Minionate: The Collectible Card Game

by

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A.B. Harvard College, 2012

Submitted to the Program in Media Arts and Sciences, School of Architecture
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Abstract

Video game players experience opposing motivations to cooperate and compete in multiplayer games. The most pervasive multiplayer games today—massively multiplayer role playing and team-based competitive games—rely on a common compromise: they stratify players by their skill and in-game resources. This design choice limits a player's most meaningful forms of cooperation: participating in novel tactics and strategies, writing her own story, and being part of another player's journey towards greatness in the game. This thesis presents "Minionate," a digital collectible card game that transforms one-versus-one competitive matchups into a multiplayer experience. It introduces new mechanics that enable meaningful and asynchronous interactions between players of different skills; a radical improvement on existing competitive games. Based on an analysis of cards using these mechanics, Minionate gives players new ways to interact in highly competitive games.

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Minionate: The Collectible Card Game
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Introduction

Our way of playing Magic the Gathering between novice and expert players was inclusive and improvised. Although Magic was a two player game, it wasn't fun for my brother and me to play against each other. At 8 years old, I wasn't competent enough to play heads-up (one versus one) in a satisfying way, especially not against his older friends.

We created a new set of rules for Magic "Free for All" that as many as six of us at a time played. The rules were totally unbalanced and lost to time. Nonetheless, it made the game fun and accessible for me, and it meant I could play with better people.

Many people improvised multiplayer (2+ opponent) rules to Magic the Gathering. The objectives of multiplayer varied. Improvisations that expanded tournament play (i.e., in the local game store's basement) became documented competitive and casual variants.[1] In this past, Wizards of the Coast defined multiplayer rules in terms of these new and changed mechanics.[2]

Today, Wizards uses multiplayer Magic (for example, the "Duels" format) to satisfy our motivation to recruit new players, like our friends, into the game. The new rules define etiquette,[3] not mechanics. Wizards proscribes the *aesthetics* of multiplayer gameplay, rather than just the specific mechanics. It encourages players to adapt the game, by sharing cards, decks and strategies or making handicaps, that were outside of traditional Magic rules.

The thesis strives to formalize intuitions developed over decades with games like Magic the Gathering: that we seek to take a competitive thing like Magic and make it meaningful for novices and experts together in the form of cooperative play.

This thesis seeks to answer a specific game design aesthetics question: *How can we feel part of a great player's journey*? It pursues an additional related objective: *to equip players to write their own stories*. Achieving these two objectives responds to player motivations for meaningful cooperative play.

Minionate introduces *persistence* to collectible card games in order to create meaningful cooperative play. It adapts the hugely successful Hearthstone CCG.[4] The thesis defines a design framework of novel persistence mechanics that, put together, satisfy the design objectives *prima facie* and in playtesting.

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[1] Various, 2012. Multiplayer [WWW Document]. Gamepedia: MTG Wiki. URL http://mtg.gamepedia.com/Multiplayer

[2] Barclay, P., 2004. Multiplayer Rules [WWW Document]. Wizards of the Coast. URL http://magic.wizards.com/en/articles/archive/multiplayer-rules-2004-07-12

[3] Styborski, A., 2012. The Eight Rules for Multiplayer Magic [WWW Document]. Wizards of the Coast. URL http://magic.wizards.com/en/articles/archive/serious-fun/eight-rules-multiplayer-magic-2012-08-14

[4] By daily active users and presence in competitive eSports spectating on Twitch.

Prior Work

SPECTATING

Game spectating is the principle approach to make novice players part of a great player's journey. The spectating ecosystem around conventional sports[5] inspired game designers to try the same for eSports. The success of spectating site Twitch shows players are motivated to be part of a great player's journey. Early research into game prototypes were promising but never deployed.[6,7] These games created mechanics to lightly and casually engage spectators.

In 2015, this author tried to introduce this "spectator plus" gameplay to a survival first person shooter in a title called *Super Death Bowl:* patrons used a real-time-strategy interface to support champions fighting in a snowy valley. The mechanics were too anarchic to be fun. Streamline, a title released in November of 2016, tried this style of gameplay too and failed to appeal to a large enough audience to sustain it—13 active players does not a spectatable game make.[8]

Integrating spectators into hardcore eSports gameplay cheapens both the spectator and core player's gameplay. In a March 2015 conversation responding to *Super Death Bowl*, Pardo described the problem simply: "You're making two games, which is twice as hard and crazy as just making one."

CO-OP ADAPTATIONS OF ONE-VERSUS-ONE GAMES

In my childhood, we improvised free-for-all rules to the typically heads-up Starcraft too. It was an unwritten rule to not destroy the author immediately, because he was the weakest player in the PC Bang. Later, "no-rush" rules became an optionally enforced rule in other real time strategy titles like Age of Empires.

Due to both their flexible modding systems and their age, real time strategy titles generated today's best cooperative/team based competitive games.[9] The most compelling co-op competitive adaptations ("custom maps") of RTS games, like Warcraft 3's DoTA and Tower Defense, spun off into the world's biggest competitive gaming titles *League of Legends* and *Clash Royale*.

In 2014, this author tried to port Starcraft Arcade's #1 title *Desert Strike*, a co-op competitive tower defense game, to mobile devices, trying to make it more accessible in the process. The

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[5] Comisky, P., Bryant, J., Zillmann, D., 1977. Commentary as a Substitute for Action. Journal of Communication 27, 150–153. doi:10.1111/j.1460-2466.1977.tb02141.x pp. 150–153.

[6] Esbjörnsson, M., Brown, B., Juhlin, O., Normark, D., Östergren, M., and Laurier, E. 2006. Watching the cars go round and round: designing for active spectating. In Proceedings of CHI '06, pp. 1221–1224.

[7] Drucker, S., He, L., Cohen, M., Wong, C., and Gupta, A. 2002. Spectator games: A new entertainment modality of networked multiplayer games. Technical report, Microsoft Research.

[8] Various, 2017. Streamline · AppID: 252850 [WWW Document]. Steam Database. URL https://steamdb.info/app/252850/graphs/

[9] See the Starcraft Arcade, its new co-op modes or its Allied Commander mode.

result, *Battleplans*, had UX imperfections, like a clunky scrollable map ported poorly to the small screens of iPhones. Supercell's *Clash Royale* ported the concept much better. In conversations with Supercell designers in October 2016, the creators still felt that they haven't quite figured out "clans" (i.e., multiplayer team-based) gameplay. Nonetheless, the game is the most pervasive competitive mobile game played today.

