Vilma Matilda Virtanen

CARD GAME BALANCING

Balancing digital and print trading card games across casual and competitive environments.

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ABSTRACT

The thesis dives deep into the intricate world of trading card games, focusing on their balance in various publishing and gaming environments. Through qualitative analysis, it explores prominent sample games such as Duel Masters, Magic: The Gathering, Hearthstone, and Yu-Gi-Oh! Master Duel, researching the core mechanics and gameplay dynamics unique to each. Central to this exploration is the importance of maintaining game balance during initial design and over the course of the game's lifespan. The work discusses foundational concepts of card games, including the distinctions between different formats across the field. Techniques such as efficient playtesting, rapid iteration, and deploying specific resource systems - like mana or life points - are highlighted to achieve the desired balance. The study's dissection of challenges inherent to "live" card game adjustments post-launch is significant, with rotating formats and responsive balancing strategies emerging as critical tools.

The research reflects the specific nuances brought to the table by digital card games, contrasting them against their physical counterparts. The thesis also delves into the balancing act between tournament and casual play, the longevity of card games, and considers the future trajectory of the card gaming industry. Through these lenses, this work offers a comprehensive overview and analysis of the complexities inherent in card game balance across multiple environments.

Keywords: card game, trading card game, game balancing, data analysis

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KEYWORDS

Card game

The game that is played with playing cards as the primary device of playing. The cards can be either traditional or designed specifically for the particular card game. (Parlett 2008.)

Trading card game (TCG)

Type of card game where the player does not get all of the cards required to play the game from the start but is instead required to trade them with other players of the same game. (Kaufeld & Smith 2006.)

Digital card game

A digital card game is a card game that is played through a digital platform, such as a computer or mobile device, rather than with physical cards. These games can either be digital versions of traditional or collectible card games, or they can be entirely original games designed specifically for the digital format, with mechanics that take advantage of the digital medium.

Game balancing

Game balancing is the process used in game design to ensure that a game is fair, enjoyable, and offers sufficient depth and variety, typically by adjusting the rules, abilities, or statistics of game elements. This can involve fine-tuning elements like character strengths, resource availability, or difficulty levels to prevent any one strategy or component from being overwhelmingly powerful, thus maintaining competitive play and player engagement.

Power level

In the context of card games, power level generally refers to the relative strength or effectiveness of a card, taking into consideration factors such as its cost, abilities, and how it interacts with other cards. A card's power level can heavily influence game balance, with high-power cards potentially dominating gameplay if not properly balanced with their cost or availability.

Orthogame

Orthogame is the type of game where two or more players play against each other, and the winner will be decided by the rules that have been agreed on before the game begins (Elias et al. 2012, 82).

Booster pack

A booster pack, in the context of collectible card games, is a sealed package of cards that players buy to expand their collections. The cards in a booster pack are typically randomized, so purchasing one involves an element of chance, with the possibility of obtaining rare, powerful, or highly sought-after cards.

In-game currency

In the context of card games, especially digital ones, in-game currency is a type of virtual currency that players can earn or buy to acquire new cards, booster packs, or other game-related items. The methods of earning can vary, often including winning matches, completing challenges, or achieving certain milestones within the game, and it is used as a way to progress and unlock more content in the game.

1 INTRODUCTION

The thesis investigates balancing card games in different environments and how games with multiple decades of publishing history manage to keep their power level balanced with different methods. The main focus is on the balancing of trading card games, but the research also delves slightly into the card games with closed balancing environments, such as card games in the board game category. Card games tend to share aspects with other game types, but their lack of gaming pieces apart from cards sets them apart from other games and also makes balancing those games different from other game types. On top of that, card games are published in both physical and digital environments, so researching their balancing is a broad topic. The results will provide valuable knowledge on the possible importance of the field of game balancing.
The thesis strives to answer the central question: **How card games are balanced**? Subsidiary questions are: **What aspects of the card game affect the game balancing**, and **how does the publishing medium affect that process?** The primary goal of this project is to determine critical factors of card game balancing and research if some design decisions affect the balancing depending on the publishing medium.

The research delves into the different types of games that utilize playing cards as the main element, apart from the classic 52-card deck of cards. The thesis will first present the key elements of card game design shortly. These topics cover card game types and the basic deck-building process. The follow-up research will delve into different ways of balancing card games in physical environments and inspect how they have been balanced in past decades and how the different approaches have affected the game balance and longevity. In order to successfully argue that the publishing platform affects both balancing and the general design of the card game, broad research of the topic is necessary to understand different aspects of the project (Table 1.)

Table 1. Balancing concepts

Balancing concepts	**Subtopics**	**Data Collection**	**Sources**
Game publishing format	Printed and digital games	User engagement	Online platforms
Game balance basics	Solvability; Metagame	Win-loss ratios, statistics	Gaming forums, website data logs
Initial balancing	Playtesting; Resource systems	Player feedback	Academic articles, game analysis blogs
Live game balancing	Card usage; Format rotation; game mechanic balancing	Usage statistics	Data analysis, player feedback
Tournament play	Metagame Casual competitive balancing	Statistic of winning decks	Competitive event coverage
Card rarity balance	Booster packs; Loot boxes	Purchase patterns, rarity distributions	Market analysis

As seen in the Table 1, the chosen research method for the thesis is thematic analysis, where common themes are identified when it comes to game balancing and how they are implemented in card game balancing. In the thesis, it is researched if any themes and topics are raised on multiple occasions and how they affect the balancing process. Another method I am using in the research is **qualitative content analysis**, closely related to thematic analysis. Therefore, the same dataset can be applied to both of those. (Tutkimusmenetelmien verkkokäsikirja 2023.)

While there have been many studies on general game balancing, more information on card games needs to be provided, which this thesis aims to do. The most significant risk to the research and its documentation is the lack of research on the game balance, specifically when it comes to card games. While it is expected that the same points can be applied to card games, there can be no certainty that that is the case, and there is a possibility for non-accurate conclusions.

2 SAMPLE GAMES

For decades, trading card games have remained a significant part of the gaming field, for example, Magic: The Gathering started publishing at 1993, which still receives new updates monthly (Magic: The Gathering 2023). Tracing their origins to simple card games and evolving into intricate systems of strategy, lore, and community-building, trading card games surround an intersection of art, mathematics, narrative, and design. From physical tables to digital platforms, these games have provided players diverse and evolving avenues to engage in strategic competition, community interaction, and story immersion.

Trading card games offer more than mere entertainment. At their heart, these games are an exploration of system thinking. Every card is a piece of a larger puzzle for the player to solve, and the combinations and strategies players can adopt can range from straightforward to deeply complex. While the core mechanics might be easy to grasp, mastering the game often requires understanding nuances, predicting opponent behavior, and optimizing one's strategy in response to evolving game states.

For this thesis four different trading card game were chosen through convenience sampling for analysis. Duel Masters (2002) and Magic: The Gathering (1993) represent traditional printed card games, while Hearthstone (2014) and Yu-Gi-Oh! Master Duel (2022) are games played in digital environments. In the research, convenience sampling was used as a sampling method to pick games featured. Because more and more games enter the market every year, choosing some that have been around for a longer time and have proven successful in their field was one of the criteria of the selected games. Although the research also utilizes other games apart from the ones listed, they are good examples of both physical and digital trading card games, and each of them has its unique points and reasons for being chosen for this study (Table 2.)

Table 2. Basic metrics of chosen trading card games

metrics/criteria	**Duel Masters**	**Magic: the Gathering (standard)**	**Yu-Gi-Oh! Master Duel**	**Hearthstone**
release year	2002	1993	2022	2014
trading card game type	physical	physical	digital	digital
tournament round duration	30 minutes	50 minutes	50 minutes	-
format	best-of-one	best-of-three	best-of-three	first one to win with all decks wins

As seen from Table 2, while trading card games might have decades between their initial release dates, the basic concepts tend to stay the same. Because of this, the games are introduced further in the following part.

2.1 Duel Masters

Duel Masters is a game developed by Wizards of the Coast, the company which has also designed Magic: The Gathering. Initially designed in 2002 to promote Magic: The Gathering, Duel Masters gathered a large audience, especially in Japan (The Legacy of Duel Masters. (Seven Deadly TCG Sins: Errata Text)).

A deck in Duel Masters comprises a minimum of 40 cards, and the player can incorporate up to four duplicates of any specific card in the deck. The cards in the player's deck are categorized into creatures, evolved creatures, and spells. Creatures primarily perform the function of attacking the player's adversary while

also warding off counterattacks. Spells bring a dynamic element to the deck, enhancing the strength of the deck's creatures and eliminating opponent's creatures, among several other capabilities. Evolved creatures, first introduced in an expansion set after the game's initial release, are a special type of card among the cards in Duel Masters. To bring one of these evolved creatures into the game, the corresponding base creature must already be in play. (Kaufeld & Smith 2006, 165.)

The gameplay revolves around players attempting to break all of the opponent's shields, which both players have five in total, and, ultimately, striking the opponent directly to claim victory. What makes Duel Masters interesting as a trading card game is that even though it was not so popular outside Japan, it has implemented many mechanics that other card games still use. The game uses just the deck for playing the game, and there is no need for equipment like calculators or separate decks, so that players can start the game with just their 40 cards.

With each turn, players can place a card from their hand into the mana zone, increasing their mana pool and allowing them to play more powerful cards. In essence, Duel Masters has, rule-wise, all of the parts of the successful card game, from simple design to not needing any equipment such as a calculator to play the game. However, the game has not reached popularity outside of Japan, and even with the reboot in the West with a new name, Kaijudo. Although Wizards of the Coast has deleted almost all information about the game from the early 2000s, something can be found in various blog posts and from a small but active community. Reddit user Foodin065 lists some reasons for the game's poor success in a Reddit post regarding the situation (ArisePhoenix 2022), which include poor metagame in the tenth set of the game, but also cancellation of the anime, reduced amount of tournaments and Hasbro dropping the toy production of the IP in 2005. Because Duel Masters was marketed towards a younger audience, the lack of animation and toys made it harder to reach the target

audience, which would have led to the decision to cancel the game in the Western market.

Duel Masters has a simple basic rule set to understand, a big company to back it up, and it solved many mana-related problems that, for example, Magic: the Gatherer, the original trading card game, has. It had well-made artwork, an appealing overall design of the cards, and an innovative way of when a player gets the rare card from a booster; all other cards in the pack support the card, forcing players to build decks around the card. From the outside perspective, if given sufficient game development space, the game could have become a success among Western audiences. Because of this, it is interesting why the game only succeeded in the Japanese market. However, It does not change the fact that in the paper, the game has some of the best core gameplay, and it is an exciting game to consider studying when discussing card game design and resource system balancing. Duel Master utilizes just the deck in the gameplay, without the need for other game pieces such as dice or calculators, and by not introducing new mechanics to the game without thorough playtesting, the game stays nicely in balance, and there is rarely need to limit the usage of cards. Overall, when it comes to long-term game balancing as well as initial design decisions, Duel Masters does many things better than the majority of the card games. It is a shame that it has not reached the same popularity in the Western market as it has in Japan, where it was the third highest-selling trading card game in 2021 with 32,5 million yen in sales (池っち店長夜話 第1回「この一年のカードゲーム業界の総売り上げ 2021).

2.2 Magic: The Gathering

Magic: The Gathering, often referred to as just MTG by its players, is a pivotal creation in card games, showcasing the blend of strategy, math, and storytelling within a collectible card game framework. Designed by mathematician Dr. Richard Garfield and published in 1993 by Wizards of the Coast, Magic: The Gathering became a renowned trading card game in the 90s and set new

standards for how trading card games are designed and played. When designing the first sets of Magic: the Gathering, Garfield wanted to create a game with easy core gameplay but endless possibilities to expand the complexity through different cards (Diagonal Move 2021). While Garfield succeeded in most parts of his design, he also added some mechanics, such as card stacking, that seemed simple to a mathematician but proved to be rather complex for an everyday player. Because of this, many card games that have drawn inspiration from Magic: the Gathering have tried to simplify the core rules even further than Magic: the Gathering did.

At its core, Magic: the Gathering is about strategic battles between players. Using a carefully assembled deck of cards, players cast spells, summon creatures, and use artifacts to reduce their opponent's life points. The amount of cards and life points depends on the game format players agree to play. The game's depth lies in the vast array of unique cards, each with functions and rules. When combined in gameplay, these cards can produce complex and strategic interactions.

Magic: the Gathering stood out in its early days for its dynamic gameplay. Unlike other card games that mainly remained unchanged, Magic: the Gathering was built on the idea of continuous growth. Although Garfield originally planned the game to run for approximately three years, he changed his original plans, resulting in a trading card game spanning multiple decades (The Orb | A History of Magic's Early Years 2023). Regular introductions of new card sets meant that the game kept evolving, constantly pushing players to rethink their strategies. Along with gameplay changes, these new sets often introduced fresh rules, ensuring the game stayed engaging.

From an academic perspective, Magic: the Gathering offers various areas of study. Its complex design and changing nature have caught the attention of researchers in fields like math, economics, and cultural studies. These studies explore the mathematics behind assembling a winning deck, the game's impact on global pop culture, or the economics of card collecting. Magic: the Gathering's

constant balancing offers a look at the game balancing in long-term games, and as one of the longest-running trading card games, it offers an excellent sample for game balance research. In this way, Magic: The Gathering is a prime example of a card game's potential influence on entertainment and academic research.

2.3 Hearthstone

Hearthstone, developed and published by Blizzard Entertainment, stands as an exemplar within the digital card game genre, merging strategy, engaging visuals, and lore deeply rooted in its progenitor franchise, Warcraft. Debuting in 2014, Hearthstone was not merely a first commercial success in the genre of digital card games but also showcased Blizzard's adeptness at repurposing and adapting established narratives to create fresh yet familiar gaming experiences. Taking inspiration not only from Magic: the Gathering but also from now discontinued World of Warcraft TCG, Hearthstone digitalized trading card game experience for players and had to come up with solutions from booster packs to card trading and the gaming area itself (W. Cheng, personal discussion, August 2023).

The foundational mechanics of Hearthstone mirror traditional trading card games: players create decks from a vast compendium of cards and engage in turn-based battles, seeking to deplete their opponent's health. However, the game's digital nature elevates this basic premise, introducing dynamic animations, voiceovers, and interactions that would be unattainable in a physical medium. The diverse cards, each with its singular abilities, when combined in gameplay, produce a layered strategic environment that rewards both forethought and adaptability.

Hearthstone's initial years were particularly notable for its design philosophy. Blizzard sought to balance depth and accessibility, ensuring that while veterans of the card game genre would find depth to explore, newcomers would not be daunted. These design decisions are displayed in various ways, from the game's intuitive drag-and-drop mechanics to its streamlined mana curve system. The

emphasis was on creating fast-paced, engaging duels without sacrificing strategic depth.

Integral to Hearthstone's appeal is its anchoring within the Warcraft universe. While the game's mechanics are distinctive, its narrative context is a tapestry of stories, characters, and settings borrowed from Azeroth's vast lore. For many players, this was a reunion with beloved characters; for others, it was an introduction to a rich narrative universe. This duality enhanced the game's charm, making it nostalgic and novel.

Hearthstone's inception and game design choices during the initial years present intriguing avenues for exploration. The game's successful translation of card game dynamics to a digital format and its design simplicity amidst strategic depth raises relevant questions about modern game design, digital user engagement, and the repurposing of established franchises for new genres. Moreover, Hearthstone's early years set the stage for its evolution, exemplifying how a game can be both an homage to its origins and a trailblazer in its own right.

2.4 Yu-Gi-Oh! Master Duel

Yu-Gi-Oh! Master Duel represents an evolution in digital card games, epitomizing the fusion of strategy, virtual aesthetics, and a rich narrative borrowed from its parent franchise, originating from the broader Yu-Gi-Oh! universe. Created by Kazuki Takahashi and launched in the late 1990s, Master Duel serves as a testament to the franchise's longevity and its adaptability in catering to contemporary gaming platforms and audiences.

At its essence, Master Duel is a digital representation of the traditional Yu-Gi-Oh! trading card game. While there have been digital games of Yu-Gi-Oh!, is Master Duel the first time the Yu-Gi-Oh! trading card game game is fully playable in digital platforms, apart from unlicensed simulators. Players construct decks from

a diverse pool of virtual cards and engage in duels, navigating complex mechanics and employing strategies to outwit their opponents.

