In [14], Schreiber investigates the mathematics behind game balancing: Every game is quantifiable to a certain degree, but those numbers only have meaning within their given context(s). These numbers and the relations between must be adjusted in order to achieve a good balance. Additionally, balancing must also consider players: Their access to information, their ability to process information, their expectations and how their behavior might be influenced even by factors outside of the game.

David Sirlin, president of Sirlin Games, is a game and graphics designer working mostly on competitive multiplayer games. Sirlin focuses on providing viable options and fairness to players, especially in multiplayer games [15]. The former refers to meaningful decisions between promising options; the latter means that every player has an equal chance of winning at the start of a match.

Tynan Sylvester, founder of Ludeon Studios, has been designing games since 2000 and has written an instructional game design book [16]. He sees balancing primarily as the act of adjusting the relative power differences of game elements. The goal is to create multiple viable strategies, so they have equal chances of success.

There are also a few scientific publications on game balancing which use or extend the term, often adopting definitions from practitioners: [2], for example, Raph Kosters references "A Theory of Fun" [6], concluding that "game balancing aims at providing a good level of challenge for the user" and keeping the player interested in playing the game. They evaluate dynamic game balancing approaches, stating that dynamic game balancing must satisfy at least three basic requirements, i.e. adapting to the player's initial level, tracking the

evolutions (and regressions) of the player's performance, and keeping the game "believable." Their evaluation indicates that adaptive approaches may be more effective, i.e. result in better user satisfaction, than traditional, non-adaptive, pre-defined game balancing with static difficulty levels.

Similarly, [17] state that dynamic game balancing is done by adjusting a game's difficulty level to a player's skill level while playing: To be enjoyable, parameters in the game should be changed to avoid undesired player emotions, such as boredom and frustration. They argue that the player's emotional (or affective) state must be considered by dynamic game balancing so that the game can become emotionally adaptive.

[18] suggest another approach: incongruity. They also define game balancing as the adaptation of the game difficulty to a player's skill or, more precisely, the relationship between a game's complexity and a player's abilities: The player should be challenged, but not frustrated, by the complexity of the game. They apply the incongruity theory, trying to avoid letting the difference between the complexity of a game and the complexity assumed by the player's internal human model becomes too large.

3 Semantical Analysis for Conceptual Structuring

Although the beforementioned authors may not seem to be far apart, their concepts differ in many details. Most obvious are their different perspectives and scopes: Some focus on game design, others already consider more technical perspectives. Many authors use terms such as "fairness" or "difficulty" that may also be difficult to grasp. While all authors emphasize different aspects of game balancing, they rarely contradict each other. Furthermore, there are some concepts they commonly agree on, despite sometimes using divergent names or descriptions. Examples are "dominant / degenerative strategies" and "(meaningful) decisions / (viable) options". To analyze and compare the presented concepts of game balancing, we, therefore, need to understand the authors' basic ideas, concepts, and assumptions that some of them take for granted, but others try to define or describe explicitly in their respective publications.

Adams [[1], p. 403] links balance essentially to the player's skill: "In the most general sense, a balanced game is fair to the player (or players), is neither too easy nor too hard, and makes the skill of the player the most important factor in determining her success."Adams thereby adopts fairness, an inherently subjective concept, as a general goal, and links fairness to the player's "skill"—another term that requires more consideration. To Adams, it is generally important that chance must not be powerful enough to make skill irrelevant. To achieve that, the game design should allow the player to make meaningful decisions, so that the outcome of the game primarily depends on the player's decisions [[1], p. 404]. Game design must, therefore, avoid so-called dominant strategies, i.e. strategies that do not need to be infallible but are so strong that they leave players no reason to use any other strategy. Thereby, they make alternatives worthless and render the player's decision meaningless [[1], p. 405f]. Even singular decisions

or the mere avoidance of losing the game can be considered dominant strategies [[1], p. 405], as well as so-called "exploits", which trivialize parts of a game [[1], p. 410f]. Sylvester calls dominant strategies "degenerative strategies" [[16], p. 160] and warns that adding new game elements does not always create more meaningful decisions; indeed, it might do the opposite [[16], p. 159].