COMMUNITIES AND THE METAGAME

Novices and amateurs use communities outside the game to interact with expert players instead. These communities take the form of online forums where players discuss strategy. They document the "metagame," or game around the game.[10] In competitive games, the most important part of the metagame is the "dominant strategy," or most competitive strategy at high levels of play. In CCGs, this concretely means the best cards and deck archetypes, or formulas for common combinations of cards.

Sharing and debating strategies is a form of cooperation that appeals to motivations not satisfied by a one-versus-one competitive game, like the motivation to socialize, teach or explore with others. This cooperation happens outside of regular gameplay.

The creators of major competitive games have tried integrating community forums to limited consequence. Studios financially invest in major game communities[11] or treat reactions to player feedback a central part of a game design culture.[12] No major competitive game integrates the metagame or its consequences—namely, dominant strategies—into the mechanics of the game.

In late 2016, this author developed *Proto3*, a procedurally generated collectible card game. It mechanically integrates the metagame by discovering and responding to dominant strategies. An AI card designer used AI opponents to simulate cards and decks in order to evaluate how new and existing cards interact with each other. By being able to write new, metagame-changing cards on demand, the AI designer could change the dominant strategies as soon as players discovered them. Major obstacles included designing an AI player as competent as a human player. It is too early to tell if mechanically integrating the metagame can be technologically achieved.

Nonetheless, Proto3 failed to appeal to the motivations of players: they want to cooperate together by discussing dominant strategies, not eliminate dominant strategies altogether. These lessons strongly inform the design of Minionate.

MASSIVELY MULTIPLAYER ONLINE GAMES

Role play and narrative has arguably been the most effective at making novice players feel part of a great player's journey in competitive gaming environments. Groundbreaking surveys in

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[10] Carter, M., Gibbs, M., Harrop, M., 2012. Metagames, Paragames and Orthogames: A New Vocabulary, in: Proceedings of the International Conference on the Foundations of Digital Games, FDG '12. ACM, New York, NY, USA, pp. 11–17. doi:10.1145/2282338.2282346

[11] Shivley, N., 2015. Riot Games invests $30 million in Curse to help online gamers talk. Los Angeles Times.

[12] Riot Games. 2009. The Riot Manifesto.

massively multiplayer online games (MMOs) show how a system of classes and adventures bring players together, satisfying motivations behind playing games.[13] EVE Online empower players to write their own stories by making politicking and propaganda a central part of high-level play.[14] Pardo, as a creator of World of Warcraft, called "player-driven narrative" a succeeded objective of its design.[15]

MMO mechanics suffer from limitations that affect how much players can cooperate with one another. Raids, the basic form of cooperative adventure in MMOs, are stratified by player level. Novice players can interact with experts by chatting or trading with them, but not by actually playing with them. Immersion, like the political dynamics in EVE Online or DayZ, is notoriously unforgiving to new players who venture beyond low-level comfort zones.[16,17] By reenacting real world economies, MMOs double-down on player level stratification by rewarding experience with wealth.[18,19] MMOs stratify players by their skill and time spent in the game, limiting how novices can play with experts.

Nonetheless, stratifying players by experience has been the most effective way to achieve cooperative play in competitive games. While this does not achieve the objective of making a novice player part of a great player's journey, it is the approach the most pervasive competitive games adopt. Elo-based matchmaking is a central feature of team-based competitive games Counter-Strike: Global Offensive and League of Legends. Overwatch's stratified matchmaking system is purposefully designed to address player's biggest complaints with its most similar commercial competitor, Team Fortress 2.[20]

ELO MATCHMAKING AND THIS THESIS

Ability to win is the greatest factor in competitive team-based matchmaking. By specifically excluding weak (or too strong) players, Elo matchmaking responds to competitive motivations—it makes competition feel fair.

This thesis contributes an alternative to Elo matchmaking to integrate players of different experiences, satisfying our cooperative motivations better than Elo in team-based competitive games alone.

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[13] Yee, N., 2006. The Daedalus Project.

[14] Smith, A. 2017. Search for the truth of a fake world at EVE Fanfest. Rock Paper Shotgun.

[15] Pardo, R. 2016. Rob Pardo MIT Media Lab Conversations Series. MIT Media Lab.

[16] O'Connor, A. 2016. Send In The Clones: EVE Online Going Free-to-play. Rock Paper Shotgun.

[17] Smith, G., 2015. Have You Played... DayZ. Rock, Paper, Shotgun.

[18] Castronova, E., Williams, D., Shen, C., Ratan, R., Xiong, L., Huang, Y. and Keegan, B., 2009. As real as real? Macroeconomic behavior in a large-scale virtual world. New Media & Society, 11(5), pp.685-707.

[19] Castronova, E. Synthetic worlds: The business and culture of online games. University of Chicago press, 2008.

[20] Kaplan, J., 2016. This is how the matchmaker works in Overwatch. Blizzard Entertainment.

Why Adapt Hearthstone

This thesis uses Hearthstone as the base of its CCG gameplay, adapting a community Hearthstone simulator called MetaStone.[21] A variety of factors guided the choice to adapt Blizzard's Hearthstone. After Supercell's Clash Royale, it is the highest ranking (by spectators and players on the biggest gaming platforms) one vs. one competitive game. According to Rob Pardo, the former Chief Creative Officer at Blizzard, it is explicitly designed to be more accessible *and* deeper than Magic the Gathering. If it is anything like Magic in my childhood, there is pent-up demand for making it accessible and multiplayer-inclusive.

Unlike other leading competitive gaming genres, like MOBA, FPS and tower defense titles, collectible card games make rule improvisation easy.[22] The grammar and vocabulary of rules are generally restricted, but the buildable gameplay (the "design space") is very rich. Despite its size, the design space stays accessible. Players encounter new gameplay one card text at a time. Strategic gameplay involves combining multiple cards together. In the testimonials of game designers and its role in design processes like paper prototyping,[23] collectible card games rule iterative design practice.

Collectible card games have significantly lower engineering requirements than other mainstream competitive games. Despite the widespread availability of licensable world-class game engines, like the Source Engine, Cryengine, and Unreal Engine 4, all but two major eSports titles (Smite and Titanfall) use an engine made by the title's studio as of 2017. Riot Games, rumored to be in its 4th year developing a tactical first person shooter based on Unreal Engine 4, hired nearly 400 engineers for this R&D effort. Hardcore competitive games have extraordinary engineering requirements. Yet Hearthstone was mostly developed by a team as small as 15 using a commercially available engine at a studio notorious for developing its own technology.[24]

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[21] demilich1, Katz, D., Czikmantory, A., kairos4242, mayuso, Jain, S., Berman, B., n.d. MetaStone. GitHub. URL https://github.com/demilich1/metastone (accessed 5.11.17).