One of the distinctive elements of Master Duel, as opposed to its physical counterpart, is its immersion within the digital realm. This digital interface allows for dynamic animations, responsive gameplay mechanics, and a more streamlined experience for both novice and veteran duelists. Regular updates and digital expansions ensure the game remains fresh, mirroring the evolving metagame and incorporating new cards and mechanics from the broader Yu-Gi-Oh! universe. Because of the game's digital nature, balancing the game is easier and faster, and the game developed has utilized the format well, rolling in new balance patches at a much faster pace than in the physical version of the game.

3 BASICS OF CARD GAMES

Card games, with origins dating back to as early as the 800s in China, have evolved over the centuries, with the 4-suit, 52-card deck configuration becoming prominent by 1400 in regions like Persia, the Middle East, and Europe. These games typically involve mechanisms such as a concealed draw deck, a public playing area, a visible personal tableau, and a discard pile with distinct interaction rules. Gameplay often revolves around objectives like shedding or collecting cards, outpacing opponents, winning multiple hands, countering adversaries, or aligning results with prior bids. These games are bound by rules dictating hand limits, card acquisition, usage, discard protocols, turn sequences, and deck compositions. (Engelstein & Shalev 2022.)

If a person is asked to name a card game, their mind most likely goes to games like solitaire and poker, and at its core, the person is not wrong. Although the most commonly well-known card games are often played with a regular 52-card deck, when the genre is researched deeper, the cards start to vary from the commonly known deck with four different nation decks featuring hearts, clubs, diamonds, and spades. Card games can be divided in different categories by including all games that use cards as their main game pieces, or by their subcategories, the biggest ones being trading card games and digital card games. While the main idea, using cards to play the game, is the same in both cases, they also differentiate in ways other than their publishing medium. Card game types, especially trading card games, can be tricky when it comes to naming them. While sometimes called collectible card games and put to the same game category as games such as Dominion, in this thesis games are divided as seen below. (Table 3.)

Table 3. Card game types

card game type	**alternative names**	**publishing type**	**contains loot boxes/boosters**	**examples**
trading card game (TCG)		long-term	yes	Magic: the Gathering
collectible card game (CCG)	board game card game	one-time publishing	not required to play	Sorceress Dominion
digital card game		long-term	yes	Solitaire, Hearthstone
party card game	party game	one-time publishing	varies	Cards Against Humanity

Bernard Suits (2004), philosopher, professor and the writer of *The Grasshopper: Games, Life and Utopia* defines playing a game as the "attempt to achieve a specific state of **affairs** (prelusory goal), using only means permitted by rules, where the **rules** (lusory means) prohibit the use of more efficient in favor of less **efficient means** (constitutive rules), and where the rules are accepted just because they make possible such **activity** (lusory attitude)." To put it concisely, Suits (2004, 55) asserts that "game playing is a voluntary effort to surmount superfluous hurdles."

For example, in Magic: The Gathering, players usually start with 20 life points each. The most common winning condition of the game (prelusory goal) is to reduce the other player's life points to 0. Because both players agreed to play a game of Magic: The Gathering (lusory attitude), they follow the same rules (lusory means): players must follow the effects printed on the cards. If the player plays, for example, Dark Depths (Figure 1, left), they have agreed to follow the card's effect and place ten ice counters on it. In theory, if the player followed the most efficient way, they would play Dark Depths without the counters, summon Marit Lage (Figure 1, right), and attack to win the game instantly (constitutive rules).

Figure 1. Dark Depths and Marit Lage token from Magic: the Gathering (Scryfall 2023)

If the players would not agree to play with set rules, the game could be decided in any possible way, from coin toss to eating other player's deck so agreeing to follow the same lusory means is essential in any game. In other words, rules are what makes the game, and without them, the game does not exist.

3.1 Trading card games

Unlike board games, where the player can purchase the game in a box and acquire everything needed, trading card games work differently. To play trading card games, players must often purchase collectible cards in randomized packs, often called booster packs, with no guarantee of what they will get. (Kaufeld & Smith 2006.)

Because players can not be sure which cards they are getting, the available card pool and playing experience are different for each player, which results in the other key point of trading card games: trading the cards with other players. When another person has a card that a player needs to complete their deck, players can trade cards to complete their decks. People engage with each other even

when not playing the game, that way, trading card games become a social interaction. Whatever the game might be, people rarely own every single card available, so trading cards are an essential part of the identity of trading card games.

One thing that is the same in every competitive trading card game is that the game can be called so-called orthogames. Orthogames are games where two or more players play against each other, and the winner will be decided by the rules that have been agreed on before the game begins (Elias et al. 2012, 82). Examples of such games apart from trading card games are, for example, football or chess.

Most trading card games are designed for two players, but some exceptions apply, such as the Commander format in Magic: The Gathering. Four players play against each other in that format with a pre-built 100-card deck (Magic The Gathering. Commander format. 2022). However, because players have agreed on the rules before the game begins, it is still an orthogame, and the uncommon amount of simultaneous players does not matter. Other games that fall into the trading card category are Yu-Gi-Oh (1996), Duel Masters (2002), Pokémon TCG (1994), Force of Will (2012), Digimon TCG (2021), Lorcana (2023), and discontinued World of Warcraft TCG (2010).

3.2 Digital Card games

A digital card game, also known as an online card game, is a type of video game that replicates traditional card games in a digital environment. They encompass various genres and formats, from classic games like Poker and Solitaire to modern trading card games like Hearthstone or Magic: The Gathering Arena. These games are typically played on computers, game consoles, or mobile devices and can involve playing against computer AI or online opponents. They often include elements not typically possible in physical card games, such as complex calculations, random effects, or elements of secrecy.

Solitaire is probably the most well-known digital card game, and even if people do not actively think of it as such, it is most likely also the first digital card game ever published. While it does not include unique cards and uses the regular 52-card deck, it is still a digital card game as much as any other card game played with computers. Solitaire, also known as Klondike, American Patience, Klondike Solitaire, gained popularity in the 1980's and 1990's when Microsoft released Windows 3.0, an operating system that allowed a colorful graphical interface (Hughes 2015). With the new additions to computer operating systems, digital card games became possible alongside the traditional printed ones.

Nowadays, digital card games often bring an added layer of strategy and depth to the gameplay, which regular printed card games can not do. They often feature aspects like a digital economy for trading and purchasing cards, season passes in some cases, or progression systems where players earn new cards or abilities as they play. In many digital card games, players can build and customize their decks from various unique cards, each with attributes and effects, allowing for strategic complexity that is not always possible in traditional card games. For example, in the case of Hearthstone, players are required to buy cards with in-game currency, and they cannot know what card they will get before the purchase is made or combine already owned cards to get the specific ones for their decks.

While some find the crafting process less than ideal way to get specific cards, it is the closest digital card games get to real-life card trading without requiring people to communicate with each other. While all printed card games require at least two people to play the game, the digital environment allows players to play against AI and does not require human interaction. For some players, this might be the reason to choose digital card games over the printed competitors.

3.3 Collectible card games

Unlike traditional trading card games, where players do not get all the game pieces, collectible card games offer an alternative solution. While some players enjoy the aspect of trading cards and not having to own every different card available, in some cases multiple copies of each one, it is also part of the game some players want to avoid engaging with. To give a solution to this problem, collectible card games offer a gaming experience where every player has access to all cards, and they can also be used in the core rules of the game. For example, having a certain amount of specific cards is a game-winning condition in a card game Dominion (Figure 2).

Figure 2. Card assortment for standard game of Dominion (Prickett 2009)

Dominion is a classic example of a deck-building game, a subgenre of collectible card games. Every player begins with an identical, small deck and seeks to expand it throughout the game by acquiring cards from a shared pool. The goal is to amass the most victory points by the end of the game. What is interesting in Dominion is that having a certain number of specific cards can lead to a game-winning condition. For instance, the game ends when the Province card pile, the card that offers the most victory points, is depleted. The strategy, therefore,

revolves around efficiently building the deck and optimally managing the resources to acquire these valuable cards.

While Dominion is a highly strategic game in the collectible card game genre, the other end, Cards Against Humanity, is a party game rather than a traditional collectible card game. However, it embodies all players' access to the same set of cards. The game also has expansion packs that add more cards to the original game, similar to how booster packs add to trading card games. In Cards Against Humanity, players complete fill-in-the-blank statements using words or phrases typically deemed offensive, risqué, or politically incorrect printed on the game's cards. In each round, one player judges and selects the funniest, most inappropriate, or simply the best response. The round winner keeps the Black Card as a point, and the game continues with the next player acting as judge. The game ends when players decide they have had enough, and the player with the most Black Cards is declared the winner.

As seen above, collectible card games are a broad genre of card gaming. However, they still share the same basic idea as any other card game, utilizing rectangle pieces of cardboard as a central gameplay element. Because of that, collectible card games are essential to include in the card game genre while researching how they are balanced.

4 BUILDING GAME BALANCE

Game balancing is a part of the development from the start to after the game has been launched to users, and it involves tweaking numbers, monitoring the user behavior, and spotting unintentional ways players find to play the game. In general, game balancing can be divided into mathematical balance, balancing difficulty, progression balance, and several smaller categories (Schreiber & Romero 2021, 5-11). In card games, balancing is managing single cards and balancing game mechanics as well as deck types during the initial design process, but every new card adds more balancing aspects to the game. Because of this, it is not uncommon to see card games start with a small amount of game mechanics and expand them later rather than adding everything at once because, ultimately, adding things is more manageable than removing them from the games.

Balancing in card games involves adjusting the game mechanics, card abilities, and other elements to ensure a fair and enjoyable gameplay experience. The goal is to avoid overwhelmingly powerful cards or strategies, which could lead to one-sided games and a lack of diversity in playstyles. Balancing requires careful consideration of card interactions, costs, rewards, and their overall impact on the game. Developers achieve balance through iterative testing, collecting player feedback, and continuous tweaking. This constant fine-tuning helps maintain a dynamic and competitive game environment, ensuring that no single card or strategy becomes dominant while promoting various viable playstyles and strategies.

The thesis research on balancing card games utilizes existing information on the topic from various sources. Because of the unique nature of the research, the process has been time-consuming, and there is a high quantity of different information sources. However, they are all critical for conducting the final results. In the research, the main focus points and research topics are general card game balancing and how the publishing type, either digital or physical, affects the game balancing decisions during the initial game design process and after the publishing.

4.1 Game balance, solvability and metagame

The effectiveness of a game hinges significantly on its balance. As developers, countless hours are devoted to achieving this perfect game balance state. If a game lacks the appropriate balance tailored for its target audience and design intentions, it could derail the entire gameplay experience. This is true even if the game boasts stellar mechanics, a captivating story, and impeccable execution in other areas. Hence, understanding and mastering game balance is essential to game design and merits thorough exploration.

Achieving game balance is a tricky endeavor. Game designers cannot infuse their game with "extra balance" any more than they can sprinkle in "extra fun." Balance is not an additive but a characteristic. Given the intertwined nature of a game's systems, rectifying one imbalance often leads to unintended disruptions in other areas, necessitating further adjustments. Imagine changing a central cog in an intricate machinery made of various cogs; it is not just modifying an isolated piece but ensuring harmony in an interconnected system. (Schreiber & Romero 2021, 3-4.)

The game's **solvability** is determined by its possibility space and factors like determinism, transitivity, information, and symmetry. A game is considered solvable if there is a consistent optimal action for every scenario. Whether a game is solvable or not plays a crucial role in assessing its balance, as seen in games where, regardless of the number of playthroughs, there is always the best response for every situation. (Schreiber & Romero 2021, 38.) While in theory, trading card games are solvable, in practice, the ever-changing metagame and balance changes, such as banned and restricted lists, make the game only solvable at a theoretical level. If given enough time, players will find the optimal way to play the game, and therefore, changing the metagame is an essential part of the game-balancing process. While games can be divided in the categories by their information type and if they are deterministic or not, trading card games always fall into the same category as seen in Table 4 due their nature.

Table 4. Skill and luck in the games with various information

	Deterministic	Non-deterministic
Perfect information	Go, Chess	Backgammon
Hidden information	Battleship	Trading card games

The term "**metagame**" refers to the strategies or actions outside of direct gameplay that influence a player's odds of winning. For instance, Poker might involve analyzing opponents' playstyles, while trading card games like Magic: The Gathering confines deck construction with an eye on prevalent deck trends. In professional sports, the metagame includes salary negotiations, player drafts, trades, training intensity, and the choice of training techniques. (Schreiber & Romero 2021, 41.)

An excellent example of game balance, solvability, and metagame is Yu-Gi-Oh! in 2005. "Goat Format," a specific Yu-Gi-Oh! format, or in other words the specific time frame in teh game's history, from the summer of 2005, named for the prominent use of the Scapegoat card, is still widely considered one of the best formats in the whole Yu-Gi-Oh! history. Played even today with the same card pool, rules, and ban list, its hallmark deck was Goat Control, leveraging the potent duo of Scapegoat and Metamorphosis (Figure 3). Although Konami does not officially support it, the format is still popular online and offline among new and veteran players, with enthusiasts upholding it out of passion and nostalgia. (What is Goat Format? 2015.)

Figure 3. Scapegoat and Metamorphosis, two critical cards in Goat Format (Yugipedia)

In 2005, it was widely regained that Scapegoat and Metamorphosis-based decks were the correct way to play the game, and therefore they dominated the metagame. Despite the constraints of a fixed card pool, Goat Format remains an essential point of Yu-Gi-Oh! metagame history for its creative deckbuilding and innovative strategies, especially when given almost 20 years to be solved. Over the years, while dominant decks have solidified their positions in the meta, dedicated players have continuously explored new avenues for gameplay, resulting in the emergence of unique tech choices and previously underappreciated strategies. For instance, while decks like Goat Control, centering cards from Figure 3, remain popular, alternative approaches like Burn, Aggro, and the more eclectic PACMAN (Pure Advantage Camel Munches All Newbs) have carved out their niches. This consistent evolution and the introduction of fresh perspectives indicate that the format is far from static, and a wealth of untapped potential is still waiting to be explored.

One of the standout qualities of Goat Format is its emphasis on skill-intensive gameplay. Unlike other formats or eras in Yu-Gi-Oh!, Goat Format is renowned for rewarding player skill, deep strategic understanding, and precise decision-making. In many scenarios, it is not merely the deck's composition but the

player's adeptness in piloting it that determines victory. This depth ensures that even if a hypothetical "best" deck exists, its success is not guaranteed in the hands of a novice. Mastery of one's deck and the broader intricacies of the format remains paramount, underscoring the importance of player skill over sheer deck optimization.

For collecting data for the research of Goat format, the well documented history was crucial for the data collection. Because of the the data available from 2005 to the knowledgeable people on Discord community of the format, analyzing the topic was possible even in 2023. As seen in Figure 4, in the 2023 metagame, Goat Control is not the dominating strategy, but multiple decks are alongside it in tournament representation. The most prominent meta status is on a Chaos Turbo deck with 28% metagame, followed by Warrior decks with 17.2%. While Goat Control is still one of the meta decks of the format, it only has 7.5% meta-game representation, unlike in 2005 (Figure 5), where its metagame percentage was 80%. The most prominent change is the rise of Chaos Decks, which were not played in 2005 but were a product of evolving metagame over the years. This shows the depth of the format and theoretical solvability, where the format seemed to be dominated by one deck in the past. With more time, active players emerge with new and innovative strategies to combat the old dominating ones.