Depending on (in-)transitivity of involved game elements, Adams sees numerous ways to avoid dominant strategies. "Transitivity" applied to relations between game elements means there is a transitive order in power or usefulness: If one game element outclasses another, it also outclasses elements inferior to the latter. In the opposite case of intransitivity, every game element can be beaten by some other, which supports the avoidance of dominant strategies. To avoid dominant strategies within a transitive relation, one can change costs or use positive feedback. Costs might be outright stated prices, but also "shadow costs" like hidden detrimental properties [[1], pp. 406-407]. Positive feedback describes giving the player rewards to accelerate future progress [[1], p. 408] without creating a sure-fire course [[1], pp. 429-430].

Furthermore, Adams recommends assessing intransitivity in the elements' properties, as is the case in rock-paper-scissor, instead of defining superiority. This can be achieved by giving elements unique traits that cannot be solely compared by their values. Adams calls this "orthogonal unit difference" [[1], pp. 408-410].

Adams also delivers specifications about chance, which should only impact a few actions that are relevant for the player's victory. Many chances with little risk are generally preferable to a small number with high stakes, so outcomes tend to stay closer to expected values. Also, the player should receive crucial information about the chances and be able to control how much of a risk they take [[1], pp. 411-412].

Besides general criteria, Adams distinguishes between priorities for PvP and PvE games: Those are fairness and remaining able to win throughout the match for PvP [[1], p. 404] vs. difficulty for PvE games [[1], p. 405]. While playing a match in a PvP game, any player should have opportunities for a comeback, if he or she falls behind early on. Stalemates, the inability to win or finish the game properly, should be avoided [[1], p. 404]. But most importantly, a PvP title must be fair. Adams defines fairness as all players having a roughly equal chance of winning at the start of every game. Fairness should always be granted [[1], p. 404], e.g., by accordingly balancing starting options, protecting newer players, or providing game updates [[1], pp. 414-416]. In symmetrical games that provide identical starting conditions to all players, fairness is already given. Most games, however, come with varying prerequisites and are called asymmetrical, which makes them more prone to developing dominant strategies [[1], p. 413]. Sirlin also adds a scale to the concept of (a)symmetrical games: While symmetry is a fixed condition, a game can be more or less asymmetrical. The more asymmetrical a game is, the more important maintaining fairness becomes [[15], p. 1].

Difficulty in PvE games is strongly connected to the players' expectations and requires consistency [[1], p. 405]: Sudden jumps should be avoided as well

as stalemates and losses the player could never have prevented. Also, important decisions should be marked as such and all necessary information to finish the game should be accessible [[1], pp. 416-417]. All this serves the purpose of bringing the player into a state of flow. However, expectations of and requirements for this can vary immensely between audiences [[1], pp. 418-419]. Adams subclassifies "difficulty" into three parts:

1. Absolute difficulty. The combination of required skill and time restrictions. It highly correlates with the game's numbers, such as enemies' strengths and maximum health points [[1], p. 420].
2. Relative difficulty. What is left when the player's power is subtracted from the absolute difficulty [[1], pp. 420-421].
3. Perceived difficulty. Also, takes the player's experience into account [[1], p. 422].

Ideally, the perceived difficulty stagnates or increases throughout the game according to the target group's preference. The relative difficulty has to grow faster, since the player's experience also increases. The absolute difficulty has to rise even faster, while the player gains more power [[1], pp. 423-424]. Also, the player should be able to adjust difficulty somehow, so the game covers a wider audience [[1], pp. 425-426].