[22] Fullerton, T., 2014. Game design workshop: a playcentric approach to creating innovative games. CRC press. p. 210.

[23] Ibid. pp. 14, 213, 222, 230.

[24] Brode, B., Dodds, E., 2013. Fireside Chat - BlizzCon Panel [WWW Document]. Fireside Chat - BlizzCon Panel.

Evaluation Methodology

This thesis extensively uses the *Mechanics, Dynamics and Aesthetics* formal design framework[25] for evaluation of Minionate and other games.

Mechanics describe concrete activities inside a game, like transitions in a state machine. Dynamics describe what players actually do, in response to victory conditions and other motivations. Aesthetics describe a player's emotional or subjective experiences as a result of the dynamics (what they have bxeen doing). The framework usefully separates the different levers of control a game designer has, reflecting the distance between a game design decision (mechanics) and their affects on a player's experiences (aesthetics).

The thesis evaluates the player's experience (aesthetics) in terms of the *Motivations for Play in Online Games*.[26] This framework is an empirical followup to Bartles' taxonomy of player types,[27] dividing a person's motivation for play into *achievement*, *social* and *immersion* components. This thesis is principally interested in satisfying *advancement, mechanics, competition, relationship, teamwork* and *roleplaying*, whose definitions are reproduced here. Player surveys will pose the same questions from *Motivations* to evaluate their experience.

Achievement Component
Advancement—The desire to gain power, progress rapidly, and accumulate in-game symbols of wealth or status.
Mechanics—Having an interest in analyzing the underlying rules and system in order to optimize character performance
Competition—The desire to challenge and compete with others
Social Component
Relationship—The desire to form long-term meaningful relationships with others
Teamwork—Deriving satisfaction from being part of a group effort.
Immersion Component
Role-Playing—Creating a persona with a background story and interacting with other players to create an improvised story

REPRODUCED FROM MOTIVATIONS FOR PLAY IN ONLINE GAMES (N. YEE, 2006)

Contribution

This thesis contributes *Minionate*, a digital collectible card game introducing new mechanics that answer the question, "How do we become part of a great player's journey?"

There are three new mechanics: "Alliances," "Persistence" and "Bag-Random." These support the dynamics of cooperative play called "Questing" and "Storytelling." These dynamics respond to achievement, social and immersion motivations.

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[25] Hunicke, Robin, Marc LeBlanc, and Robert Zubek. "MDA: A formal approach to game design and game research." Proceedings of the AAAI Workshop on Challenges in Game AI. Vol. 4. No. 1. 2004.

[26] Yee, N., 2006. Motivations for Play in Online Games. CyberPsychology & Behavior 9, 772–775. doi:10.1089/cpb.2006.9.772.

[27] Bartle, R., 1996. Hearts, Clubs, Diamonds, Spades: Players Who Suit MUDs. Journal of MUD Research.

"Alliances" describe how players share cards with one another. Players form alliances and gain access to each other's decks and card collections. This is the basic vehicle for cooperative interaction in a one-versus-one CCG like Minionate.

"Persistence" describes card abilities that interact with persistent attributes of a card, a player or an alliance. Persistent attributes persist between matches; examples include the total amount of damage a minion has dealt, the number of matches won by an alliance today, the last minion destroyed by a spell, etc. Since cards are shared, multiple players can interact with their persistent effects.

"Bag-random" describes how random outcomes are pulled out of a persistent bag, refilled when it is emptied. By making the selection of random outcomes persistent, multiple people can interact with them and control them strategically. It is the multiplayer version of "RNG." "Bag-random" is a broadly-applied improvement of "pity algorithms,"[28] a widely-used mechanic[29] that provides fair rewards from lotteries in games.

Together, these mechanics support two new dynamics: "Questing" and "Storytelling." Questing describe players completing straightforward goal-based missions written on the card. All options lead to benefits for the whole team. Storytelling describe players using cards whose power increases and decreases over time. Their text uses bag-random effects or tactical decisions to pose a dilemma: should a player help herself now or help her teammates in future matches? These dynamics replace the more alienating form of fixed card grading like Hearthstone's card rarities.[30,31] Cards using the mechanics above are designed to support either questing or storytelling.

This thesis documents how these contributions affect competitive CCGs specifically in the context of Minionate. It suggests the ways game designers can transfer these concepts to competitive gaming at large.

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[28] Treubel, C., 2016. Pity Timer on Packs Opening analysis[Kinda proofed] • r/hearthstone [WWW Document]. reddit.

[29] Breckon, N., 2009. Blizzard Details Secret World of Warcraft “Progressive Percentage” Item Drop Mechanic [WWW Document]. Shacknews.

[30] "Legendaries usually have quite powerful abilities, and only a few are terrible." Various, 2017. Golden Monkey [WWW Document]. Hearthstone: Heroes of Warcraft Wiki.

[31] Stonekeep, 2017. Hearthstone Legendaries You Can Safely Disenchant. Hearthstone Top Decks.

Minionate

Minionate is the basis of testing alliances in CCGs. Its most important product is a digital collectible card game with multiplayer matchmaking. Its evolving card collection, playable build and associated support systems were created between September 2016 and June 2017.

This section summarizes the gameplay, describes the specific design objectives, discusses the contributions (the design frameworks), and discusses specific cards. It also provides a detailed description of the narrative and engineering. Throughout this discussion, the document will provide context and commentary on the why—why cards work a certain way and not another, why alternative decisions were considered and refused, etc. These considerations inform future CCG design.

Quick Play

First, start the Minionate application. After creating a user account or logging in, choose Quick Play. This will put you into a match with a computer opponent.

Drag and drop cards with green borders out onto the battlefield, then end your turn! This plays minions.

When the border turns green around your minion on your turn, drag your minion towards your opponent's face to attack your opponent. When her health goes down to zero, you win! Target her minions too to defend yourself.

Manual

Minionate is a one-versus-one competitive collectible card game (CCG) with player-formed alliances. This tutorial will focus both on the mechanics and dynamics of this CCG's gameplay.

In Minionate, the objective is to destroy your opponent by playing cards from a deck, dealing damage, and surviving your opponent's plays. Players take turns playing these cards. A match is decided once a player's hero, or in-game avatar, is reduces to zero hitpoints from thirty.