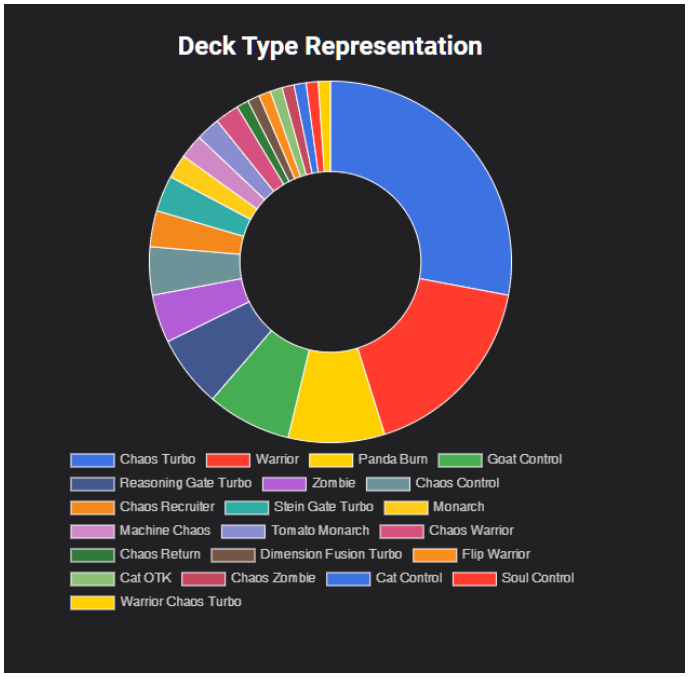


Figure 4. Goat Format metagame in 2023

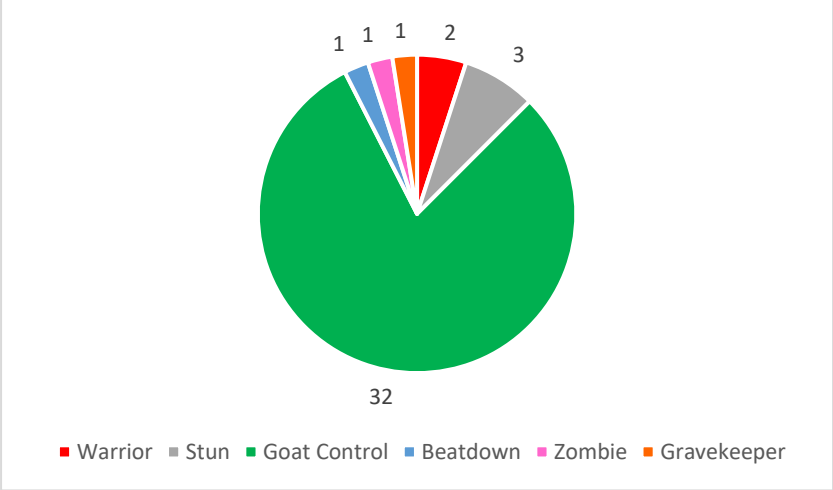


Figure 5. Goat Format metagame in 2005, data from https://yugiohtopdecks.com

With all its depth, the Goat format gives an excellent sample for the basics of trading card game balancing, solvability, and metagame. It shows how trading card games can be solved, and even sections of the game's history that seem to need balancing can change when given sufficient time. Be it a new game that is being balanced to initial release or an existing game receiving a new expansion, trading card games and their metagames are ever-changing. This is also why

players engage with them almost twenty years after the initial launch, like in the case of the Goat format.

4.2 Rapid testing and iterating with playtest cards

Playtest cards are crucial in game development as the foundation for testing and iterating on gameplay mechanics, balance, and overall player experience. Game designers and developers create these cards, often with simple designs or temporary artwork, to prototype and playtest their games before final publication (Figure 6). Since these cards often undergo revisions based on tester feedback, they are usually made in a cost-effective and easy-to-modify manner - think photocopies or printouts affixed to regular card stock. These playtests help identify strengths and weaknesses in the game, which designers can address in further iterations.

Figure 6. Magic the Gathering playtest cards (Ancestry 2022)

In the specific context of a card game like Magic: The Gathering, five main sets of playtest cards were used before the First Edition, including Alpha and Beta sets, was published. These sets, known as alpha, beta, gamma, delta, and epsilon, played a crucial role in the game's development. The alpha playtest involved a single 120-card deck hand-created by Richard Garfield, with players playing until one had an unplayable deck. This initial test provided fundamental feedback on the game's basic mechanics and overall gameplay experience. (Ancestry 2022.)

The initial playtest cards refined the game mechanics, balance, and design aspects. For instance, the beta playtest introduced separate power and toughness values for creatures and adjusted mana-casting costs. In contrast, the gamma playtest was the largest in card variety and tester participation, bringing the game closer to its final form (Ancestry 2022). In later stages, the focus shifted more towards perfecting balance and testing new card designs, which helped to form the first correctly printed sets of Magic The Gathering.

As seen above, playtest cards are meant to be used as disposable and easily modified components, not as final versions of cards. They do not feature the final card layout or artwork but focus on delivering information to playtesters most effectively. Because the cards' visuals are irrelevant to the information itself, it does not have to be produced before the final iteration of the card effect has been decided. The playtest cards are not meant only for initial testing, but with every new set of cards, there are many iterations and playtest cards of almost all that end up in the print.

With proper manual and automatic playtesting, game developers can do their best to make the game as balanced as possible. Occasionally, a card way too powerful compared to others ends up in the final print, but playtesting aims to minimize the possibility of that happening. If, however, a card like that ends up in the final printing and to players, game developers can use different balancing methods to counter their mistake even after release, which is researched further in the following chapters.

4.3 Efficient playtesting

Playtesting any game is a crucial point of the game development process, but card games are especially tricky when it comes to playtesting. Because of the different behaviors of the player base, different players might utilize the same card in different ways, and the results are not nearly as black and white as in video game testing.

Jaffe (2013) divides the game-balancing process into **automated analysis, causal models, player skill analysis, and meta-game analysis**. In his research, he utilizes quantitative methods in the game balance process, which can help to ensure that the process includes the widest variety of players possible. Jaffe has done broad research on game balancing and has researched multiple ways of utilizing AI in game balancing. This field has recently been proliferating as of writing this thesis.

The first part of Jaffe's research (2013) is automated analysis, utilizing AI and machine learning tools in game-balancing. Whether some portion of competitive game balance evaluation could be automated through AI simulation by a backend reasoning tool (Nelson & Mateas 2009) rather than playtesting has not disappeared in recent years; it has become more critical than ever. To some point, using AI for playtesting can be highly efficient, especially to find card interactions, or so-called loops, that break the core gameplay. Sometimes, those cards are easy to spot, but other times, especially when the loop requires multiple cards, finding the game-breaking interactions with just manual playtesting is impossible. While AI is a powerful tool to find problems in card and effect design, it is not a tool that can altogether remove the manual work because, especially in more complex games, the decision-making process and vast amount of strategies make it hard for AI to behave like a human player. (Jaffe et al. 2012.)

Because of the extensive playtesting process in games, it is essential to note which parts can be automated and which can not to ensure smooth testing and accurate results. In their research, Jaffe et al. (2012) designed a prototype version of a tool that could simulate different situations and decisions players made during the game, and if a tool like that could take into account large amounts of variables, could it speed up the card game balancing process significantly. Just the initial sets of card games usually consist of hundreds of cards, so game balancing becomes a significant task that requires even more work as the game ages. This issue is researched further in the later parts of this

thesis, as many trading card games tend to face issues at specific points of their life span.

The second quantitative research method Jaffe (2013) uses in his research is causal models. In video games, those can be, for example, completed levels, earned trophies, and hours played (Jaffe 2013, 81). In digital games, those analytics can be tracked in multiple ways, for example, in Mixpanel, where game developers can add variables to track during player's gameplay sessions. For digital card games, such variables could be tracking how big of a percentage of games are won after resolving a specific card and, therefore, finding cards that need balancing or attention regarding possible further interactions with upcoming cards.

Yu-Gi-Oh! Master Duel, a digital version of a 25-year-old physical card game, tracks specific cards and their win percentages after resolving said card. Any player can access this data in-game, which can help developers see possible problem cards and help players with the deck-building process. As seen in Figure 7, Yu-Gi-Oh! Master Duel players can get data regarding the cards played during the game and use that to build better decks. In Figure 7 (VillalobosChamp 2023), a card named Maxx "C" has an 87.8% usage rate, and players play 2.81 copies on average, so it can be said that the card is potent and is most likely something developers must keep in mind when looking at the game balancing. Similar data can be utilized in other games, although rarely shown to players, to aid with balancing while the game is already in a live.

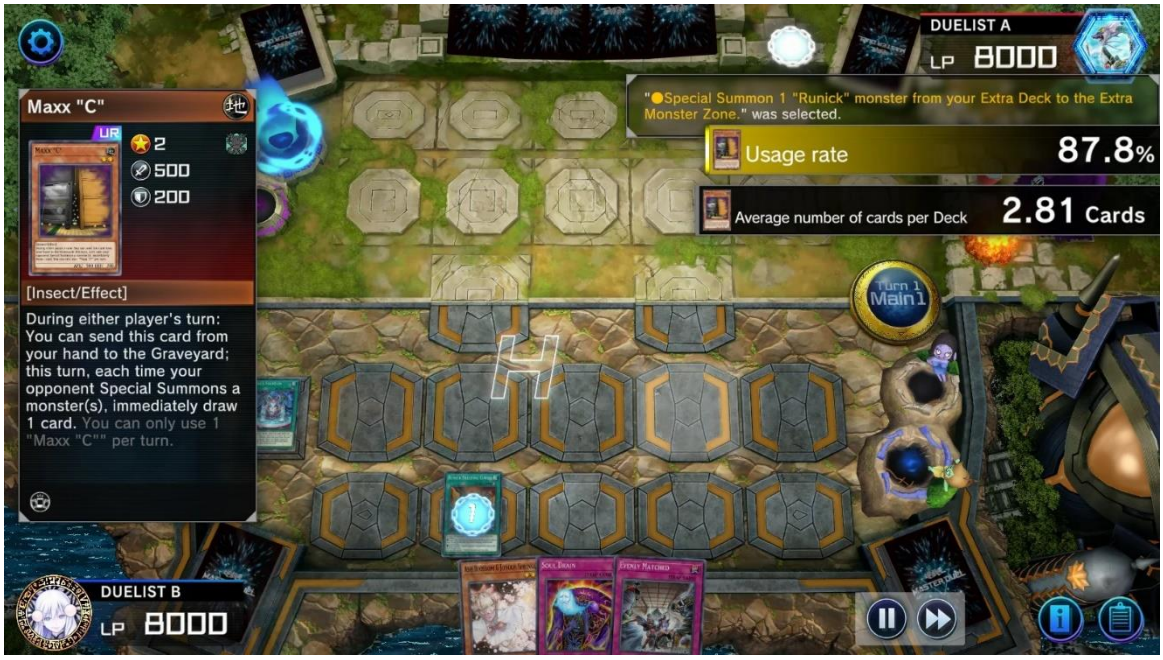


Figure 7. Master Duel UI with usage data (VillalobosChamp 2023)

The game balancing between casual and competitive players is a challenging task, because of the vastly different ways to play card games between those two groups. It might be easy to balance the game for one player group but not for another, making player skill analysis important. Card game tournaments allow for collecting large amounts of quantitative data regarding the metagame. They are such a way to get a picture of the state of the game balance, although only from the tournament perspective. Because of this, it is an excellent way to do metagame analysis, which is the fourth and final quantitative method of Jeffe's research (2013) .

5 RESOURCE SYSTEMS AS A WAY TO BALANCE THE GAME

Mana or resource systems in card games are the mechanisms that limit the actions players can take during their turns, adding strategic depth to gameplay. Several different types of resource systems are used in various card games, from mana cards to using cards from the deck to count life points during the game, and, in the following chapter, those are studied further. Each resource system presents unique strategic elements, impacts the pace of gameplay, and contributes to the overall game balance. Whether it is the land-based system of Magic: The Gathering, the increasing mana crystals of Hearthstone, or the energy system of Pokémon Trading Card Game, these resources dictate what actions players can take and when.

Understanding these systems, how they differ, and how they impact gameplay is crucial to playing and designing balanced card games. The system's design can heavily influence the game's metagame, the viability of different strategies, and the overall player experience. This chapter delves into the intricacies of various mana systems, exploring their strengths, potential challenges, and the unique gameplay dynamics they create, and we will also discuss how these systems contribute to balance in card games, promoting strategic diversity and counterplay.

5.1 Mana systems

The resource or mana system is one of the most critical mechanics of any card game. The mana system impacts the pacing of the game, the strategic decisions that players make, the depth of the gameplay, and the overall balance of the game, and it essentially regulates the extent to which players can take actions or play cards during their turn, ensuring that players do not overpower their opponents by playing too many cards at once or too soon. Different card games employ various types of mana systems, each contributing to the game's unique flavor and strategic depth. These systems can broadly be categorized into

accumulative mana systems, refreshing mana systems, and games with no mana system; a life point system.

In the following sections, the research delves deeper into each of these mana systems, discussing their design, function, impact on gameplay, and some examples of card games where they are implemented. Understanding the mechanics of these different mana systems can provide valuable insight into the strategic depth of card games. It can be an essential aspect for game designers and players alike, so the topic is essential regarding game balancing.

5.1.1 Accumulative mana system

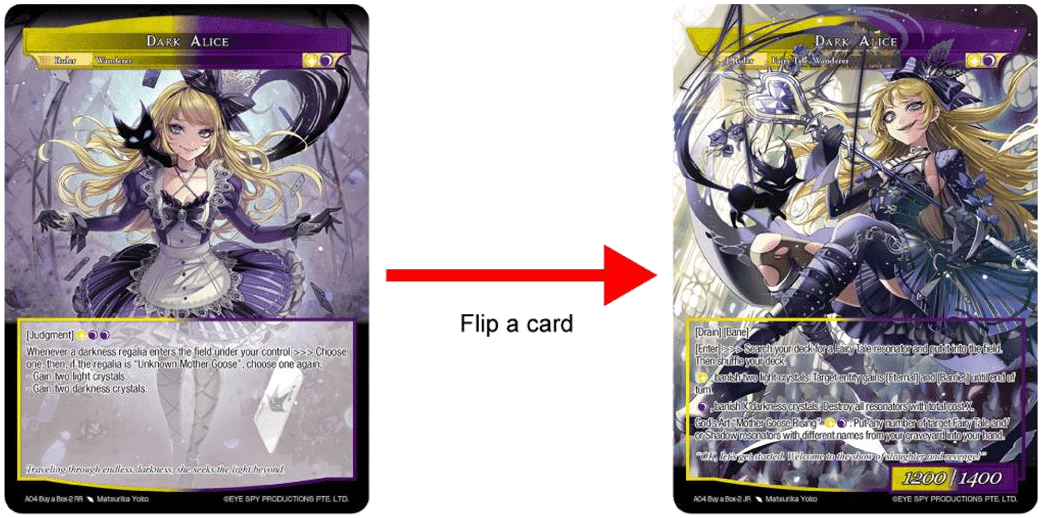
An accumulative mana system, such as the one used in Magic: The Gathering, as well as many other trading card games, is a resource system where players increase their available resources, or mana, over time through specific cards. Other games that use the accumulative mana system include, for example, Force of Will and World of Warcraft TCG. In Magic: The Gathering, these are land cards, and each one represents a different type of mana, or in simple terms, color, that can be used to cast spells, summon creatures, and activate abilities.

At the start of the game, players have no mana and must draw and play land cards from their deck to generate mana. Each land card typically provides one mana of a specific color each turn. The mana from these land cards can be used to play other cards from the player's hand, each with a mana cost that must be paid for it to be played.

What is unique about the accumulative mana system is that the mana resources stay on the field once played and can be used every turn. Players can accumulate more mana and play increasingly powerful cards as the game progresses. This adds a layer of strategy to the game, as players need to manage their mana base, plan future turns, and balance their deck between land cards and other cards. However, this system can also lead to "mana screw" or

"mana flood" scenarios where a player draws too few or too many land cards respectively. These scenarios can significantly affect the game's outcome, as players may be unable to play their cards effectively.

Because of Magic: The Gathering (1994), many physical trading card games use mana that starts in the deck, which also leads to many problems. One game that took the accumulative mana system and removed mana-related problems simultaneously is Force of Will, a trading card game created by Eye Spy Productions PTE. LTD (Figure 8).