While Burgun [[4], p. 2] primarily addresses multiplayer games, he includes single-player games in most of his statements, especially if they are supposed to have replay value. Generally, a well-balanced game stays interesting for longer. His definition focuses on choices [[4], p. 1]: "Gameplay is all about making choices and in a poorly-balanced game, many of the choices available to the player are essentially rendered useless." He argues, as does Adams, that dominant strategies can render other strategies useless and game elements irrelevant. Whether, a strategy is dominant or not, however, can depend on the player's skill, especially in more complex asymmetrical games. Therefore, the target group should be taken into account when setting a balancing goal. While tailoring to all audiences would be ideal, this is too intricate. The effort rather should focus on one group, e.g. competitive players [[4], p. 2].

Furthermore, game elements must be balanced within all contexts they operate in. This includes, for example, costs compared to other elements in the same production line, their usefulness when competing with opposing elements, but also their power about others that prohibit or limit each other's use [[4], p. 1]. This contest on multiple layers takes place even in symmetrical games, although they typically include fewer contexts since all players use the same selection of elements [[4], p. 2].

James Portnow of Extra Credits [[9], 0m34s] summarizes his concept of perfect imbalance as follows: "Fundamentally, it is the idea in game design that you don't always want things to be perfectly balanced. In fact, in most games, you actually wanna make sure that there are some imbalances in your systems. (. . .) many games are actually made far more engaging by just a little bit of imbalance, multiplayer games especially." Portnow highlights that those imbalances refer to

subtle differences, not huge gaps in power [[9], 0m30s-1m00s]. The distinction between "out of balance" and "broken" is crucial: No strategy or game element should be much stronger than the rest, but only slightly. These subtle variations in power can be measured and adjusted with the help of a "power curve", a relation from cost to power for game elements [[5], 3m35s-4m20s]. In the metagame, which is basically the situation or context in which the game is played, such an imbalance allows for discussions, discovery and therefore fun, while players try to find slightly advantageous strategies. They can even find new solutions for problems of their current state of play without having to know all established strategies. The resulting metagame allows players to grow into the game and prevents any playstyle from becoming the best [[9], 2m45s-3m35s].

In contrast to a perfect imbalance, in (almost) perfectly balanced games like chess, the best strategies are discovered sooner or later. At that point, most players are left with nothing but executing those instead of creating their own strategies. Only the best players could still find new strategies that are not already established. This removes part of the fun for a huge portion of the audience [[9], 1m00s-2m45s].

Felder [5] bases his view of balancing on the avoidance of imbalance: "I've found that the most useful definitions of balance are based on what we're trying to avoid: Broken Gameplay. (. . .) When you're designing a game you naturally want to create a positive experience for your players. When your gameplay isn't providing that experience, your game is broken. It's that simple." An example of something broken would be a strategy that makes all others obsolete, and therefore a lot of decisions, if not all of them, broken. However, the exact opposite would also render decisions useless: If every option was equally good, there would be no reason to prefer one. Instead, subtle differences in power allow for strategic decision making. Using a power curve also benefits the balancing of game elements that are introduced later [5].

Novak [[8], p. 202] relates balancing to the player's skill: "The ease of winning the game also increases as the players' skills increase. Random events (e.g. a meteor hitting the area, destroying a player's resources) can still occur in the game that might decrease a skilled player's chance of winning. However, a better player should be more successful in general at the game than a less-skilled-player, unless the game is based purely on luck instead of skill." Considering the desired results of balancing, Novak concludes: "A game is balanced if players perceive that it is consistent, fair, and fun," implying that perceived quality of game balance may be subjective.

Without using potentially subjective terms, Rollings and Adams [[11], p. 240] similarly state that "A balanced game is one where the main determining factor for the success of the player is the skill level of that player. That does not mean that random events cannot occur, but a better player should ordinarily be more successful than a poor one unless he has an unusually long run of bad luck." While not identical, [8] and [11] have a similar focus. They name criteria found in well-balanced games:

- The game becomes consistently more challenging [[8], p. 202ff] until the climax [[11], p. 272].
- The player perceives fairness by always being able to win, even after early mistakes [[8], p. 202ff]. This perception extends to offering the player information, control, training, and beginner protection. Unnecessary repetition of tasks should be avoided [[11], p. 272-276].
- No unsolvable situations that lead to the player being stuck [[8], p. 202ff] or lacking the information to continue [[11], p. 276f].
- No trivial decisions. These are decisions that have no impact, or one alternative is clearly the best [[8], p. 202ff]. Additionally, micromanagement – the act of administering a high number of small elements – should never be mandatory, only optional [[11], p. 277-279].
- Adjustable difficulty [[8], p. 202ff] [[11], p. 279-281].