Before a match starts, players build decks out of their collection of cards. Players enter a game with one of the decks they built themselves. These cards interact with each other in sophisticated ways. The best decks contain cards that adapt to many situations on the battlefield and many different opponents' possible strategies. They also use cards that interact with each other in very powerful ways.

Players only face-off against other players with similar Elo scores—similar performance in game. However, in Minionate, they are free to form alliances with any players they choose. Players in an alliance share their collection of cards and decks non-exclusively.

On the next page is a description of the battle (in-match) view in Minionate. This description adapts and quotes the official Hearthstone game guide.[32]

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[32] http://us.battle.net/hearthstone/en/game-guide/

GAMEPLAY SCREENSHOT FROM MINIONATE

Above is a screenshot from Minionate. Two players, DrPangloss and Robotredbot, are in the middle of a match against each other. At the bottom is DrPangloss, the local player; at the top is the remote player, Robotredbot. They are battling inside a cloning laboratory, whose role is cosmetic inside the game.

1. A player draws a card from her deck and puts it into her hand each turn. Some cards have a green glowing border; these can be played. Cards without the border cannot be played because the player doesn't have enough Energy or a condition of play written on the card has not been met.
2. The player's avatar is the Hero, a playable character that takes and deal damage. It depicts Dr. Q, a deep-ocean obsessed superscientist, one of the nine heroes playable in Minionate. In the bottom right corner, the number "25" is the amount of hitpoints remaining. Damage from the opponent's minions and powers reduce your hero's hitpoints, while some powers played by the local player can restore hitpoints. Heroes have at most 30 hitpoints. If it drops to zero, the local player loses.
3. Every hero has a unique power they can use once each turn. Dr Q's hero power costs two Energy, and it grants Dr. Q two additional hitpoints as "armor." Other heroes can draw cards, deal damage to targets or spawn small, cheap minions. Some cards trigger effects when a hero power is used.
4. Cards and hero powers cost Energy. At the start of the player's turn, her Energy is fully restored; her maximum Energy increases by 1 up to 10 Energy. Some cards can increase the maximum or make the Energy supply grow faster.
5. The local player has one minion in play on her battlefield. After the turn they are played, minions can "physical attack" the opposing hero and other minions. Minions have special effects that impact the local and opposing player's strategies, limit or expand a player's

choices and interact with other cards in the game. In the lower right corner is the minion's Attack, which is the amount of damage it deals to a target. In the lower right corner is its Hitpoints, which behaves just like the hero's hitpoints. Minions started as a card in the player's hand. Stronger minions have higher attack and hitpoint values, while typically costing more Energy to play.

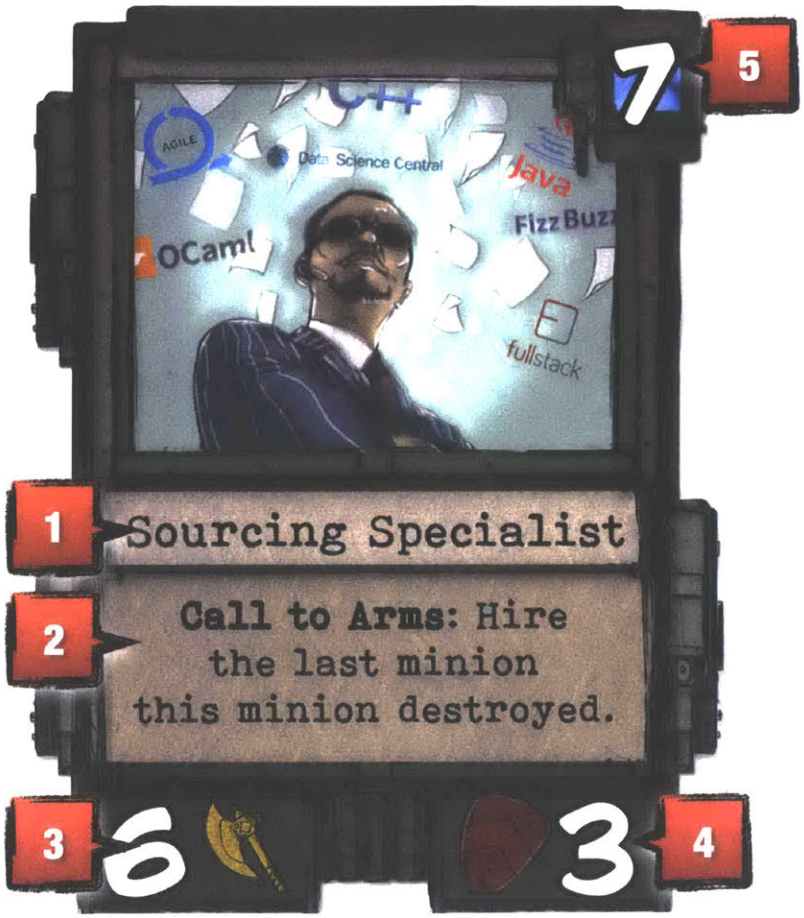
6. The opposing hero is Virginia Khan, a roboticist. With 28 hitpoints compared to the local player's 25 and her 4 minions to the local player's 1, she has a strong board position and is in the lead. However, she has fewer cards in her hand compared to the local player, who has many opportunities to turn the game around. With many turns still left to go, the game is still well undecided.
7. The local player ends her turn by pressing the End Turn button. Typically, players try to spend all their Energy each turn, using their hero power to eat up slack, or wait until they have the right cards in their hand and the right situation on the battlefield to perform many actions at once. Players only make decisions and plays during their own turn; unlike other CCGs, there is no change in "priority," or decision-making interleaved between players during a player's turn.

Mechanics of Cards

Playable cards belong to two categories: Minions or Powers. They have a few common attributes and text describing their special effects.

1. **Title**: The name of the card.
2. **Text**: The card's effects.
3. **Attack** (Only Minions): The amount of damage the Minion deals to the target of its physical attack.
4. **Hitpoints** (Only Minions): The reservoir of damage the minion can sustain. The minion dies when this value declines to zero.
5. **Cost**: The Energy cost of playing this card.

Card text generally explains exactly what the card does. It relies on a brief, external vocabulary to summarize some effects common to all cards.



KEY CARD EFFECTS

- **Permanently**: The effect persists between matches.
- **Bag-Random**: The effect chooses a random outcome from a bag. When it's emptied, it's refilled. The player sees which outcomes are left inside the bag.
- **Call to Power:** The effects occur when the minion is played from the hand onto the battlefield.
- **Revenge:** The effects occur when the minion is destroyed.