FRONT SIDE: Ruler

BACK SIDE: J-Ruler

Figure 8. Ruler card from Force of Will (Force of Will 2021)

As stated, the accumulative mana system causes several issues in the gameplay. To combat this, many games have taken the base idea of accumulative mana and tried to eliminate as many problems as possible caused by the said system's core function, the necessity of having mana cards that serve just that purpose on the deck. One such way is not to include mana cards in the main deck but to place them in separate decks where they can be accessed with various methods, such as, for example, ruler cards in the card game Force of Will. In said game, each player has a ruler (Figure 8), and players access one mana each turn by tapping the said card. However, there are other ways to

accumulate mana in said game, so some formats might become explosive and aggro deck-heavy, whereas in other formats, games might take much longer to finish.

The accumulative mana system's core issue is that the element of luck is heavily present in said systems. Because of that, it causes a hindrance to game balancing and might, therefore, make it unnecessarily hard for game developers. Because of that, it is essential to understand the issues if the accumulative mana system is chosen for the game, and even if it has been used by many successful games such as Magic: The Gathering and Pokemon, it is far from a perfect gameplay mechanic.

When mana-producing cards are put in the deck rather than in a separate deck, they produce a mechanic of randomness to the game. Typical problems include players drawing too many or too few mana cards, leading to situations where players need help to proceed (Figure 9).

Consider a 60-card library with L_{lb} lands. Consider an opening hand with N_{op} cards and L_{op} lands. The probability $\mathbb{P}(\mathrm{hit})$ of hitting at least L_{rq} lands after N_{dr} draw steps is given by

$$\mathbb{P}(\mathrm{hit}) = \begin{cases} \sum_{\ell=L_{\mathrm{rq}}-L_{\mathrm{op}}}^{L_{\mathrm{op}}+N_{\mathrm{dr}}} H(\ell, N_{\mathrm{dr}}, 60-N_{\mathrm{op}}, L_{\mathrm{lb}}-L_{\mathrm{op}}) & \text{if } L_{\mathrm{rq}} > L_{\mathrm{op}} \text{ and } N_{\mathrm{op}} = 7; \\ \frac{L_{\mathrm{lb}}-L_{\mathrm{op}}}{60-N_{\mathrm{op}}} \sum_{\ell=L_{\mathrm{rq}}-1-L_{\mathrm{op}}}^{L_{\mathrm{op}}+N_{\mathrm{dr}}-1} H(\ell, N_{\mathrm{dr}}-1, 60-N_{\mathrm{op}}-1, L_{\mathrm{lb}}-L_{\mathrm{op}}-1) & \\ \quad + \left(1-\frac{L_{\mathrm{lb}}-L_{\mathrm{op}}}{60-N_{\mathrm{op}}}\right) \sum_{\ell=L_{\mathrm{rq}}-L_{\mathrm{op}}}^{L_{\mathrm{op}}+N_{\mathrm{dr}}} H(\ell, N_{\mathrm{dr}}, 60-N_{\mathrm{op}}-1, L_{\mathrm{lb}}-L_{\mathrm{op}}) & \text{if } L_{\mathrm{rq}} > L_{\mathrm{op}} \text{ and } N_{\mathrm{op}} < 7; \\ 1 & \text{if } L_{\mathrm{rq}} \leq L_{\mathrm{op}}. \end{cases}$$

where $H(a, b, c, d)$ represents the hypergeometric probability of hitting at least a successes in a sample of size b from a population of size c containing d successes.

Note that case involving mulligans distinguish between having a land on top, which happens with probability$(L_{\mathrm{lb}} - L_{\mathrm{op}})/(60 - N_{\mathrm{op}})$, and having a spell on top, which happens with the complementary probability.

Figure 9. Karsten's formula of calculating the amount of lands to consistently play the chosen Magic: The Gathering deck (Karsten 2017)

A typical deck of Magic: The Gathering contains 60 cards, and the typical amount of mana in the deck is around 25 mana-producing cards. In his research, Frank Karsten (2017) developed a formula, Figure 9, to calculate the probability of having a certain amount of land cards after multiple game turns. Karsten (2017) used the following rules, which are in general thought to be a good base for the mulligan strategy in Magic: The Gathering:

- You mulligan any 7-card hand with 0, 1, 6, or 7 lands.
- You mulligan any 6-card hand with 0, 1, 5, or 6 lands.
- You mulligan any 5-card hand with 0 or 5 lands.
- You keep any 4-card hand.
- After a mulligan, you always scry a land to the top and a spell to the bottom.

Lands in deck	P(2 lands by turn 2)	P(3 lands by turn 3)	P(4 lands by turn 4)	P(5 lands by turn 5)	Exp. opening hand	P(mana flood)
17	96.8% / 95.6%	77.2% / 69.1%	51.1% / 41.0%	28.8% / 20.8%	6.458 cards	1.2%
18	97.7% / 96.8%	80.7% / 73.0%	56.3% / 45.9%	33.8% / 24.9%	6.530 cards	1.9%
19	98.4% / 97.7%	83.8% / 76.5%	61.2% / 50.6%	39.0% / 29.2%	6.594 cards	2.8%
20	98.9% / 98.3%	86.4% / 79.6%	65.8% / 55.2%	44.1% / 33.7%	6.649 cards	3.9%
21	99.2% / 98.8%	88.6% / 82.3%	70.0% / 59.6%	49.3% / 38.3%	6.697 cards	5.4%
22	99.5% / 99.2%	90.5% / 84.7%	73.9% / 63.7%	54.3% / 43.0%	6.738 cards	7.3%
23	99.6% / 99.4%	92.1% / 86.8%	77.4% / 67.7%	59.1% / 47.6%	6.772 cards	9.5%
24	99.8% / 99.6%	93.5% / 88.7%	80.6% / 71.3%	63.8% / 52.2%	6.801 cards	12.2%
25	99.8% / 99.7%	94.6% / 90.4%	83.5% / 74.7%	68.2% / 56.7%	6.825 cards	15.2%
26	99.9% / 99.8%	95.6% / 91.8%	86.0% / 77.9%	72.3% / 61.1%	6.844 cards	18.7%
27	99.9% / 99.8%	96.4% / 93.1%	88.3% / 80.8%	76.0% / 65.3%	6.858 cards	22.6%
28	99.9% / 99.9%	97.1% / 94.2%	90.2% / 83.4%	79.5% / 69.2%	6.868 cards	26.8%

Figure 10. Formula results (Karsten 2017)

As seen in Figure 10, a couple of columns contain two percentages that Karsten (2017) explains to be the probability of having the land card when you are on the draw, and the second refers to the probability when you are on the play. The sheet above shows that if a player has 25 land cards in the deck, they have an 83.5% probability of having a land card on the draw and 74.7% on the play. If the same player would like to have 90% consistency, they would need to increase

the number of land cards to 28 while raising the probability of mana flood from 15.2% to 26.8%. This not only makes over ¼ of the games hard to play but also makes the player remove three cards that are used to play the game from their deck.

Competitive trading card games often tend to minimize randomness in their gameplay, and because of that, the mana system is one possible problem when balancing the gameplay experience. Because of that, other games have tried to eliminate this design problem with various solutions, which are researched further in upcoming sections.

Card games operate similarly to chess in that players try to eliminate as much of the element of luck as possible from their gameplay experience, especially in higher-level gameplay, such as tournaments. While trading card games can never achieve zero-luck gameplay, such as in chess or, for example, tic-tac-toe, it is not a reason to stop considering ways to minimize the luck from early on in the game design process. The accumulative mana system, intrinsic in its design, can introduce such a dose of randomness that disrupts the desired rhythm of gameplay and, therefore, causes players to dislike the core gameplay mechanics of the game, even though the other parts of gameplay work in a sufficient manner. Over the years, game designers have brainstormed and experimented with various methods to eliminate this randomness, aiming for a more balanced play experience.

One notable solution is the introduction of a separate mana deck, as evidenced by games like Force of Will. By demarcating a deck exclusively for mana or resource cards, players are assured of consistent access to their resources each turn while simultaneously acquiring cards necessary for the gameplay with each card draw. This design choice eliminates mana problems, ensuring players are always provided with their strategic potential due to mere chance. Another approach that has gained traction is the fixed mana increase system, the so-called refreshing mana system, which is researched further in the following

chapter. In the refreshing mana system, players receive a predetermined amount of mana or resource increment each turn rather than being contingent on the luck of the draw. The refreshing mana system ensures predictability in the game's resource curve, allowing both participants to strategize with certainty, knowing that their resource pool will grow at a fixed rate. One player can not gain the upper hand in the match because of the mana.

After all, one of the most efficient ways to battle the problems caused by an accumulative mana system is also the simplest. By allowing players to mulligan cards in their hands, many of the system's problems can be reduced. Karsten's (2017) detailed calculations on the previous part show that mulligan can offer players a safety net against unfavorable starting hands in Magic: The Gathering. By providing players with more opportunities to redraw or balance their initial hand, the game can reduce the initial impact of an unlucky draw. In essence, while the specter of luck can never be wholly removed from card games, these design innovations aim to strike a balance in luck in card game design.

5.1.2 Refreshing Mana System

A refreshing mana system, used in digital card games like Hearthstone (2014), is a resource system where players gain a set amount of mana each turn, wholly refreshed at the beginning of their next turn. The digital format of the game allows automatization, which ensures that both players can easily keep track of their progress and player errors are eliminated. In refreshing mana systems, mana is usually presented as gems, like in Hearthstone (Figure 11), or orbs, like in Shadowverse (2016).

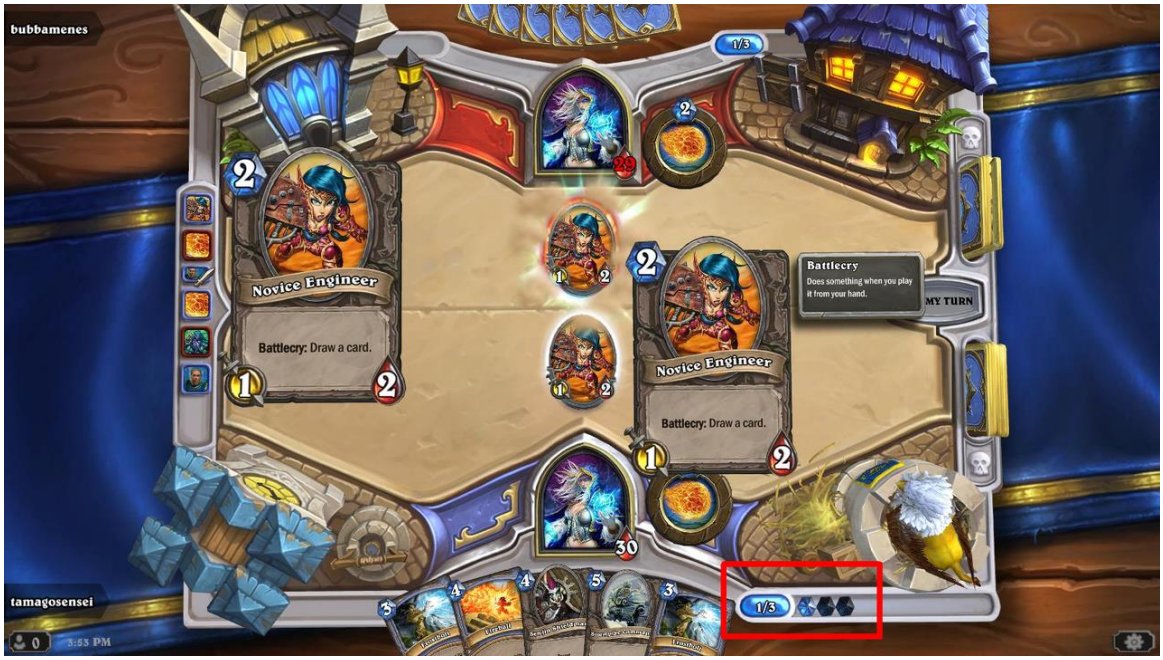


Figure 11. Visualization of the mana in Hearthstone (Burton et al. 2014)

At the start of the game, each player has one mana crystal. With each new turn, the player gains an additional mana crystal up to a maximum limit. For example, Hearthstone is ten. These mana crystals are used to play cards from the player's hand, each with a specific mana cost. Once mana crystals are used, they're emptied for the rest of the turn but entirely refreshed at the start of the player's next turn. This lets players plan their turns, knowing how much mana they will have available.

This kind of mana system eliminates some of the randomness of an accumulative mana system, like in Magic: The Gathering. In the refreshing mana system, there's no need to draw resource cards from the deck, which means players will not experience mana screw, getting too little mana, or mana flood, getting too much mana. Instead, it ensures a predictable and consistent increase in resources every turn, allowing players to focus on strategic card play.

Some games with a refreshing mana system may also include cards or abilities that manipulate mana crystals. For instance, cards that grant additional mana

crystals, cards that cost less under certain conditions, or even cards that can reduce the opponent's mana. While this system offers more predictability and less randomness when compared to an accumulative mana system, it still requires careful resource management and strategic planning. Players must decide how best to use their mana each turn, considering both the current game state and potential future turns. The refreshing mana system, therefore, retains strategic depth while reducing the luck factor associated with drawing resource cards.

5.2 Life point systems

Life point systems, often indicated with health or hit points, are another common way to track the game's progress in many card games. While mana systems provide the game's pace, life point systems give the game a goal and the main objective, typically to reduce the opponent's life points to zero. Each player starts with a specific number of life points. For example, Magic: The Gathering players begin with 20 points, whereas Yu-Gi-Oh! players start with 8000. Additionally, life points can sometimes be used as a resource for activating powerful effects when they become a mana system themselves.

Each increment or decrement can have a significant relative impact on a system that uses small numbers. For example, in a card game where health values might range from 1 to 10, changing a card's health by 1 is a big deal—it is a 10% to 100% change depending on the initial health of the card. Changes like this could drastically alter the game's balance, making a previously weak card overpowered or rendering a previously vastly used card ineffective.
In a system that uses more significant numbers, changes can be made more gradually and precisely. If health values range from 1 to 1000, a change of 1 unit is a much smaller relative change, making it easier to fine-tune the balance. (Mayo 2018.)

However, it is essential to note that while more significant numbers can make balance easier to fine-tune, they can also make the game more complex and harder to understand for players. If numbers get too large, it can become difficult for players to instinctively grasp the relative strengths and weaknesses of different cards or characters, negatively impacting gameplay. Because of the decision of keeping numbers relatively small, Magic: The Gathering has little room when it comes to balancing cards with just their attack and defense values alone, which has led to various design problems, such as once powerful cards becoming not competitively playable (Magic: The Gathering has a Power and Toughness Problem 2020).

On the other hand, games might also utilize both large and small-scale numbers, such as with Duel Masters. Duel Masters uses a mix of both large and small numbers to create a dynamic and balanced gameplay experience. Attack points, often represented by large numbers, introduce a broad spectrum of creature power levels, varying from a few thousand to over ten thousand or more. This variation in power level offers players strategic choices both in deck-building and during actual gameplay. For instance, players might grapple with incorporating a high-power creature with potential drawbacks versus a lower-powered creature with advantageous abilities. Moreover, these large numbers have a psychological impact. Players can find it thrilling to command a creature with 12000 power, creating a sense of impact and dominance.

Conversely, the game employs smaller numbers to regulate essential gameplay elements such as mana and shields. Mana, a crucial resource in the game, demands careful management from players due to its limited nature. Every card in Duel Masters can be used to produce mana, resulting in the hybrid of two mana systems.

Shields, represented by another set of small numbers, add another layer of strategy and tension to the game. Players start with five shields, a modest number that intensifies the gameplay. These shields serve as both a player's

defense mechanism and potential resources. As the game progresses and shields are broken, the defending player can draw and possibly utilize the shield card, introducing a twist in the gameplay. This system ensures that matches remain tense, with players constantly on the edge, aware that the game's tide can turn in just a few moves. This is further emphasized by Duel Masters lead game designer, Tony Sharma, who has designed a modern version of Duel Masters to be played in the best-of-one format, unlike most trading card games that use the best-of-three format to decide the winner of the game. Sharma (personal discussion, August 22, 2023) explained that this is not only because the game is balanced to be played with a best-of-one format but also because it makes it enjoyable for kids to play.

Duel Masters decision to harmoniously integrate large and small numbers offers a rich, multi-layered gameplay experience. Each number set brings challenges and rewards, ensuring players remain profoundly engaged and strategic in their approach throughout the game, making the decisions regarding the initial number design crucial to the game. While choosing too small of numbers can cause problems like in Magic: the Gathering, too big numbers can cause player errors since people would need to operate with big numbers.