Beyond general criteria, they continue their investigations of static and dynamic balancing. Static balancing is concerned with the game's rules and how they interact. Its main goals are to avoid dominant strategies [[11], p. 243] and provide fairness [[11], p. 267]. Rollings and Adams contribute two new aspects to dominant strategies: A strongly dominant strategy always wins the game, while a weakly dominant strategy prevents a loss. Other than the former, the latter can be beneficial to the game. Furthermore, an "almost dominant strategy" does not always win the game but is still the best option available under any circumstances [[11], p. 244ff]. Novak describes another strategy-related concept a game should include, so-called "obvious strategies". These are strategies that are generally the best, but explicitly not under any circumstances [[8], p. 203]. Game elements with transitive relationships to each other are useful as rewards for progress [[8], p. 204] [[11], p. 252ff], while those with intransitive relationships profit from having orthogonal unit differences [[11], pp. 258-261]. The latter should not contradict the narration of the game and its world, Novak adds [[8], p. 205].

Dynamic balance covers how the game changes over time and with player interaction [[8], p. 207]. It can be done passively or actively to prevent unfair advantage [[11], p. 267]. Players interact with the dynamic balance in three ways [[8], p. 207]:

1. Restore balance. The player restores a disturbed balance. De-balancing forces are weaker than the player or can be removed [[11], p. 269].
2. Preserve balance. The player repels de-balancing forces. Those are at least equally as strong as the player. There is no win condition and the player loses when doing nothing [[11], p. 269ff].
3. Destroy balance. The player alternates the state of balance or creates chaos [[11], p. 270ff].

Rollings and Adams continue with "emergence", the creation of complex results using simple rules. A world can be simulated by reduction to basic properties and still deliver the targeted experience. This reduces complexity and preserves

control for the player but might favor the formation of dominant strategies [[11], pp. 262-265]. There is also a reverse version of positive feedback called negative feedback, which limits progress or leadership, e.g. by adding further costs [[8], p. 206] [[11], pp. 265-267].

Rouse [[12], p. 493] describes games as systems composed of subsystems: "In order for the game to be balanced, all of these [sub-]systems must be in place, since changing one system impacts how the other systems must be set up in order to achieve the overall balance you are seeking." He distinguishes between provisional and true balancing. While the former creates a balanced foundation, the latter uses this basis mainly to adjust numbers to deliver a quality game. Playtester feedback is crucial for this iterative approach [[12] , pp. 493-494]. It is also necessary to understand the relations and influences within and between one's own systems to avoid unintended consequences, while being able to quickly iterate values within the game [[12], p. 495].

Schell [[13], p. 202] states that "Balancing a game (. . .) is all about understanding subtle nuances in the relationships between the elements of your game and knowing which ones to alter, how much to alter them, and which ones to leave alone." He continues with various patterns that frequently appear and are partially opposed to each other. Some of them are:

- Challenge vs. success. A game should neither be too easy nor too difficult. The goal is to keep the player in a state of continuous flow. However, learning rules and controls are already challenges in themselves [[13], pp. 207-209].
- Skill vs. chance. It is commonly good to have both in a game to a certain degree, dependent on the audience [[13], p. 214f].
- Strategy vs. dexterity. The best ratio depends on the audience [[13], p. 215ff].
- Competition vs. cooperation. Although many games contain just one, they can appear combined [[13], pp. 216-218].
- Short vs. long. Via changing win conditions, players should have enough time to strategize, but never get bored [[13], p. 219].
- Rewards vs. punishment. Rewards are a human desire. The rewards must increase over the course of a game to keep the player interested [[13], pp. 219-222]. Although rewards should generally be preferred, punishment can also enhance the experience, e.g. by increasing the challenge [[13], pp. 222-225].
- Simple vs. complex. It is generally better to create complex results using simple rules, but small case-specific additions might still be beneficial. The former makes a game "elegant" and can be referred to as "natural balancing", while the latter is called "artificial balancing". Games should neither be unnecessarily complex nor simple to the point of being trivial [[13], pp. 226-230].