OTHER EFFECTS

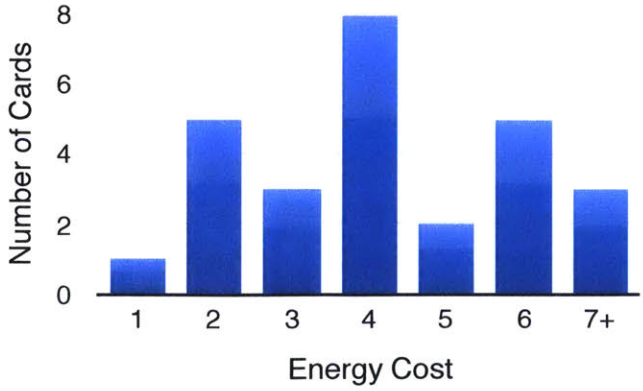
- **Storm**: The minion can attack the same turn it is played.
- **Combo**: The effect is activated if a card has been played before this one this turn.
- **Select One**: The player chooses one of two effects.
- **Pick**: The player chooses one of three cards satisfying some attributes.
- **Blastproof**: The minion has a one-time shield that absorbs all the damage it absorbs the next time it receives damage.
- **Bloodlust**: The minion gains a bonus the first time it survives damage.
- **Shrinking**: The mninion cannot attack for the next two turns.
- **Heal**: The card restores hitpoints up to the target's maximum hitpoints.
- **Energize**: The effect is triggered whenever the minion's owning player uses her hero power.
- **Toxic**: The minion always destroys another minion whenever it deals at least 1 damage to it.
- **Hypnotize**: The target of hypnosis loses all of its current card text and effects.
- **Invisible**: The minion cannot be targeted by other minions or powers until its first attack.
- **Hire**: The minion adds another minion to the battlefield.
- **Guard**: The minion must be targeted by other minions first.
- **Transform**: The card changes the target card into another card.
- **Supersonic**: The minion can attack twice per turn.

Dynamics: Strategy

Players rely on a few general strategies to play well.

In deck design, the major decision is the *energy curve*, or the count of cards that cost a particular amount of energy. Midrange curves peak at four, meaning the player is highly likely to have a cost four card by the fourth turn, when the player can afford the card. Decks that aim to end the game quickly tend to have more left-skewed energy curves; decks that seeks victory in the late game skew right.

MIDRANGE MANA CURVE



Decks can be categorized into *archetypes*, a variety of cards that grouped together interact commonly and positively for the player. In Hearthstone, an example archetype is called the Zoolock, which relies on "a large number of cheap minions and buffs [bonuses] to overwhelm the opponent and trade efficiently against their minions."[33]

In Minionate, very powerful cards synergize with a variety of common cards. Their effects are complementary. The cards are designed to encourage players to *build around* powerful cards. Since a card's power changes over time, this deck design strategy is more dynamic than Hearthstone's, where powerful cards are fixed for months.

Dynamics: Tactics

CCGs have accessible and diverse tactical gameplay. In Minionate, players must master a small number of tactics to play most decks well.

Players must understand the order of play and how one card affects others in order to plan their turns. Mastering these effects is called playing "interactively," or in response to the threats in the opponent's hand and battlefield.

Hibernator	**2**
Bloodlust: +3 Attack	
1 Attack	Hitpoints **4**

For example, **Hibernator** will gain +3 attack after it survives damage. Damaging but not destroying Hibernator is very dangerous. If your opponent has a **Hibernator** on the battlefield, you should try to deal 4 damage to it; playing anything that deals 3 damage or less to it, even if it destroys other minions or damages your opponent, puts you in a very bad situation. Minionate has many situations where cards in play create trade-offs.

Players also try to achieve "card advantage," or a superior number of cards in hand compared to their opponent. More cards means more opportunities for interactive play, since more plays can be considered or made in response to a given situation. In order to maintain card advantage, players must not "overplay" their hand—playing too many cards early without reserving powerful ones for later makes players vulnerable. Players must also "trade" in a cost-effective way, using as few cards of as low cost as possible to counteract opposing plays and achieve an advantage. Players finally must use card drawing effects, like **Failed Experiment** or **Plasma Blast**, to replenish their hand faster than one-card-drawn-per-turn.

Failed Experiment	**1**
Revenge: Draw a card.	
1 Attack	Hitpoints **1**

Plasma Blast	**2**
Deal **3** damage. If your hand is empty, draw a card.	
Power	

Players must finally master the right balance of "cleverness" with their decks. By virtue of random drawing, players will have different cards to play every match. A too-clever deck relies on very rare card combinations, making most matches unplayable even if the combinations are powerful.

Abstractly, these tactics represent decisions between optimizing a current turn ("greedy" optimization) versus later turns ("turtling"). Minionate's cards tend to favor players who optimize greedily in order to promote interactive play and suspenseful matches.

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[33] http://hearthstone.gamepedia.com/Zoolock

Results

This section will review, in detail, the results of the game: new mechanics and card designs.

HOW MINIONATE ACHIEVES ITS AESTHETIC DESIGN OBJECTIVES.

Minionate focuses on three aesthetic experiences and achieves them with the brief summary below. The remainder of this document will focus on explaining how these objectives were achieved with a "bottom up" approach: it will examine and explain the mechanics first, then what kind of gameplay (dynamics) they support, followed by those dynamics create player experiences and respond to their motivations (aesthetics). Refer to this table as guidance for how a particular part of Minionate fits into the bigger picture of cooperative play in competitive gaming.

Aesthetics	**To Become Part of a Great Player's Journey**	**Players Write Their Own Stories**
Dynamics	Because multiple players interact with persistent effects, some with more challenging goals than others, players of different skill levels progress quests and stories on cards together.	Because the decisions around persistent consequences involve tradeoffs, players discuss good vs. bad plays, their role and their impact on their teammates.
Mechanics	Alliances, Persistence	Alliances, Persistence, Bag-Random
Motivations	Advancement, Mechanics, Teamwork, Relationship	Mechanics, Relationship, Role-Playing

Background

This section covers how to understand cards in Minionate and other CCGs. This guidance will inform how Minionate's novel mechanics can interact with other existing CCG mechanics; how players experience new card game mechanics; and what considerations go into the translation of an abstract idea like a card mechanic into text on a card.