6 BALANCING THE LIVE TRADING CARD GAME IN A LONG TIMEFRAME

Based on the author’s experiences as a trading card game player as well as an official judge in multiple games such as Yu-Gi-Oh! and Pokemon TCG, alongside with experience in game design, balancing card games is an essential part of the initial game design decisions and an ongoing process during the life cycle of the trading card game. Some things, like the number scaling of the game, need to be decided before even starting the balancing process. In contrast, singular card balancing happens all the time while making game design decisions. When balancing games, the scale of numbers involved can significantly impact the difficulty of achieving balance, and this has a lot to do with the granularity and the relative impact of changes that can be made.

In this chapter of the thesis, the primary source of information is collected from an in-depth data analysis of the selected games coupled with feedback from the players. Through a examination of game mechanics, strategies, and outcomes, it was possible to collect valuable insights about the topic. Moreover, direct feedback from players offers a firsthand perspective on their experiences, challenges, and suggestions. Together, the quantitative data from the games and qualitative insights from player feedback provide a comprehensive understanding of the subject under study.

Game designers often strive to find a balance between granularity for balance purposes and simplicity for player comprehension. However, there are also other long-term ways to balance card games. Some of the most well-known are rotating formats or restricting specific cards from competitive play. Therefore, it is essential to notice that most game-balancing methods apply primarily to sanctioned and competitive gaming experiences.

Rotating formats, or set rotations, are a common strategy in many card games, including Magic: The Gathering and Hearthstone. This method involves regularly cycling older card sets out of the standard competitive format and introducing

new ones. The rotation keeps the meta-game dynamic, as players must continually adapt to a changing card pool. This strategy also helps mitigate power creep, the trend of newer cards being stronger than older ones to remain attractive. Although this approach may alienate some players attached to their older cards, it helps keep the competitive scene fresh and balanced. Restrictions or bans on certain cards are another common approach in balancing card games. These measures are typically taken when a card is deemed too powerful or disruptive in the competitive scene. By banning or restricting the card, designers can adjust the game's balance without changing the card itself. This is particularly useful in a physical card game where altering a card after it has been printed and distributed is impossible.

It is essential to highlight that game balancing is not a one-time task but an ongoing process. Designers continually monitor player feedback, competitive game data, and the evolving metagame. Sometimes, unforeseen strategies or card interactions emerge that could disrupt the game balance, and the ability to adapt and respond to these shifts is a critical skill for game designers. In the end, the goal is to create a game that is both fun and fair and where strategy and skill determine victory.

6.1 Why do card games need balancing after launch?

To understand card game balancing, starting with the example from the well-known Magic: The Gathering case is the most straightforward way. The earliest sets of Magic The Gathering, including the Alpha, Beta, and Unlimited sets, are renowned for containing some of the most powerful cards in the game's history, collectively known as the "Power Nine." These nine cards, including Black Lotus, Ancestral Recall, and the five Moxen, known as mana-positive cards, are infamous for their extreme potency and game-altering abilities. The reasoning for making powerful cards like Black Lotus is understandable, as players who accumulate resources and get into a positive game loop tend to do well in games,

such as players who get to the point in Monopoly when they get more resources than they spend, and therefore win the most amount of games.

When Magic the Gathering was first created, the concept of a trading card game was entirely new, and there was little precedent for how such a game should be balanced. The game's designers were exploring uncharted territory, and they still needed to clearly understand how different card mechanics and effects would interact and impact the game's balance. Richard Garfield, the creator of Magic: The Gathering, states that when designing Magic the Gathering Richard Garfield, the lead game designer had two options: either make cards more potent by each set or leave the game at some point and start a new one, and in a relatively short amount of time it was clear that neither of those ideas would have been doable (Fullerton et al. 2003).

The Power Nine is a clear example of this. These cards provide immense advantages with minimal cost. For example, Black Lotus (Figure 12) provides an enormous mana boost for no cost, and Ancestral Recall allows a player to draw three cards for just one mana—both effects are vastly more potent than what the player would find on most cards in later sets. As the game evolved, the designers learned more about what made cards too powerful and how to balance them better. They realized that specific mechanics, like fast mana acceleration and cheap card draw, can easily disrupt the game's balance by providing too much advantage too quickly. They also learned to consider factors like card rarity and play format when balancing cards.

Figure 12. Black Lotus from Magic the Gathering Alpha edition (Scryfall 2023)

These lessons have informed the design of later sets, making them generally more balanced and less likely to include overwhelmingly powerful cards like those found in the Power Nine. The Power Nine are banned or restricted in most play formats due to their power level, further acknowledging their status as outliers in the game's balance. However, Wizards of the Coast, the company behind Magic: The Gathering, learned valuable lessons from these initial sets, which have informed their design and balance philosophy for later sets.

Magic: The Gathering has adopted a system of regular set releases and a rotating format in Standard play. Releasing new sets keeps the meta fresh and allows for natural phase-outs of potentially problematic cards, assisting overall game balance and banned and restricted lists. Wizards also learned to actively manage and update banned and restricted lists for different game formats. Different lists for different game formats allow them to address any cards that prove too disruptive or dominant in the practice of the specific type of game, even after all the testing and balancing done during the design process. These lessons have helped Magic: The Gathering to evolve and maintain its popularity over the years despite the balance issues of its early sets. As one of the first trading card

games, Magic the Gathering had to come up with these concepts, which later became standard to many other card games, such as banned and restricted lists and card text erratas.

6.2 Banned and restricted lists and limiting the usage of a specific card in competitive environment

Banned and restricted lists in card games are lists of specific cards prohibited from being used in certain game formats or tournaments due to their perceived impact on game balance. These lists are typically created and maintained by the game's developers or the governing body responsible for official tournaments and competitive play.

Balancing in gaming involves fine-tuning and playtesting to enhance elements such as depth, pacing, equality, unpredictability, and diversity. The range of balance inquiries varies, from understanding the benefits given to the first player to evaluating the scope of a long-term strategy to ensuring the functionality and relevance of every action in the game. These inquiries hold significant importance for competitive games that need to maintain engagement within their community over an extended period, often spanning several years. (Jaffe et al. 2012. 26.)

Banned and restricted lists are essential in physical card games, where it is harder to make changes to existing cards, but they can also be utilized in a digital card game-playing environment. While a casual player who plays with their friends on a kitchen table setting does not necessarily need to be aware of the banned and restricted list or follow it, it is one of the vital balancing mechanics of competitive long-term card games after the initial card design process.

There are several reasons why a card might be added to a ban list. One common reason is that the card is deemed too powerful, leading to an unhealthy game environment where the banned card or decks utilizing such cards to a high degree are overly dominant. Situations like this can reduce the variety of viable strategies and make games repetitive or unenjoyable. A card might also be

banned because it enables a combo or strategy deemed unfun to play against, even if it is not necessarily overpowered. Sometimes, a card is banned because its effect is too complex, confusing, or time-consuming, leading to practical issues in gameplay, particularly in a tournament setting. Ban lists are essential for maintaining the health of the game environment. They are a tool that game designers and tournament organizers can use to control the metagame, the game's competitive landscape, and ensure a diverse and enjoyable play experience. By banning certain problematic cards, they can encourage players to explore various strategies and deck types, promoting creativity and discovery. It is worth noting that ban lists are usually a measure of last resort. Game designers typically prefer other balancing methods, such as designing new cards that counteract the problematic ones or modifying the game's rules. However, in some cases, particularly in physical card games where existing cards can not be easily modified once printed, banning is the most practical solution.

To ensure the integrity and fairness of the game, the process of adding a card to the banned or restricted list is usually a rigorous one. Game designers and organizers typically rely on a combination of playtesting data, competitive results, and player feedback to make these decisions. It is not a decision made lightly, as banning a card can upset players who have built decks around it and, in the case of physical card games, have invested money in acquiring it.

Banned and restricted lists also vary depending on the game format. Some card games have multiple formats, each with different rules and card pools. For instance, in Magic: The Gathering, there is a format called Standard, which only includes the most recent card sets, and another format called Modern, which includes all sets from a certain point onwards. Each format has its own banned and restricted list, tailored to its specific needs and balance issues. Decisions like this allow players to choose the format that best suits their play style and card collection. It is crucial to consider the impact of these lists on the community as well. While they are essential in maintaining game balance, they can also cause frustration among players. This is particularly true when a popular card or a key

card in a player's deck is banned. To mitigate this, game designers often provide a detailed explanation when a card is added to the banned or restricted list, outlining the reasons behind the decision. This transparency can help players understand the necessity of the ban and can generate discussion within the community, leading to a more robust and engaging game environment.

Banned and restricted lists are a vital tool for maintaining balance in card games, but they can also cause issues because of their nature or how they are published. In some cases, developers do not tell the exact date of the next banned and restricted list, so players have to guess when that happens, which can affect both the initial sales and the second-hand market of the game. Because of the fear of their cards ending up on the banned and restricted list, players can avoid buying new products around the time the new list should come up and then buy it after seeing what changes developers made after the release. While they are not the only method and often act as a last resort, they provide a means of control over the metagame. Their effective use, in conjunction with other game design and balancing techniques, contributes to the longevity and enjoyment of the card game, fostering a diverse and evolving play environment. Competitive play and how it differentiates from casual play is discussed further in Chapter 7.

6.3 Rotating formats

Banning and restricting specific cards might be the most effective way to balance the competitive environment of the card game after the initial balancing process. However, there are other ways to ensure the game balance. Rotating formats in card games refer to game modes where only the most recently released sets of cards are allowed to be used, and they are used in both physical and digital games to eliminate the possible interactions of cards outside of the rotation, which could include game-breaking interactions. The specific number of recent sets that are allowed can vary depending on the game. However, sets typically become no longer allowed after a certain period, for example, a year after the

release. Games from Hearthstone to Magic: the Gathering uses rotating formats to balance their competitive playing environments (SET ROTATION!!: The Seven Deadly Sins of TCG Design Part 1 2020).

The main reason for having rotating formats is to keep the game fresh and dynamic. With each new set, the metagame changes as players experiment with new cards and combinations. This constant flux can make the game more exciting and engaging, encouraging continuous learning and adaptation. Rotating formats also help with game balance. As more and more cards are added to a game, the complexity of balancing the game increases exponentially. Limiting the card pool to a subset of all available cards makes it easier for the game designers to predict interactions and balance the game. Additionally, if a specific card or strategy becomes too dominant, it will eventually rotate out of the format, naturally rectifying the issue.

Another benefit of rotating formats is that they can be more accessible to new players. In an “eternal format” where all cards are allowed, the card pool, and thus the knowledge required to play competitively, can be overwhelming, especially for a player with no prior trading card game experience. Additionally, some older cards may be hard to obtain or expensive, so in a rotating format, the card pool is smaller and typically consists of readily available cards. Because of that, rotating formats give new players a lower level of entry. It also allows game developers to test out new mechanics without affecting the balance of the whole game. If one mechanic seems problematic, it will not destroy the balance of a long-term game, as eventually, cards rotate out of the format, and new cards replace them. However, this should not be used as an excuse for poor game design and balancing situations because even though the cards will eventually rotate out of the format, the game stays relatively lovely to play at all times.

6.4 Responsive balancing

Game balancing in digital card games involves continuously monitoring, analyzing, and adjusting game elements to ensure a fair and enjoyable player experience. The digital nature of these games allows developers to take a data-driven approach to balance, and provides flexibility in making adjustments post-release. Game developers closely monitor gameplay data and player feedback to identify any potential issues with game balance, and card game developers are no different. They may track metrics such as win rates for specific cards or decks, frequency of card usage, and player progression rates. Based on the insights gained from monitoring and analysis, developers can change the game to address balance issues. In digital card games, this might involve altering the attributes of specific cards, such as their cost, power, or effects. Because the game is digital, these changes can be made without needing to physically reprint cards, as would be necessary in a physical card game.

Any proposed balance changes are tested extensively before being implemented in the live game. This can involve internal testing by the developers and potentially public testing on a separate "test" or "beta" server. Once testing is complete, balance changes can be implemented via a game update. After the changes go live, the cycle begins anew, with developers monitoring the effects of the changes and players' responses to them. For example, in the case of digital games, it might be a good idea to implement a service such as Mixpanel to the game so the players' decisions can be monitored more closely. As stated in chapter 4.2, for example, Yu-Gi-Oh! Master Duel the game tracks specific cards and therefore gives essential data to the game developers and players alike when it comes to the game balancing. Monitoring data this way allows developers to respond to gameplay issues faster than in physical card games when balancing said problems might take weeks and, in some cases, even months.

The goal of game balancing in digital card games is to ensure a diverse and dynamic metagame where multiple strategies and deck types are viable. Having

more decks in the meta helps keep the game exciting and engaging for players, although it usually also makes it harder to play on the highest level. Good game balance also ensures that skill and strategic decision-making are critical to success, rather than having certain overpowered cards or decks.

6.5 Should specific cards be limited to ensure the wellbeing of the game?

While usage of cards is limited, there is always someone who is unhappy with the changes. The player may have just invested in the card, or their deck revolves around it, and limiting the usage of the card significantly impacts their gameplay experience negatively. Whether or not specific cards should be limited to maintain the health and balance of a trading card game is a complex and nuanced issue. The answer is only sometimes applicable across all trading card games, be they digital or physical. However, restricting or outright banning specific cards is often considered a viable option, albeit contentious, for rectifying imbalances that may emerge over time.

One argument in favor of limiting specific cards is that as the pool of cards in a game expands, the task of maintaining a balanced competitive environment grows increasingly complex, and even with rotating formats and responsive, data-driven balancing, there remains a level of unpredictability in how cards will interact, mainly as new sets are introduced. In such a complicated landscape, limiting or banning specific cards can serve as a surgical intervention. Limiting the usage of a specific card can be particularly important when a card or combination of cards proves so powerful that it stifles other strategies, effectively reducing the variety of viable gameplay styles. In essence, the limitation of specific cards can serve as a stopgap measure to prevent a "solved" metagame where one dominant strategy prevails.

However, the limitations and bans come with their own set of challenges and drawbacks. For players who have invested considerable time, effort, and even real-world money into acquiring specific cards, the sudden restriction or banning

of those cards can feel like a betrayal. This is particularly true in physical card games, where cards often hold tangible value, and even in the realm of digital card games, where adjustments can be made more quickly, players may still feel aggrieved if they have spent money on in-game purchases to acquire cards that are subsequently nerfed or banned. Furthermore, the limitation of cards can also have a chilling effect on the community's willingness to experiment with new, innovative strategies, particularly if players fear their creative new approaches will just be banned in the future.

In light of these challenges, a balanced approach that combines elements of rotating formats, responsive balancing, and careful card limitation is most likely to succeed in maintaining a game's health over the long term, and this approach should be underpinned by transparent communication between the game's developers and its player community. Player feedback and in-game data should be considered side by side when contemplating any changes, and these changes should be communicated and explained to the community. Mechanisms for compensating players for limited or banned cards can also help to maintain trust; in the digital realm, this might involve offering refunds of in-game currency, while physical games might explore buy-back programs or similar solutions. While the limitation or banning of specific cards should not be the first or only tool used to maintain balance in a card game, it remains a viable strategy when used judiciously and combined with other methods. With careful planning, transparent communication, and a multifaceted approach to game balancing, developers can strive to create a game environment that is both dynamic and balanced, providing an engaging and fair experience for players of all levels.

7 UNIQUE GAMEPLAY MECHANICS AND BALANCING ASPECTS OF DIGITAL CARD GAMES

In this section of the thesis, the main focus of our data collection and analysis is on digital card games, with a particular emphasis on Hearthstone. By diving deep into the mechanics, strategies, and player behaviors associated with digital card games, the thesis aims to discover insights specific to this modern evolution of traditional card gameplay. Hearthstone, as a leading representative in the digital card game realm, serves as a central case study, enabling us to explore the nuances and intricacies that set digital card games apart from their physical counterparts.