Despite all details being important, Schell emphasizes the big picture: The game should feel right. If it does not, one should ask and search for the causes [[13], p. 237].

Schreiber [[14], p. 1] follows a mathematical approach: "While perhaps an oversimplification, we can say that game balance is mostly figuring out what numbers to use in a game." It is important to understand that every game contains numbers, even if these are not stated outright [[14], p. 1], and that numbers only have a meaning within a context [[14], p. 2]. These numbers are connected within greater systems that are divided into subsystems, like combat or economy [[14], p. 2].

He differentiates between "deterministic" and "non-deterministic" games. Former always produces the same outcome dependent on the action in a certain state; the latter does not, due to chance or other players' actions. "Solvability", which means that in every situation, there is a recognizable best action, is generally undesirable to have in a game since it renders decision-making obsolete. There are different levels of solvability, starting with trivial, which can be solved in real time. Others are theoretically solvable but require too much calculation to be solved within an acceptable time frame. However, even non-deterministic games are solvable. While every game that provides perfect information about its state is theoretically solvable, one can limit the players' access to information. This might be affected by the metagame [[14], p. 1].

Another dimension to balancing is costs. Costs are everything that limits access to advantages or interferes with them. The advantage is basically everything that benefits the player. We can view costs as negative advantages and vice versa. They can be calculated as such to create a cost curve [[14], p. 3]. Schreiber adds that shadow costs can be divided into two concepts: Sunken costs and opportunity costs. The former describes prerequisite costs that are indirectly related to the stated costs, while the latter limits the player's future possibilities once s/he has spent the stated costs [[14], p. 6].

Schreiber also adds to the concept of rewards. Regularly giving out smaller rewards should be preferred to fewer larger ones. Players prefer randomization, as long as it still feels like the result of their actions. Rewards and progress should support each other, and popular rewards should not be held back [[14], p. 7].

"Economic systems" are another topic Schreiber addresses. These comprise any resource of a game and typically involve the following mechanics for resources: Generation, destruction, trading and limited zero-sum. In-game economies can exhibit traits and interactions similar to real economies and marketplaces. Open economies allow outside intervention, such as buying resources with real money, while closed economies do not. Each should be designed differently [[14], p. 10].

Sirlin [[15], p. 1] focuses on balancing multiplayer games: "A multiplayer game is balanced if a reasonably large number of options available to the player are viable especially, but not limited to, during high-level play by expert players." In addition to fairness, "viable options" must be provided. This refers to meaningful decisions between promising options and excludes the existence of dominant strategies. Meaningless decisions unnecessarily increase complexity; only meaningful ones benefit a game [[15], p. 1]. However, despite the need for

fair starting conditions, a game does not have to be completely balanced within every state of the game. On the contrary, imbalanced states can be situationally desired, e.g. by giving rewards for playing well. He continues that "checkmate situations", in which one player is clearly going to lose, should generally not arise. Although manifold games are generally desired and provide many benefits such as counter elements and actions, no game element should be worthless. Worthless elements never provide meaningful decisions [[15], p. 2].

Sirlin further discusses the concept of fairness: Comeback mechanics are helpful to prevent unforeseen balancing issues. Also, new game elements should be introduced after a balanced basis is created, and banning certain elements or combinations subsequently, e.g. for tournaments, is highly undesirable. When a power curve is used, it should be noted that the exact ratios between power values are not necessarily provided. Also, decisions, that are made at the beginning of a match or game should not determine the outcome right away [[15], p. 3].