CARD TEXT USER EXPERIENCE

Interpreting card text is like using a computer program. Computer programs need to be accessible to their users, especially if they do complex things. The same applies to card text. This section will focus on the "user experience" of the card: how well a player understands and can imagine what the card text does. Minionate obeys certain design rules to make good UX for card text.

The user experience of card text should support good imagination of play. In Minionate, players only have 75 seconds each turn to make their moves. Succinct, descriptive and clear text is essential to imaging how actions will interact with each other. The whole game's design supports imagination of play; the card texts especially so.

In order to achieve this, card text relies on some basic jargon to summarize otherwise verbose and repetitive descriptions of gameplay, plus a brief description of the card's novel effects.[34]

Experimenter 1	**Experimenter** 1
Revenge: Draw a card.	After this minion is destroyed, draw a card.
1 Attack Hitpoints **1**	**1** Attack Hitpoints **1**

To illustrate, are two ways to write **Experimenter**, a simple card. "Revenge" is a common effect that translates to, "After this minion is destroyed..." By trading five words for one, the player gets a more succinct and easier to read collection of cards overall in exchange for learning what "revenge" means.

Substituting verbose effects for a one-word description is a design tradeoff best approached case-by-case in CCGs. Though Magic the Gathering is notorious for its long and obtuse card texts,[35] it aims to immerse players too.[36] Minionate, by contrast, focuses on communicating rules, and not immersion, via text.

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[34] The card effects section in the tutorial provides a glossary of this jargon as it appears in Minionate.

[35] Fitzpatrick, J., 2014. Longest Magic the Gathering Card [WWW Document]. URL https://www.howtogeek.com/didyouknow/longest-magic-the-gathering-card/ (accessed 5.11.17).

[36] Martin, B.A.S., 2004. Using the Imagination: Consumer Evoking and Thematizing of the Fantastic Imaginary. J Consum Res 31, 136–149. doi:10.1086/383430

Minionate follows a basic set of rules to guide the "UX" of card text. It obeys a word limit; it excludes interesting gameplay longer than 21 words as a matter of accessibility for the player. The texts practice the principle of least surprise,[37] so that players can imagine exactly what a card will do. The text also use jargon when at least two other cards have a similar effect; this is an interpretation of "Don't Repeat Yourself," a software engineering principle[38] that aids in the creation, understanding and execution of something algorithmic like software or card text.

Card Text UX Rules
21 Word/4 Line Limit
Principle of Least Surprise
Don't Repeat Yourself

```
Minion experimenter =
  createMinion("Experimenter", 1, 1,
  Rarity.COMMON, HeroClass.ANY, 1);

Spell revenge = new DrawCardSpell();
experimenter.addRevenge(revenge);
```

EXPERIMENTER AS CODE (JAVA)

```
{ "name": "Experimenter",
  "baseManaCost": 1,
  "type": "MINION",
  "baseAttack": 1,
  "baseHp": 1,
  "heroClass": "ANY",
  "rarity": "COMMON",
  "description": "Revenge: Draw a
card.",
  "revenge": {
    "class": "DrawCardSpell",
    "value": 1
  },
  "attributes": {
    "REVENGES": true
  },
  "collectible": true,
  "set": "MINIONATE",
  "fileFormatVersion": 1 }
```

EXPERIMENTER AS DATA (JSON)

CARD TEXT MECHANICS: TEXT AS AN ALGORITHM

Like a computer program, card text can also be interpreted like an algorithm. It takes attributes of the cards, battlefield and players as inputs and outputs new attributes and a series of events. The mechanics of a card are the repeated or common parts of different cards that change the state of the game. They are the sub-procedures of a typical algorithm.

A simple card text like "Experimenter / **Revenge:** Draw a card" can be represented in nearly every common visual and textual representation of a computer program used today.

But directly translating the mechanics to code obfuscates the underlying meaning of the text. Players don't think like this, even though the code representation is very precise. A different example is more illustrative.

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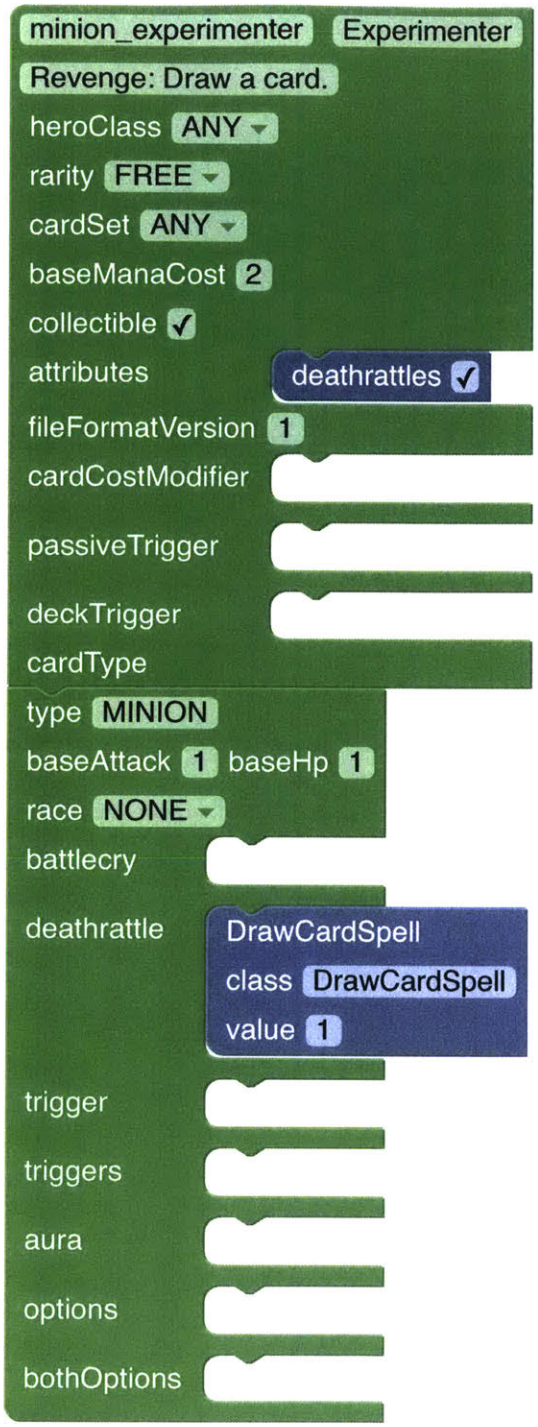
[37] Riehle, R., 2005. Engineering on the Surprise Continuum: As Applied to Software Practice. SIGSOFT Softw. Eng. Notes 30, 1–6. doi:10.1145/1095430.1095443

[38] Wilson, G., Aruliah, D.A., Brown, C.T., Hong, N.P.C., Davis, M., Guy, R.T., Haddock, S.H.D., Huff, K.D., Mitchell, I.M., Plumbley, M.D., Waugh, B., White, E.P., Wilson, P., 2014. Best Practices for Scientific Computing. PLOS Biology 12, e1001745. doi:10.1371/journal.pbio.1001745



EXPERIMENTER IN VISUALS (BLOCKLY)

Consider Experimenter: the mechanics are the parts that interact with state on the board—the "DrawCardSpell," the "Revenge," and its stats as a minion.