Digital card games have revolutionized the genre by introducing unique mechanics only possible in a digital medium. For instance, randomization is often utilized in digital card games like Hearthstone. While randomness exists in physical card games, it is typically limited to the draw of cards. Cards can have effects that summon random creatures, deal random amounts of damage, or even transform into random other cards, and this adds an additional layer of unpredictability to the gameplay, requiring players to continuously adapt their strategies, which would not be possible in printed card games.

Developers also can add or modify cards in a player's deck during a game more efficiently in digital card games than in traditional ones. For example, in Hearthstone, numerous cards with effects shuffle new cards into a player's deck. The digital format allows for interesting strategic considerations and surprising turns of play that are impossible in a physical card game. For example, a player can use a card that shuffles high-cost, powerful cards into their deck, altering the power dynamics as the game progresses. Digital card games can also incorporate visual and auditory effects that heighten the gameplay experience, such as spells that erupt with visual flair and creatures that can roar as they enter the battlefield. These features, while not influencing the game mechanics per se,

contribute to a more immersive and engaging play experience, offering a spectacle that's impossible with physical cards.

Digital card games offer the ability to balance and patch cards in real time. Unlike physical card games, where a printed card's power and effects are fixed, digital cards can be altered after release if they prove too powerful or weak. The digital format allows developers to maintain game balance and fairness more effectively, ensuring a healthier competitive environment. In essence, the digital format of card games provides developers with a broader toolkit for game design, allowing for more complex mechanics, dynamic gameplay, and immersive experiences. As technology continues to evolve, it is exciting to see how digital card games will continue to innovate and shape the genre's future.

7.1 Adding cards to players hand outside of the initial deck

Usually, in trading card games, the deck that the player builds and the cards they decide to put there are the only pieces they will use in the game. Especially in physical card games, requiring the player to choose cards outside of their deck would not only lead to the situation where players are expected to own multiple copies of every card in the game but also logistical problems. If players need to carry all of the possible cards with them, that would lead to multiple thousands of cards per person, which is why such mechanics are unique to digital card games.

The "Discover" mechanic in Hearthstone is a gameplay feature that introduces randomness and strategic depth into the game (Figure 13). It was first introduced in the League of Explorers adventure in 2015 and has since become a staple mechanic in the game, and many players like it because of its uniqueness (Guardian 2023).

Figure 13. Discover screen in Hearthstone (Dummy 2016)

Players playing a card with the Discover mechanic are presented with three random cards that fit specific criteria determined by the Discover card, as shown in Figure 13. For example, a card might allow the player to Discover a spell, a minion of a particular cost, a card from a specific class, or any other card that fits into a particular category. The selection is made from a pool of all eligible cards, regardless of whether they are in the player's deck. The player must then choose one of these three cards to add to their hand. This choice is not revealed to the opponent. The other two cards are discarded and not used. The chosen card can then be played on subsequent turns as if it were a typical card in the player's hand.

This mechanic introduces an interesting element of strategy and adaptation into the game. The Discover mechanic can allow players to find a card that fits their current strategy, find a solution to a problem on the board, or choose the card that offers the most value. However, it is also important to note that while Discover presents the player with choices, these choices are still random. The player does not have control over which three cards they are presented with, only over which of those three they choose. While Discover can provide robust and game-changing cards, it can sometimes present less than optimal-choices. While some players enjoy the element of randomness, as stated in the previous chapters, some players find the element of luck disturbing in a game where it does not necessarily be part of the game. Because of that, if the game designer

is thinking of introducing the element of randomness in their game, the pros and cons should be thought through carefully before adding the mechanic to the game.

7.2 Selecting random targets

Random target selection is a critical mechanic in Hearthstone that contributes to the unpredictability and strategic depth of the game, although also pushing the element of luck. This mechanic is most commonly found in card effects, which might deal damage, apply debuffs, or bestow buffs to random targets (Figure 14). When a card states that it affects a "random enemy" or "random minion", the game selects the target from the available options without player input. For instance, if a card's text reads "Deal 3 damage to a random enemy minion," it will randomly select one of the opponent's minions on the board and deal three damage to it. Similar effects are sometimes found in physical card games, although they require player input when added. Usually, situations that require selecting random targets are solved by giving each eligible card on the field a corresponding number of the dice, which is then rolled to resolve the effect. However, this mechanic slows down the game's pace and is easier to apply to digital games rather than physical ones.

Figure 14. Examples of the cards with random targeting effects (Gallant 2016)

This mechanism can create unique, often game-changing situations. Randomness can sometimes result in highly favorable outcomes, like when a

powerful enemy minion is chosen as the target and destroyed. However, it can also lead to less ideal results if a weak or less significant enemy minion is selected instead. This unpredictability requires players to weigh the potential risks and rewards before playing cards with random target effects. In his article, Luke Winkie (2015) states that Hearthstone senior game designer Mike Donais has stated that adding the element of randomness to the game adds both emotional highs and lows because of the nature of the mechanic. This statement is essential to remember as tournament players usually try to minimize the aspect of luck. The casual players might find the emotional impact positive to the game.

On the whole, random target selection can create thrilling and unexpected moments in games, significantly impacting the pacing and outcome of matches. While it introduces an element of chance, strategic planning, and clever play can often tip the scales favorably, underscoring Hearthstone's balance between skill and luck. It is also a mechanic that can be utilized more effectively in digital mediums than in physical games, which is why even though adding it might cause challenges, it should be considered while making a card game, especially in digital format.

7.3 Changing cards during the game

In Hearthstone, there are multiple ways to reduce the cost of the cards during the game, even if the cards are not currently in the game. The digital format of Hearthstone allows the game to keep track of the changes, so cards that, for example, reduce the cost of all of the remaining cards in the deck are possible, while those are not doable in physical card games due to player errors that those cards would cause (Figure 15).

Figure 15. Examples of the cards that change during the game (Hearthstone Top Decks)

Cost reduction in Hearthstone refers to specific strategies employed by players using certain cards that reduce the mana cost of cards still located within their deck or their hand. Once the cost reduction card has been played, the remaining cards that fit the cost reduction criteria can be played for less mana than they typically would require. Examples of cards providing deck cost reduction are fewer compared to those that reduce the cost of cards already in hand, but their impact can be substantial, which makes them essential to balance correctly. While not balanced to fit the game's general level, they can quickly become the dominating strategy of the game.

Using deck cost-reduction effects can significantly influence gameplay, enabling players to play cards earlier or multiple cards in a single turn, thereby providing substantial tempo swings and often forming the backbone of specific deck archetypes. These effects are interesting because they are unique to digital card games and can not be replicated in printed media. Player errors are part of the physical trading card games; eliminating them is impossible. However, if a game designer would introduce effects that happen once and linger for the rest of the game, it would result in more errors. Because of that, while interesting as a

mechanic, it is also a trait that should be kept strictly in digital trading card games.

7.4 Balancing unique mechanics and ideas in digital card games

Balancing unique mechanics and concepts in digital card games is a critical challenge that developers must address, and it becomes an increasingly complex task given the myriad of variables that can impact gameplay, from card costs to special abilities and the influence of randomness. In addition, the fluidity of digital card games – the ability to add, alter, or remove cards after release – while a unique advantage over physical games also imposes a continuous balancing responsibility on developers. From data analysis to analyzing win rates and other statistical data, even tracking singular cards, this data can identify overpowered or underpowered cards that may disrupt game balance. In addition to quantitative data, qualitative player feedback is another invaluable resource in the balancing process, and by understanding the players' experience and their perception of specific mechanics or cards, developers can gain insights that data alone might not provide. Some cards might not be powerful, but they are not fun to play with or against, and developers can make adjustments to fix those issues.

Balancing unique mechanics is an ongoing process requiring continuous monitoring, feedback, and adjustment, where developers must strive to maintain the delicate balance between creating novel and exciting mechanics and ensuring that those mechanics do not disrupt the game's overall balance. The advent of digital card games has introduced a new set of possibilities for gameplay mechanics and strategies, but also new challenges in maintaining a fair and balanced game environment. The advent of digital card games has revolutionized the traditional card game genre by introducing unique gameplay mechanics and a new level of immersion, and these new mechanics, while exciting and engaging, bring with them the challenge of maintaining game balance. Through tracking and monitoring data and player behavior, as well as feedback, developers can rise to this challenge and continue to push the boundaries of what is possible in digital card games, providing players with

innovative and engaging experiences. As technology continues to evolve, so will the genre of digital card games, continually reshaping and redefining the gaming landscape.

8 BALANCING TO TOURNAMENT PLAY VERSUS CASUAL PLAY

Balancing the game for a small group of people who all agree on the same thing is an easy task. Balancing the same game for the whole player base is entirely different because while one player might think like a game balancer, another probably has a different opinion.

When looking at the typical card game players, there are three subcategories of players: tournament players, casual players, and collectors. Collectors are the most accessible group. They are the players who like the game because of its visual aesthetic and do not care about the gameplay. These people are valuable for the game because they are the ones that usually buy the most products, but the game balance only affects that group does not affect said group in the same manner it affects to the other two. People like Pokémon card collectors and those investing in old Magic: The Gathering cards fall into this category. However, casual and tournament players are more challenging to balance simultaneously because of their vastly different ways of playing the same game. While casual players play with the cards they happen to have and in a closed environment, such as a kitchen table gaming with their friends, tournament players aim to optimize their playing experience. Casual players usually want a pleasant gaming experience, are happy whether they win or lose, and are willing to bend the rules if needed. However, tournament players get positive feedback from winning and are the most challenging group to balance the game.

Tournament players require meticulous balancing because they are the ones who exploit the system to its full potential. They strategize, analyze, and use their knowledge of the game rules and the meta to gain any advantage possible. This high level of competition requires the game to be finely balanced to ensure that the game remains fair and skill-based rather than relying on luck or the power of individual cards. When a game is unbalanced, some strategies, decks, or cards are significantly more dominant than others, leading to a stale and predictable meta where everyone uses the same powerful strategy to win. To ensure that

these hardcore players continue to enjoy the game and keep participating in tournaments, developers need to constantly tweak and balance the game, which can involve changing the rules, nerfing or buffing cards, and introducing new cards to shake up the meta. This ongoing process keeps the game fresh, dynamic, and competitive.

On the other hand, casual players are less concerned about winning and more interested in having fun, experimenting, and exploring different aspects of the game. They value variety, creativity, and thematic elements. Therefore, it is not about optimizing for the most efficient strategies for casual players but about the fun and enjoyment they get from playing with different cards and trying various combinations. An unbalanced game is less of an issue for casual players as long as it is fun and they can win. When game developers balance a card game, they must consider these two different playstyles. Balancing for tournament players involves a focus on fairness and competitiveness while balancing for casual players involves ensuring that a wide range of strategies and playstyles are viable and enjoyable. This can be challenging because changes made to satisfy one group may not please the other. However, by maintaining a clear understanding of the needs and wants of both tournament and casual players, developers can make careful changes and adjustments to strike a balance that keeps both groups engaged while ensuring the long-term health and diversity of the game. Because of this, both player groups are studied more in-depth in the following parts.

8.1 Balancing tournament play

It is 2018, and one of the biggest tournaments of Yu-Gi-Oh!, the Championship Series, or YCS for short, is just starting. As per the tradition, the first round of the stream features the last winner if they happen to take part in the next tournament, and because of the randomized pairings of the first round, the last winner ends up against a relatively new player in the live stream (Figure 16). There is one

problem. The 2018 September ban list is one of the worst mistakes regarding card balancing in the whole Yu-Gi-Oh! history.

Jesse Kotton, the most accomplished player of the game, is facing his first opponent in the tournament hosted in London. Kotton plays a deck called Danger FTK, the term FTK being short for First Turn Kill. The term means that if the deck functions appropriately, the game ends before the other player can even play their turn.

Figure 16. Kotton explains to Thompstone that he is doing lethal damage to his opponent before Thompstone has played a single card in game 1 (2018 YCS London: Yu-Gi-Oh Championship Series - Round 1 - Jesse Kotton vs. Matthew Thompstone)

In the next banned and restricted list, Firewall Dragon, the key card to enable the Danger FTK combo, is banned. In casual play, the same card would have been strong but not game-breaking. However, in a situation where the player has all the tools to push the effect to its limits, Firewall Dragon is too mighty in a competitive environment.

While casual players use the cards they happen to own and rarely end up in a situation like the above, for tournament players, it is not uncommon to play tournaments where a big part of the game is decided, even when deciding who can play their cards first. The tournament players do not strive for a fun and

balanced experience, but rather, their main goal is to win the game, even if it requires breaking the game because game designers have made a mistake at some part of the process. While the unbalanced cards and combos are the main problem when balancing tournament play and can be fixed by banning and limiting the usage of cards in various ways, are not they the only reason why some cards might be problematic for tournament play, and those game balancing issues are delved further in the following parts by utilizing some of the most famous examples from the history of Magic: the Gathering tournaments.

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8.1.1 Sensei's Divining Top and cards that affect the pace and flow of the game

Some balancing decisions are made because the game affects certain cards' power levels, but this is only sometimes the case. Where the tournament play is usually balanced within the game and cards, another significant aspect of tournament play is the time. Tournament games usually have a time limit of 40 to 50 minutes to ensure that tournaments do not last an excessive amount of time. Because of that, some cards might end up being restricted in tournament play because they negatively affect the flow of the game. One of the said cards is Magic: The Gathering's Sensei's Divining Top (Figure 17).

Figure 17. Sensei's Divining Top (Scryfall 2022)

Sensei's Divining Top (Figure 17) is a fine card, but in itself, it is not at all game-breaking and worthy of restricting. However, its effect has an unintentional drawback that can not be restricted and landed the card in the restricted list in tournament play rather quickly. Sensei's Divining Top tends to cause delays in the game. The card allows a player to look at the top three cards of their library at any time for one mana. This can slow the pace of games significantly because players may choose to activate the Top's ability multiple times during not just their turn but their opponents' as well. In a tournament setting, this can lead to games that go on time or take longer than expected, disrupting the event schedule.

One of the most significant issues with Sensei's Divining Top is that it encourages repeated and time-consuming decisions that can significantly slow down the game. Magic: The Gathering is a game where each player's time is limited, both in the interest of fairness and to keep the tournament schedule on track. However, Sensei's Divining Top can cause games to run much longer than intended, disrupting the flow of gameplay and the tournament schedule. Just

looking at the cards on top of the player's deck might take up to a minute, so repeatedly activating Sensei's Divining Top can quickly eat up the round time in the tournament setting.

The card lets a player look at the top three cards of their library at any time for one mana. This ability can be activated not only during their turn but also during their opponents' turns. This creates many strategic decision points, which would typically be good. However, the number of these decision points, combined with the fact that they occur on both the player's and opponents' turns, can cause games to drag on. Moreover, these decision points are often not straightforward. They can require considerable thought, as the player has to consider their current situation, predict their opponent's potential actions, and then decide the optimal order of their top three cards. This adds to the time each player takes for their turn. Sensei's Divining Top can be used in response to an opponent's actions, it can cause further delays, making the opponent wait for the Top's controller to decide. These factors can lead to games that last far longer than they would otherwise, a significant issue in a tournament setting. In the worst cases, games can go on time without reaching a natural conclusion, leading to unsatisfactory results based on tournament rules.

Because of the constant decision-making, Sensei's Divining Top is an excellent example of Hick's Law (Figure 18). Hick's Law revolves around the fact that the amount of different choices increases the decision-making time and therefore makes the game more complicated (Nikolov 2017). In other words, the simpler the game state, the less time it takes for a person to solve it.