Sylvester [[16], p. 155] extends the importance of power to strategies: Balancing "means adjusting game mechanics to change the relative power of different tools, units, strategies, teams, or characters." In addition to being fair, games need to be deep which refers to meaningful play even at higher skill levels: Even experts must be uncertain as to the best option in a given situation. To achieve this, strategies should be balanced. A strategy is a specific combination of actions a player can choose from to achieve a certain goal [[16], pp. 157-158]. Multiple viable strategies must be offered; even two can be enough though, since adding more decisions, even meaningful ones, can increase complexity without making the game deeper [[16], pp. 161-162]. A difficulty in balancing strategies comes from having to change game elements which are typically part of multiple strategies, to affect a strategy [[16], p. 166].

4 Discussion

Having analyzed the semantics behind the abovementioned authors' concepts of "game balancing", we will now look for similarities and differences in their concepts and will then move on to a discussion of these. The complete formal concept analysis including all tables of concepts, properties, and formal objects (see example in Table 1) is available in [[3], pp. 163-202]; its results are visualized in Fig. 1.

This diagram shows which author covers which concepts, and which concept is covered by which author. Also, coupled occurrences can be identified. The

Table 1. Exemplary extract from the table of formal properties from [[3], pp. 163-202]

Authors Concepts	Formal Properties	Formal Objects: Game Balancing according to Ad No RA Ro SII Sy Bu Po Fe Sr Si			
Asymetrical games	Asymetrical games give players different starting conditions	No	SII	Bu	Si