The most interesting mechanic of this card is that it draws a card. Generally, when this thesis talks about new mechanics, it's referring to alternatives to "DrawCardSpell:" something conceptually more sophisticated than attack or defense that affects gameplay.

In this illustration, Experimenter is represented in the idioms of block programming.[39] Blocks can be combined together and translate to code. This image is from the current Minionate card editor, and it produces code like the examples above.

The elements in blue are mechanics—like "deathrattles" (a Revenge) and the DrawCardSpell. The elements in green are control structures and data, describing a card (the first large green block) and aspects of the card that are specific to minions (the second large green block).

The key distinction between something that is and is not a mechanic is similar to the distinction between control structures and everything else in a visual programming language. Mechanics modify state, while control structures just help string pieces of state-modifications together.

Minionate has about 140 mechanics, or blue blocks, that can combine with each other and create novel gameplay. XMage, a digital implementation of the nearly two decades old Magic the Gathering, would have nearly 1,160 such mechanics based on its source code.[40] This difference correlates closely to the contrast between Magic and Hearthstone,[41] on which Minionate is based: that fewer mechanics make Minionate more accessible. The next section describes how.

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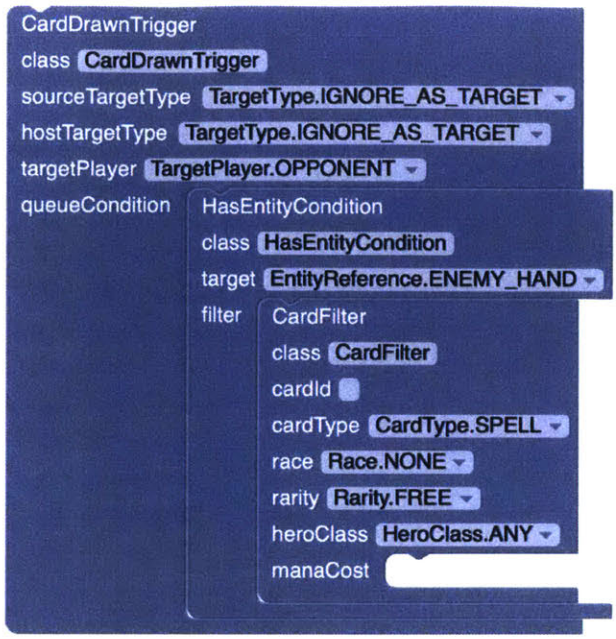
[39] Resnick, M., Maloney, J. et al, 2009. Scratch: Programming for All. Commun. ACM 52, 60–67. doi:10.1145/1592761.1592779

[40] LevelX2, Biter, R., 2010. magefree/mage GitHub. URL https://github.com/magefree/mage

[41] Altenburger, T., 2016. Players who come from Magic, what do you think of Hearthstone?

In the example to the right, the CardDrawnTrigger, HasEntityCondition and CardFilter mechanics are combined to describe the effect, "When your opponent draws a spell..." Like *Scratch* blocks, mechanics can accept other mechanics as arguments or variables, changing their behavior with the same complexity as writing a computer program.



"WHEN YOUR OPPONENT DRAWS A SPELL..."

When reading the card text, strategically-minded players *see* these distinct mechanics, informing strategic decisions like building decks. Knowing nothing more about what this card text does (e.g., what actually happens when the opponent draws a spell), a smart player considers how it could work against opponents who draw a lot of cards, or who draw a lot of spell cards, or how this card tells them something about the contents of the opponents hand, etc. The text is read as a collection of mechanics instead of a single rule.

CCGs must carefully balance how mechanics interact with each other. On the one hand, the amount of unique game situations increases exponentially as more mechanics interact with each other. This appeals to a player's motivations to master mechanics and discover new things.[42] On the other hand, greater complexity limits the accessibility of the game. After twenty years, Magic the Gathering starts to feel arcane, and criticism of its new expansions focuses on whether or not the complexity is "manageable."[43]

Card Text Algo Rules
3 Mechanic Limit
2 Variables Limit
1 Arithmetic Op. Limit
Imaginable Play

Minionate's new mechanics emphasize accessibility across all the player motivations it tries to address. The card text-as-algorithm design rules constrain the complexity of the cards. The number of mechanics on any card is limited to three; there can only be at most two variables; if there is any arithmetic at all, the card limits its arithmetic to one operation; and the way that the card will play on the battlefield must be easy to imagine.

These constraints limit the scope of the new mechanics in the next section. They are based on gut feelings of the designer, learned from the differences between Hearthstone and Magic the Gathering. Based on this experience, the cards make the right tradeoffs of complexity and accessibility for new players.