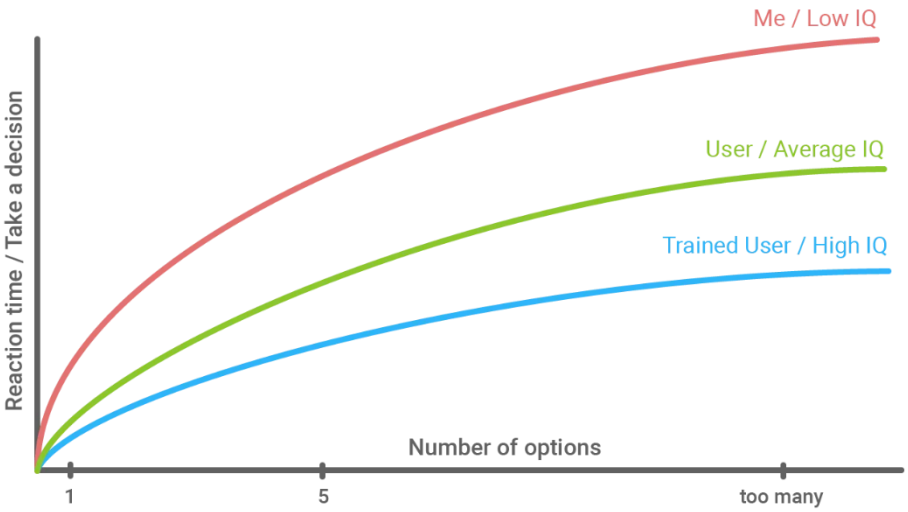


Figure 18. Hick's law; how the number of options and player skill level affects the time to make the decision (Nikolov 2017)

In trading card games, the game state can reach complex levels relatively fast, and because of the limited time in tournament plays, players must be able to solve states as fast as possible. Whenever a player activates Sensei's Divining top, they introduce multiple new possibilities to the game state. Because of the repetitive nature of the card, it can be disturbing to the flow of the game. As seen in Figure 18, the more comfortable a player is with the game, the less time they take to make the situation. However, when introduced to many possible options, even skilled players take a significant amount of time to come up with an answer.

There are multiple options to solve problems because of too complex game state. When it comes to trading card games, the easy option is to simply restrict the card usage that causes the issues. Hick's Law offers other solutions that include but are not limited to reducing the number of choices, breaking complex tasks into smaller tasks, and not introducing the most complex task to new users but giving them to players little by little (Nabil 2022). For trading card games, this could mean, for example, introducing new players to game mechanics one at a time rather than making them understand all of them at once. However, solutions like that cannot be applied to competitive play. Because of this, cards that introduce multiple possible decision-making situations in a limited amount of time are complicated from a game design perspective for competitive balancing. While

designing cards, developers can think of topics such as card effect repetitiveness and the flow of the game, and with proper playtesting, eliminate said issues even before the final design decisions are made.

8.1.2 Chaos Orb and adding dexterity and luck-based element to trading card games

In a competitive Magic: The Gathering tournament, the emphasis is on strategy, skill, and a deep understanding of the game's mechanics. Chaos Orb (Figure 19), introduced in the game in its earliest set, Alpha, in 1993, acts, unlike most cards where the emphasis is on the strategy rather than onboard game-like elements, such as dexterity involving gameplay. Because of this reason, Chaos Orb (Figure 19) introduced multiple issues in the tournament playing experience.

Figure 19. Chaos Orb (Scryfall 2022)

Chaos Orb introduces multiple issues to game balance that are unique to the specific card. Competitive Magic relies on a well-understood set of mechanics and interactions, providing an even playing field where the better strategist can prevail. Chaos Orb introduces an element of physical skill that is entirely separate

from the game's usual mechanics, so some players could be naturally better at flipping the card in such a way that it lands most favorably for them. This opens the door to an unfair advantage that is based neither on strategic skill nor on the quality of a player's deck, but rather on an entirely unrelated skill set. This breaks from Magic's core identity as a game of intellectual and strategic competition that it is known now, although the designer of Magic: The Gathering, Richard Garfield believed dexterity element would add to the game of Magic: The Gathering, rather than take away from the game, but because of the backlash from gametesters, opted not to include it in larger scale to the game (The Orb | A History of Magic's Early Years 2023).

On top of the dexterity element, the fairness of Chaos Orb is a significant concern in the tournament setting. A tournament should be a venue where all players, regardless of their physical capabilities, have an equal shot at victory, and the inclusion of a dexterity element immediately excludes or puts at a disadvantage players who may have physical impairments or reduced motor skills. Furthermore, other variables like table size, surface material, or even the air currents in the room could all have an unintended impact on the card's effectiveness, leading to non-uniform playing conditions, making it better or worse, which isn’t the case in regular trading cards that stay same regardless of setting.

While Chaos Orb introduces many issues when it comes to fairness of the card and differentiating players by their dexterity skills, it also introduces problems when it comes to rule enforcement. Competitive play often involves complicated board states, intricate interactions, and precise timing, and adding a card that requires physical dexterity brings with it an entirely new set of variables that would be difficult to regulate consistently. For example, what constitutes a proper "flip"? How do you adjudicate disputes over whether the card landed in a particular way or impacted enough of the target card? The subjectivity involved in making these calls would place an unnecessary burden on judges and could lead

to disputes that slow down tournament play, and as seen in the case of Sensei's Divining Top, is something tournament organizers and players are highly against.

Although Chaos Orb causes issues with dexterity and pacing, it is also complicated in tournament settings where players are required to play with the same deck, and can't modify it during the rounds. As the nature of Chaos Orb, the card allows the player to tear it to pieces when it is played, it also forces people who played it carry with them extra copies of the said card to include it on deck for the future games, if the card was ever played. On top of that, if a player has included the minimum amount of cards to their deck and rips the Chaos Orb when played, they immediately render their deck illegal to play as happened in the early Magic: The Gathering tournament in 1990's. (The Orb | A History of Magic's Early Years 2023)

Because of its various issues, Chaos Orb is an excellent case of what things to avoid when designing cards for tournament play. When played in a casual setting, Chaos Orb might be a fun addition, but when the game is played on a high level, it causes more issues than positive impact, which is why including cards like it should be considered heavily. Chaos Orb is however, in its infamy, a card that has inspired multiple other cards similar to it on sets of Magic: The Gathering that are not legal to play in tournaments such as card on the set called Unhinged in 2004, showing that in the end Richard Garfield was right when it comes to the funness of the mechanic, as long as it stays on the more casual side of the gameplay.

8.2 Casual players as game balancers

Casual players bring a distinct perspective to the game-balancing conversation. Unlike tournament players who prioritize optimization and winning, casual players often emphasize fun, experimentation, and narrative immersion. This distinction does not mean casual players are not concerned with balance; instead, their

tolerance for variability is often broader, as they are not beholden to the rigid structures of tournament play.

For example, cards deemed "too powerful" or "unbalanced" in tournament settings might find a warm welcome among casual players. These cards can inspire unique deck-building challenges, amusing anecdotes, or even new house rules in relaxed environments. Chaos Orb, with its dexterity-based mechanics, is a nightmare for competitive events. However, at a kitchen table setting, it can become the focal point of a game night filled with laughter and memorable moments.

However, game designers must recognize balance even if a segment of the player base is more lenient. Cards that are overly dominant or suppress other strategies can curtail the experimentation and variety that casual players cherish. However, there is a silver lining: casual players are a fantastic source of feedback. Engaged in the game for the love of it, they often develop innovative solutions, house rules, or formats that can inform designers about potential balance adjustments or even inspire official game variants. Moreover, while casual players might not dissect the meta as meticulously as tournament players, they still contribute significantly to the game's economic model. They uphold the game's health by purchasing packs, exploring different themes, and engaging in the broader community. Recognizing and balancing for both tournament and casual players ensures the game remains accessible and enjoyable for everyone, regardless of how they choose to engage.

9 LONGETIVITY OF THE CARD GAMES

As stated, the more options the player has, the longer it takes to decide the following action in the game. While Hick's law (Nikolov 2017) applies to singular gameplay decisions, it is also a thing to consider when considering the game as a whole. Because long-running card games such as Yu-Gi-Oh! and Magic: the Gathering print new cards constantly, they also increase the number of cards players have to learn when starting the game, especially in cases when the usage of old cards is not limited in any way, the game may become daunting to start for new players. In the case of Yu-Gi-Oh!, the player can use almost any card from the game's 25-year span, causing the player to have over 11,000 cards to choose from as of January 2022 (Sharma 2022).

When compared to newly launched card games where the amount of cards to learn is way under a thousand, the task of learning even the basics of the game might be daunting. However, when trading card games started publishing, they had to constantly print out new cards to keep players entertained, which, more often than not, caused games to fail. While making a one-time game is a relatively straightforward task, keeping a long-time trading card game pleasing to play is a much more daunting task, which is why the nuances of longevity are essential to understand in greater detail.

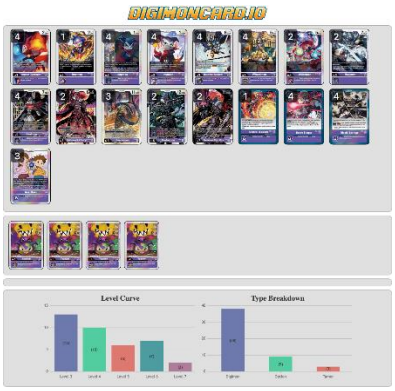
9.1 P(l)ay to win

"Any deck can win." The saying is relatively common in the card game community, especially in more casual play circles. People tell themselves that they can build a deck to their card game of choice, and if they just play well enough, they can win even the most effective and expensive decks in the game. In their new player guide (Magic: the Gathering Quick Start Guide), Wizards of the Coast, the developer of Magic the Gathering, implies that the player's skill is the sole factor in winning or losing the game. This, however, is not true, and some level of pay-to-win applies to every trading card game on the market.

In order to play trading card games, players are required to purchase the basic game, with the opportunity to enhance their decks through developer-provided additions such as extra decks or booster packs. The expenditure of real-world resources to enhance in-game assets is part of the gameplay and its rules, and any dissatisfaction from players unable or unwilling to invest such resources could arguably be attributed to their misunderstanding of the game's inherent structure rather than the game itself and its mechanisms. (Maisenhölder 2018).

Although considered a relatively cheap trading card game, even Digimon TCG has its tournament meta decks. While a starter deck to Digimon TCG costs around 15 euros (Cardmarket Digimon 2023), tournament decks are significantly more expensive. For example, the winning deck of CoreTCG's BT12 May Regionals, played by Jean Flores, cost around 100 euros in August 2023 (Figure 20). While cheaper than, for example, the decks in Magic: the Gathering, the deck is still around 6.5 times more expensive than the starter deck of the game. Digimon releases new products almost monthly, so the meta develops fast, causing players to build decks more often than in other card games. So, it can be debated if the price point of the game is cheaper than in other games, where the change in metagame is slower.

15e starter deck for Digimon TCG



100e Regional level tournament winning deck list

Figure 20. Comparison of starter deck in Digimon TCG versus a regional-level tournament deck listed as a winner of the event. Prices are from August 2023 and from cardmarket.com (Virtanen 2023)

In his research, Maisenhölder (2018) states that playing games, whether online or not, is fun because of competition and luck; everyone starts at the same place, and you win or lose based on your skill, game resources, or luck, but if someone can use real money to get more in the game, it is not fair and ruins the fun. Because of this, when one starts to play trading card games, it is essential to understand that not every deck is equal, and to some extent, trading card games are pay-to-win games. However, as long as players play with the decks with the same power level, they can enjoy the game. However, suppose one has invested significantly more money than the other one. In that case, it is almost certain that the one with more investment in the game will also be in a more favorable position to win. Because of this, the understanding is that acquiring cards is part of the card games and part of the game balance process.

Card game economy works like any other supply and demand. High demand paired with low supply typically results in higher prices, as evidenced by rare cards in trading card games that can reach the price of hundreds or even thousands of dollars. This phenomenon is also observed in many other situations, such as the spike of graphics card prices due to their demand in bitcoin mining, so trading card games are an economy like any other. (Schreiber & Romero 2021, 107.)

9.2 Balancing card rarities

Not every trading card is equal; even the most casual players know that. When the Pokemon trading card game was released in the Western market, it was not uncommon to see kids trade cards with each other during the lunch break, and even then, it was clear that some cards were better than others. If someone had a card with holographic foiling on it, another person had most likely traded multiple cards to acquire that one shining card or offer an equally impressive-looking card on the trade.

Cards vary in rarity from common, to depending on the game, anything from mythic rare to starlight rare or other expensive-sounding rarity, and usually, rarer cards have better abilities or effects and offer more possibilities and combinations. While common cards are usually something players discard away, most rare cards are the ones that shape the metagame or, on the other hand, the balance of trading during the school lunch break. The difference in the power level of the card because of its rarity is true for both digital and non-digital games. In any game where the player can buy cards, the price of a card depends not only on its abilities and rarity but also on how rare the card is.

Players with more money can buy more vital cards or booster packs, increasing their chances of getting rare and powerful cards. This lets them build strong decks, as well as trade other impressive cards that are hard to beat with just basic packs or a few boosters. (Maisenhölder 2018.) So, players with more real-world money have an advantage. They can make the game less fun for others by making the competition and even the luck factor favor them, using things not part of the actual gameplay. From tournament play to simply trading cards, the one with more disposable income favors being the most successful, which leads to numerous game-balancing issues.

If every card is a metagame-shaping powerhouse, the overall game design process becomes an impossible task, and because of that, there is a place for so-called "junk cards" in trading card games. The rarest cards make just a tiny portion of each trading card set, so game designers have to design just a few powerful cards and, therefore, can keep the balance from creeping up way too fast while filling the cards that do not offer much change to the game. However, even the cards that do not otherwise see play are essential in formats other than the ones played in tournaments. Over time, casual game modes, like draft, have evolved where the enjoyment of the game is preserved and not distorted by real-world financial investments, and card rarity is not the critical factor of gameplay; in these modes, players' skills, abilities, and luck become the deciding factors for victory or defeat, maintaining the ideal balance between competition and chance

(Maisenhölder 2018). In the draft, players can only use cards they receive from the boosters they are given before the game starts. The rarest cards are usually the most powerful in those formats, too, but as seen in the next part of the thesis, acquiring is less than likely.

Whether the player decides to chase after the rarest cards or play with the cards they happen to own, the card rarity affects the gameplay experience and balancing process. Because of this, it is also essential to understand the structure of a card game booster, which is discovered further in the following part.

9.3 Card game boosters as loot boxes

As seen in the previous parts of the thesis, trading card game boosters are an inconvenient way to obtain needed cards to play the game, yet they are still widely used in the card game industry. If the player's only goal is to acquire all the cards to build the deck they want, why do publishers decide to print out randomized boosters, not just print out sets where players can get all the cards needed to play the game?

Loot boxes are a part of everyday gaming, and researchers have discovered that loot boxes in desktop video games increased by 67% between 2010 and 2019 (Zendle et al. 2020). Players are expecting loot boxes in the game, and recently it has become so common that game developers have started to implement season passes to fill out the role loot boxes used to take as players' money sink. Some researchers and authors claim that loot boxes introduce gambling elements into gaming and argue that they may act as a gateway to problematic gambling or aggravate the problem (Drummond et al. 2020). The addictive feeling when getting a rare item in a loot box works the same way as when a player acquires a rare card from a loot box, so those two are almost identical in gambling.

As stated above, booster packs in trading card games work similarly to loot boxes in video games. The dopamine player receives when opening a rare or expensive

card makes them believe that buying boosters is financially profitable, while in reality, the complete opposite is true. Trading card games and sets in those games vary, but as an example, the Yu-Gi-Oh! set Amazing Defenders is widely viewed as a valuable set and has held its second-hand market prices even after the initial print run.

The booster box of Amazing Defenders contains 24 booster packs with seven cards in each pack, while the whole set contains 60 different cards. Ten cards are ultra rare, and 15 cards have a collectors variant. In one box of Amazing Defenders, the buyer gets three ultra-rare cards, and one in four boxes (1/96 boosters) has a collector's card. The cheapest box of Amazing Defenders as of July 2023 in Cardmarket is around 50 euros, so one booster comes to around 2,1 euros. (Table 5.)

Table 5. Booster box breakdown of Amazing Defenders

booster amount in box	24
card per booster	7
different cards	60
ultra rare cards	10
collectors variant cards	15
probability of collector’s rare card	1/96 (approximately 1%)

The most expensive card in the set, excluding the collectors variant, Purrely, starts at around 24 euros at the same website, and the average price of all of the ultra-rare cards in the set is 10 euros. When getting two ultra rares per box and the most expensive card, excluding ultra rares and collectors cards being under a euro, it is clear that most of the booster boxes of Amazing Defenders do not get to their 50 euros price point without the buyer getting the collector's card in one of their boosters.