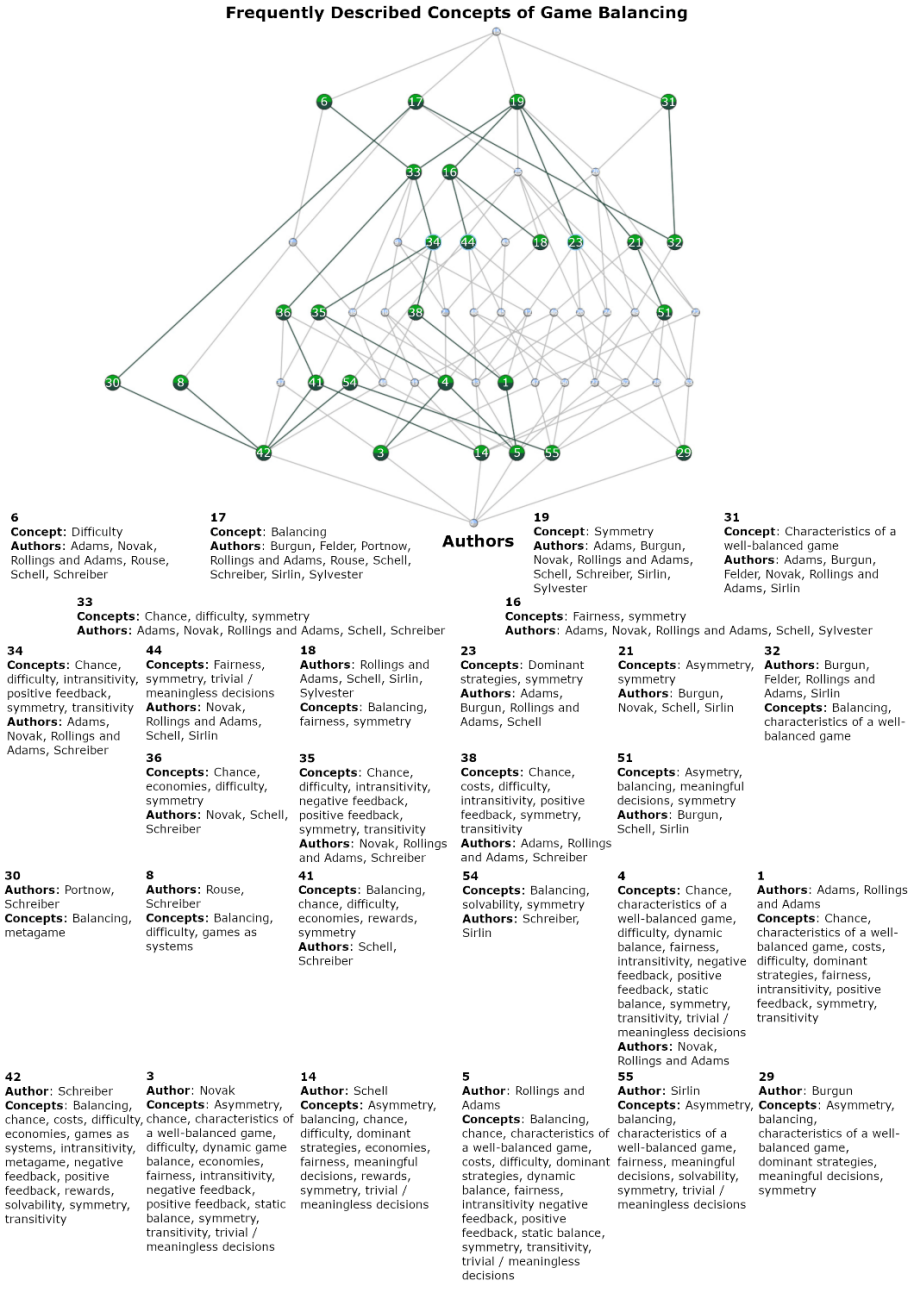

Fig. 1. Conceptualization of "game balancing" as a lattice form diagram created with [7]

higher on top a node appears in the diagram, the more authors and fewer concepts it contains, and vice versa. Only the green nodes are labelled since they mark the fundamental level on which an author or concept occurs. The line "Author(s):" is only listed above "Concept(s):" if the node contains all concepts of at least one of its authors, it shows his or her first appearance. Smaller nodes indicate a combined appearance and can be used to follow connecting lines.

The diagram reveals countless implications, among them: No concept is covered by every author, which means that there is not even a consensus about one concept being the singular essential core of the term "game balancing". No author covers all concepts; instead, Schreiber, Novak, Schell, Rollings and Adams, Sirlin, and Burgun each introduce combinations of concepts no other author covers. These implications corroborate our original impression that there is no comprehensive definition of the term "game balancing." There is not even a common foundation or central core concept for the term, although often several authors employ the same or similar concepts.

Surprisingly, concepts such as fairness, flow, or user satisfaction appeared to be important, but there were no central or fundamental concepts for the definition of game balancing. However, there is a basis of only four concepts that are not exclusively covered together with specific other concepts, but which are shared by many authors and connected with many other concepts: Difficulty, balancing (as a purposive act or process), symmetry, and characteristics of well-balanced games. Therefore, we will now continue discussing these qualitatively.

Characteristics of a well-balanced game: While various characteristics meet explicit approval, such as avoiding stagnation (3/6) and allowing the user to make meaningful decisions (3/6), some aspects are still vague. One such aspect is when something becomes "stagnant": Even though the player should not have to unnecessarily repeat tasks, no boundaries are given when repetition becomes a problem; after all, games do feature tasks that can or must be repeated in order to progress or improve something. While examples are given such as having to repeat easy parts, no rule or definition applies generally. Additionally, there is no comprehensive definition of the commonly used term "skill": Though there is an implicit distinction between skill as "decision-making" and skill as "dexterity" in executing actions, skill is rather the presumed entirety of influence a player has on the course of a game rather than a well-defined term. This leads to further problems within the concept of "difficulty."

Concerning meaningful decisions, all authors (3/3) underline their importance and describe meaningless decision-making as useless or even harmful to a game. However, there is no exhaustive definition of what a "meaningful" decision exactly is; instead, it is circularly defined as not being meaningless. The type of meaningless decisions that only provide weak options plus one option that is clearly the best, can also lead to dominant strategies. If these are obviously dominant, Sylvester even calls them "degenerative strategies." Those authors who talk about any sorts of strategies agree that dominant strategies should generally be avoided (7/7).