If the trading card game boosters almost never give their value in cards, why do people buy them? For many individuals engaged in trading card games, the process of playing the game extends beyond the game itself. The pleasure of amassing an extensive collection of cards can be as thrilling as gameplay. Each booster pack a player purchases provides a randomized set of cards. Over time, these packs gradually contribute to a complete, perhaps thematic, collection filled with diverse cards from various sets or expansions. Some collectors might even seek to acquire every card from a particular set. They do not often care about the cost because acquiring cards from randomized boosters is part of their collecting experience.

Booster packs represent a gamble where each purchase promises a rare or valuable card. This element of surprise brings excitement and anticipation that many players find immensely enjoyable, although, at its core, the experience is similar to people who enjoy gambling. Every booster pack is an opportunity for something extraordinary, and that thrill, the possibility of discovering a highly sought-after card, fuels the continuous attraction towards buying more boosters.

From a different point of view, commitment to a particular trading card game often goes beyond personal enjoyment. However, the amount of players who go into this category or people is relatively small. Many players are passionate about their game of choice, cherishing the community and the creative effort that goes into the game's development, and by purchasing booster packs, players contribute financially to the game's developers and distributors. This support helps maintain the game, finance new expansions, and ensure the game's continued growth and success. This is true for significantly smaller trading card games that often have a small but active player base. For these players, buying boosters is not just about personal gain; it is a way to sustain the game they love to play. Purchasing booster packs in trading card games is multifaceted, catering to the desire to build powerful decks, assemble comprehensive collections, enjoy the excitement of surprise, participate in trading, and support the game and its

community. Each factor adds a unique dimension to the experience of engaging in trading card games.

10 RESULTS

The research of this thesis delved into an area of increasing significance in the contemporary gaming landscape. The research was motivated by the need to discern the complex paradigms underpinning the balance of trading card games in digital and print formats. Understanding the intricate parameters that dictate their balance becomes crucial as these games permeate various settings, from casual gaming contexts to intensely competitive arenas.

The methodological approach was twofold, informed by convenience sampling and analysis. By adopting convenience sampling, qualitative data was harvested from a spectrum of games representing physical and digital card games in modern gaming environments. This not only endowed the research with diverse perspectives but also facilitated a comprehensive understanding of game dynamics, differences, and their different nuances. After data collection, the data was subjected to a thorough analytical process.

Table 6. Results of the research

metrics/criteria	**Duel Masters**	**Magic: The Gathering**	**Yu-Gi-Oh! Master Duel**	**Hearthstone**
number of viable decks (September 2023, over 5% meta)	-	8	7	6
set rotation frequency	never	once per year	never	once per year
card set release rate	4 sets / year	4 sets / year	10 sets / year	3 sets / year
balance update type	restricted to 1 copy -list	banned and limited list	banned and limited list	re-balancing single cards
balance update rate	varies	varies	1-2 times /month	1 time / month

While a detailed examination of these results can be found in the preceding chapters, key outcomes include that while there are differences in balancing the game after the initial release, digital and physical card games share many similarities. For example, the tournaments function similarly regardless of the publishing type, and the metagame usually consists of multiple decks. While digital format gives more flexibility in the balancing process, at its core, the same methodology of banned and restricted/limited lists is utilized in almost all cases. (Table 6.)

The implications of this research are both profound and manifold. From an academic standpoint, this investigation offers a granular understanding of card game dynamics. For industry practitioners, including game developers and researchers, the findings present empirical insights that can be instrumental in shaping game design paradigms and tactical considerations. As the domain of card games witnesses consistent growth, the insights from this research underscore the importance of achieving a meticulous balance to ensure both the game's longevity and appeal to a diverse audience.

While this study has endeavored to provide a comprehensive understanding of card game balancing, it inevitably points to several areas warranting further research. Therefore, I hope that my further research on the topic delves even deeper into the smaller nuances, such as the accessibility issues of card games and how digitalization can be utilized to bring competitive card games to broader audience. I hope to also shed light on the lack of non-masculine presenting people in competitive card gaming.

To conclude, trading card games offer a ground for academic research because of their strategic depth, design considerations, and player experiences. It is hoped that this thesis contributes meaningfully to the extant literature and serves as a robust foundation for future scholarly pursuits in this domain.

11 DISCUSSION

In the age of rapid technological advancements and an increasing shift towards digital solutions, the realm of card games is still being explored by this evolution. As we stand at the crossroads of tradition and innovation, a pressing question emerges: **is the future of card games digital**? This chapter delves into this inquiry by contrasting the sensory-rich experience of playing a physical card game, such as solitaire, with the convenience and accessibility offered by its digital counterpart. We also explore the various challenges and opportunities associated with both formats, paying particular attention to the costs, accessibility concerns, and the distinct dynamics of developing a game in today's diverse market.

11.1 Is the future of card games digital?

Imagine playing a game of solitaire. First, the player shuffles the deck to ensure that their game is randomized. Then, they deal the cards: seven stacks are laid out on the table, with the first card in each pile face up and the rest face down. The first pile has one card, the second pile two, and so on, with the seventh pile having seven cards. The rest of the deck is set aside as a draw pile.

Playing the physical version involves a certain rhythm: the player draws from the deck, place cards onto the piles, flip cards over when a pile is emptied, and always watch for the next possible move. The soft flutter of cards and the gentle arrangement of the piles add a unique sensory dimension to the physical game. Mistakes or oversights cannot be corrected once a move is made, requiring careful thought and adding a layer of challenge. It is a solitary experience of silence, concentration, and calculation as the player works to uncover the face-down cards and complete the suit stacks. On the other hand, the player could open their computer and type "Solitaire" into the search bar.

Digital solitaire offers several advantages over the game's physical version that make it easier to play. Automating the game rules in digital solitaire allows

players to focus more on the gameplay without worrying about rule infractions while preventing moves not in line with the rules, significantly reducing the chances of making errors. It also handles dealing cards, shuffling, and rearranging stacks, which can become cumbersome in physical solitaire, providing a more streamlined gaming experience.

Another significant advantage is the inclusion of hints or tips in many digital solitaire games. These features can guide players, especially beginners when they get stuck or overlook possible plays. Additionally, most digital solitaire games include an undo function, allowing players to rectify mistakes or experiment with different strategies without restarting the entire game, a feature typically unavailable in the physical version. Portability is yet another bonus with digital solitaire as it can be played on various devices, such as smartphones and tablets, enabling players to indulge in the game whenever and wherever they wish without the need to carry a deck of cards and the digital version of the game can also offer enhanced accessibility for individuals with physical disabilities who might find handling cards difficult. Features like more prominent card visuals or voice commands can make digital solitaire a more inclusive experience.

Like solitaire, many other card games have been adapted to digital formats to introduce new players to games from Poker to Yu-Gi-Oh!. The digital format allows a wide variety of functions to make gameplay flow nicely and allows players to play wherever they want. In the following parts, we go through some mechanics that make digital games pleasant for players, as well as unique digital gameplay mechanics that are not possible for physical card games, from randomization to card generation during the game.

11.2 Accessibility issues of physical card games

While offering an enjoyable and tactile experience, physical card games have accessibility challenges that must be acknowledged and addressed. These

issues can potentially create barriers for individuals with visual, motor, cognitive, or other disabilities, thereby limiting their ability to participate in the game entirely.

For example, for individuals with visual impairments, the standard size of text and graphics on playing cards can be difficult to read, and the color contrast may also pose challenges for those with color vision deficiency. Some card games rely heavily on different colors to differentiate card types or factions, which can be problematic for players who cannot distinguish between specific colors, and there can be accessibility issues for those who are completely blind, as braille versions of many card games are not readily available.

Individuals with motor impairments may struggle to handle and manipulate standard-sized playing cards. Shuffling, dealing, and holding cards often require fine motor skills, which can be challenging for players with conditions such as arthritis, Parkinson's disease, or physical disabilities. This is not the case with just the conditions mentioned, but it can also hinder the ability to shuffle the deck if the player has small hands, which is the case with kids. Because of that, high-level Pokemon tournaments offer official deck shufflers for the youngest players to ensure that their decks are appropriately shuffled.

Social accessibility can also pose challenges. For instance, people with autism or social anxiety disorder might find the social interaction in most card games overwhelming. Moreover, many card games involve competitive play, which may not be suitable for people who find such environments stressful or anxiety-inducing. Addressing these accessibility issues requires careful game design and innovation. Game designers can enhance visual accessibility by using large, clear fonts and high-contrast colors and considering color-blind-friendly palettes. Tactile elements can be added for blind players, while alternative rules can be developed to lessen the dependence on fine motor skills. Creating inclusive and supportive community guidelines can foster a welcoming environment for people with social accessibility needs.

While physical card games have unique accessibility challenges, they also provide inclusive design and community-building opportunities. As our understanding of accessibility improves, the gaming industry must continue developing solutions that make card games enjoyable for everyone.

11.3 Printing and designing expenses in trading card game development

Printing trading cards is expensive, and even the most critical component of the game, a trading card, has many layers. A conventional playing card from a standard 52-card deck spread across four suits is typically crafted from a moderately dense card stock partially comprising plastic. The material is not too thin to inhibit resilience against bending, yet not so dense as to prevent flexibility altogether. These cards frequently feature a linen or smooth finish for enhanced grip and handling, and the packaging commonly involves straightforward cartons boasting a semi-gloss coating. Artistically-designed decks may possess a linen, embossed, or raised ink finish. However, trading card games feature cards that have been made with unique anti-counterfeiting and sturdiness attributes, specifically a blue plastic layer that, for example, almost every Magic: The Gathering card has. Upon dissecting a card, this blue component can be discovered, neatly embedded within the card. (Riddell 2013, 17.)

There are other printing costs for trading card games besides the cards. From packaging to promotional materials, trading card games require a vast amount of printing work, and most of that cannot be made with regular printers but requires a printer explicitly made for card printing. Although multiple companies specialize in trading card printing, acquiring a price estimate from them is challenging without an existing trademark for a new trading card game. Because of that, I could not get more detailed data from them, even after reaching out to several different companies from Belgium to China, but I hope to provide more data on the topic in the future.

11.4 Developing a card game as an indie game developer

Developing a card game as an independent developer presents opportunities and significant challenges. At the start of the card game development process, one of the critical decisions is whether to create a trading card game or a collectible card game. This choice impacts the game's design, monetization strategy, and player engagement over time.

Trading card games are characterized by the continual release of new card sets and expansions, where players purchase randomized booster packs to expand their collection, trade with other players, and improve their decks. This model encourages long-term investment from players, as the continual release of new cards keeps the game fresh and strategically evolving. From a development perspective, trading card games require ongoing content creation and balancing, which can be resource-intensive. However, they also provide a continuous revenue stream as players keep purchasing new cards, unlike one-time purchase games, which usually drop revenue after the initial launch. Creating a trading card game can be a significant undertaking for an indie developer. However, with a dedicated player base and sufficient resources, it can be rewarding and better as a long-term game development project.

Collectible and board-game card games like Cards Against Humanity and Sorceress often involve a one-time purchase or, in digital format, a free-to-play model with optional microtransactions. Players may acquire expansions at a later date, or in digital games, card packs through gameplay or purchases, but unlike trading card games, they usually cannot trade cards with other players. In most cases, trading cards from the collectible card game break the game, rendering it unplayable, and such, collectible card games are closer to board games than trading card games. The barrier to entry for collectible card games tends to be lower than for trading card games, making them potentially more accessible to a broad audience.

Developing a collectible card game might be less resource-intensive than a trading card game since it does not require continual content creation to the same extent. Monetization for collectible card games often comes from one-time purchases or optional in-game purchases, like buying card packs or cosmetic items. As an indie developer, choosing between a trading card game and a collectible card game will depend on factors such as the developer's resource availability, revenue model preference, target audience, and the developer's capability to provide ongoing support and development for the game. Both types have pros and cons, and choosing the model that aligns best with the developer's overall vision for the game is crucial.

Funding a digital card game can often be more manageable than funding a physical card game due to several key factors. Many indie developers opt to choose digital format not only because of the unique gameplay mechanics it allows but also simply because of the costs of publishing a game. While physical card games entail substantial production and distribution costs, such as printing, packaging, shipping, and storage, digital games circumvent these physical costs, being distributed globally at nearly no expense, thereby making them cheaper and more straightforward to produce, so many principles of publishing a video game apply to digital card games.

Faeria (Figure 21), a digital card game developed by Abrakam Entertainment SA, is one example of why choosing a digital format for the card game might benefit independent and small developers. In 2016, the game raised over 90,000 dollars in Kickstarter (Faëria - Strategy Card Game 2016), making it one of the most successful trading card game projects funded on the Kickstarter platform as of July 2023. The game strongly resembles Hearthstone regarding UI design, but the gameplay is different and features some unique mechanics, such as the day-night cycle and collecting resources from the map (Faëria - Strategy Card Game 2016).

Figure 21. Faeria, a crowdfunded digital card game (Faeria)

Being a digital card game, Faeria can cut all of the costs related to printing and packaging cards, which gave more budget to game design and publishing the game possible with the backed amount of money. Faeria has 462 cards (Faeria cards), so it can be hypothesized that if printed in a physical format, the total number of cards would be less than 300. Printing a 300 deck of cards costs around 6000 euros for 500 units (PrintNinja) on the most basic settings, the price rising with each addition to regular playing cards. In other words, printing one deck costs around 12 euros, a decent price. However, it does not include any shipping and handling costs. When those are added to the price, in, for example, Faeria's case, the final price would have been more than 20 dollars on Steam in the digital release. Because of the expensive and time-consuming printing, handling, and shipping, many indie developers publish their games digitally. Even with the additional costs for UI design, sound design, and other costs exclusive to digital card games, the barrier of entry is lower for digital rather than physical card games.

Additionally, the accessibility of digital games is a significant advantage. Players worldwide can access and play the game anytime, anywhere, with a compatible device, circumventing any concerns regarding shipping costs or regional availability. This broader reach can attract more backers. Another aspect of the rise of digital card games, even if it is not so much talked about, is the growing

environmental consciousness, which means that some backers are more inclined towards digital games, which do not involve physical resource production or fuel for shipping, as well as the card printing process itself. However, it is crucial to note that despite these advantages, digital games come with their own set of challenges, including the requirement for programming expertise, server maintenance, and robust cybersecurity measures that physical games do not have. Because of that, keeping the pros and cons of both card game types in mind when designing games as an indie developer is an essential part of the design process.

12 CONCLUSIONS

In the vast research on balancing trading card games, I explored both digital and print platforms and tournament and casual gaming of trading card games. At the start, the overarching objectives of the study were introduced, shedding light on the increasing importance of ensuring the initial card game design and playability. The primary methodological approach in the research on balancing trading card games was qualitative content analysis. This in-depth examination allowed the exploration of the intricacies of digital and print card games, delving into their unique nuances and shared challenges.

Initially, the overarching goals of our study were introduced, emphasizing the necessity of a proper game balance in card game design and playability to ensure their long-term playability. Through qualitative content analysis of games such as Duel Masters, Magic: The Gathering, Hearthstone, and Yu-Gi-Oh! Master Duel, thematic insights could be found, recognizing patterns and drawing comparisons between these diverse samples.

Recognizing the evolving nature of card games, the continuous need for balancing and how it is done was researched. The qualitative content analysis allowed the discernment of the perceptions of banned and restricted lists, rotating formats, responsive balancing, and the contentious topic of card limitations. Balancing between tournament and casual play emerged as a crucial area of focus. By qualitatively analyzing specific mechanics, such as the "Sensei's Divining Top" and the "Chaos Orb," it was possible to research different problematic areas in tournament settings from limited play time to accessibility issues.

Throughout this extensive research on balancing trading card games, I have delved deeply into the multifaceted world of digital and print platforms, uncovering the complexities of maintaining balance in tournament and casual settings. The primary method, qualitative content analysis, was a powerful tool to probe and

interpret the intricate layers of these games. As I journeyed through the realm of card games, several key themes emerged: the continuous evolution of games demanding consistent balancing, the pivotal role of perception in shaping responses to banned lists and card limitations, and the challenges faced in catering to both tournament competitors and casual players. By drawing comparisons and identifying patterns, this research provides a comprehensive perspective on the art of card game balance, offering valuable insights for developers and players. As card games continue to grow and adapt in our ever-evolving digital age, the findings from this study will undoubtedly help future explorations and developments in the field.

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