Difficulty: Which difficulty level may be right is assumed to depend on the players' perception, the players' skills and how quickly their skills improve (5/5). Although skill and the individual perception of skill are somewhat subjective quantities, they must be mapped onto in-game numbers that can be calculated and manipulated. Several authors (2/5) explicitly name on the goal of keeping the player in a state of flow. To achieve this, the perceived difficulty must be right, by staying the same or steadily growing.

Symmetry: Most authors (5/8) state that symmetrical games are automatically fair. Many modern games, however, are asymmetrical, which leads to a higher balancing effort. Sirlin appears to be the only author to explicitly state that a game can be more or less asymmetrical. Fairness is an important concept, most authors agree. However, Adams and Sirlin especially emphasize the importance of fairness for multiplayer games and also state that fairness alone does not provide a well-balanced game.

Balancing: The high number of methods and means for balancing games may be an indicator of the lack of agreement on the actual goal of balancing, i.e. the pursued state of game balance: While no author denies that huge imbalances are bad, smaller ones can be accepted. Not only that: Portnow and Felder even state that a slight imbalance might be more beneficial than perfect balance. They primarily base their view on a perfectly balanced game offering little to no reason to try something other than proven strategies, or all options being equally good; therefore, the decision between those options does not matter anymore. However, it is unclear if this is the only solution, or if players can have other reasons to use or try different strategies. This might be connected back to the concept of meaningful decisions not being fully grasped yet.

5 Conclusion

Our analysis of eleven renowned authors' concepts of game balancing revealed that their concepts are clearly different. Although the authors usually agree on certain aspects, for example, that games should provide meaningful decision options to the players, there is no central aspect, no central goal of balancing that all eleven authors focused on in their respective books, texts, or videos. Often, the authors are not far apart, though: For example, while Novak, assuming the players' perspective, concludes that a "game is balanced if players perceive that it is consistent, fair, and fun", Schell advises keeping the player in a state of continuous flow, and Koster concludes that "game balancing aims at providing a good level of challenge for the user."

Going into detail, it becomes obvious that some authors focus on certain types of games (e.g. Sirlin and Burgun on multiplayer games), while others try to address games in general (Adams, Schell, etc.). All of them, however, talk about games made for fun and entertainment, but not about games made for other purposes: serious games, health games, exergames and others that might need to be balanced towards achieving goals other than fun. Still, the authors' different perspectives already lead them to differing concepts about game balancing.

Our analysis, however, also revealed that never all, but at least most authors focus on four aspects of their respective game balancing concepts: the characteristics of well-balanced games, difficulty, symmetry, and the balancing process itself. Combining these authors' opinions on the characteristics of well-balanced games, meaningful decision options, player skill, and the prevention of dominant strategies seem to be pivotal. Combing their opinions on difficulty and symmetry, most authors seem to agree that finding the right level of difficulty is essential; that the difficulty should stay the same or grow steadily, according to the player's increasing skill; that fairness is inherent to symmetrical games but must be ensured in asymmetrical games alike; and that fairness alone does not make a game well-balanced.

However, concerning the balancing process and the available means to balance games, the authors' opinions and concepts differ. While many authors seem to strive for some sort of "perfect" game balance that must be fixed before a game is released and played, others argue for intentional imbalances and dynamic balancing. Though it is obvious that the balancing process is of utmost interest to renowned game designers wanting to share their knowledge and experience, their concepts about the balancing process itself are diffuse: They present many aspects and ideas, ranging from feedback loops and the transitivity of game elements to chance and metagame—but no author presented a practical, clear, and concise abstraction of an actual game balancing process.

We, therefore, conclude that further research is required to develop a commonly agreeable definition of "game balancing" and a suitable abstraction of a practical game balancing process.

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