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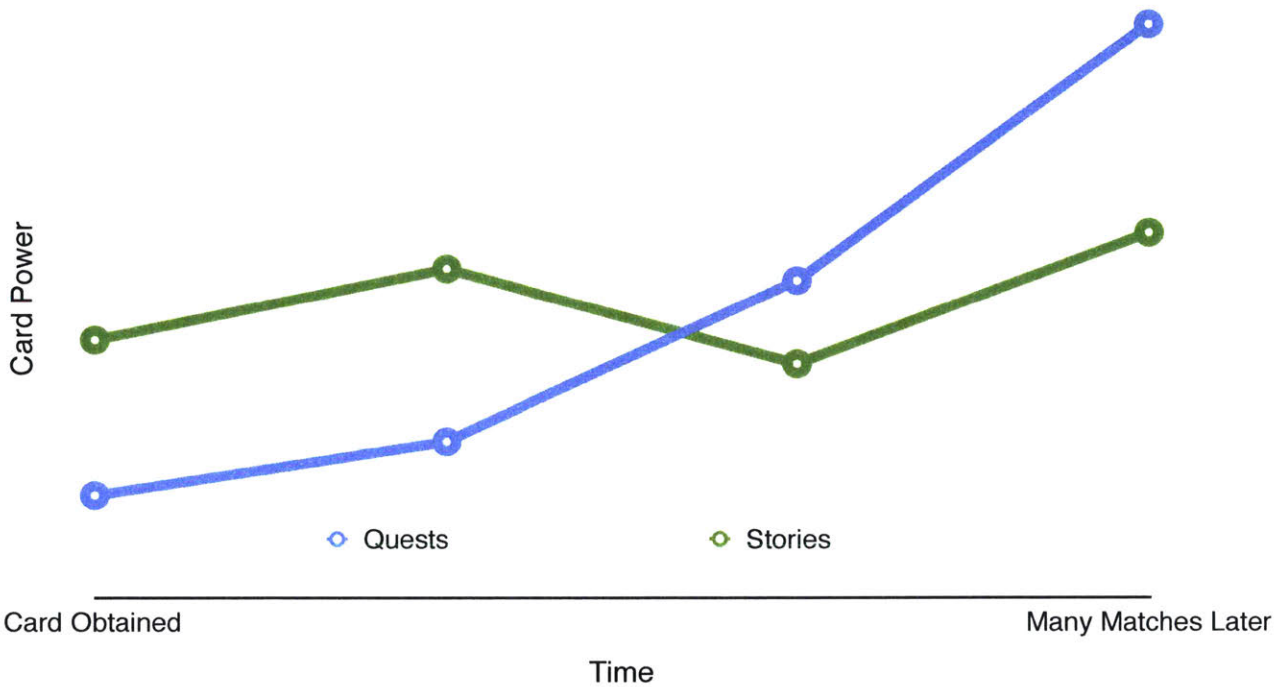
[42] Yee, N., 2006. Motivations for Play in Online Games. CyberPsychology & Behavior 9, 772–775. doi:10.1089/cpb.2006.9.772.

[43] Chapman, K., 2017. Amonkhet review: A gleaming Egyptian city where humans are fattened for slaughter. Ars Technica.

New Mechanics and Dynamics in Minionate

This section will review in detail the new mechanics in Minionate. It discusses the four concrete new mechanics—alliances, persistence and bag-random—and discusses specific cards. It will give a brief user story for the cards and how they fit into *questing* or *storytelling*, the two dynamics these mechanics support.



DEFINING THE DYNAMICS: QUESTING AND STORYTELLING

Questing and storytelling both describe how players satisfy their motivations by interacting with cards together. Questing describes a dynamic where satisfying a simple goal written on a card makes it more powerful. In contrast, storytelling describes a dynamic where players are faced with a dilemma every time they interact with it: do an action that improves the card for the player at the expense of the alliance, or do an action that improves the card for the alliance with no immediate benefit for the player.

Illustrated above, quests describe a card dynamic where a card gets more powerful over time, while stories describe a card dynamic where power changes over time, from multiple agents' perspectives (the player, the alliance and the opponent). These dynamics together satisfy different motivations and have different levels of accessibility, but together they make a complete framework for what kind of gameplay a card can encourage. Specific examples will be illustrated by cards in later sections.

The mechanics of Minionate make other dynamics possible, but these were excluded because they lacked accessibility or did not encourage adoption by players. For example, imagine a card with the dilemma, abstractly: "Benefit your alliance at your expense, or benefit yourself at the expense of the alliance." This simple dilemma, distinct from storytelling, had poor adoption. Players very rarely play cards that harm them, even if those cards have sophisticated positive

side effects, because there are less complicated and more rewarding alternatives.[44] Based on a conversation with Riot Games R&D Producer Marco Carillo in September 2016, players don't like cards that "kick them in the pants."

Storytelling emphasizes the positive in the midst of the negative. Players have to feel like a cost comes with a benefit or at least a less than optimal outcome. Cards need a *character arc:* in order to feel like a loss or penalty written on a card was worth it, players need a close reward.[45] Consistent, small rewards better motivate players than rare, large ones.[46] In other words, for every storytelling card, there must be light at the end of the tunnel, and the tunnel had better be short.

The next section will describe how specific mechanics, represented by cards, promote the dynamics of questing and storytelling.

NEW MECHANIC: ALLIANCES

Alliances let groups of players to join together and share cards. By sharing cards, players can play cards whose beneficial effects only trigger when multiple players interact with them. Players also shortcut through an economic grind by sharing cards, gaining access to each other's collections unlimitedly. Unlike similar mechanics in other games, alliances are always a net positive for players—joining one does not have any cost. Alliances encourage players to cooperate with straightforward rewards and access to the richest strategic system in the game: the persistent card effects.

The user experience of alliances borrows heavily from the clans mechanic in Clash of Clans.[47] For readers familiar with the Clans mechanic, the key distinction is that players in a Minionate alliance share their entire collections and can borrow an unlimited number of copies of any other player's cards. Unlike clans, alliances break conventional economic rules of scarcity and donation. The strategic depth of alliances lies in which players join them and which cards they add to the alliance's shared collection.

In Minionate, players can create a new alliance; browse existing alliances, asking an alliance *leader* to join one; or, they receive invitations to join one from friends or players at large. Each alliance can have at most fifty players, and only leaders have the administrative power to change the membership of an alliance. Players can only belong to one alliance at a time, and can only change alliances once a day. Once a player leaves, the actual consequences of leaving from the perspective of other players, like losing access to cards, only occur a day later.

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[44] Brode, B., 2016. Designer Insights with Ben Brode: Purify • r/hearthstone [WWW Document]. reddit and YouTube.

[45] Freeman, D., 2004. Creating Emotion in Games: The Craft and Art of Emotioneering™. Comput. Entertain. 2, 15–15. doi:10.1145/1027154.1027179

[46] Wood, R.T.A., Griffiths, M.D., Chappell, D., Davies, M.N.O., 2004. The structural characteristics of video games: a psycho-structural analysis. Cyberpsychology & Behavior: The Impact Of The Internet, Multimedia And Virtual Reality On Behavior And Society 7, 1–10.

[47] Clans [WWW Document], 2014.Clash of Clans Wiki. URL http://clashofclans.wikia.com/wiki/Clans (accessed 5.12.17).

THE COLLECTION VIEW

Once joined, players get access to each other's collections, unifying all their cards into one card collection screen. Ordinarily, players spend in-game gold, earned through victories, to get more cards; an alliance shortcuts that process significantly. In this interface, players can see a history of events that have happened to a card when they hover their cursor over the card—this is called the "Power History." It presents the relevant persistent effects here too.

Money Maker 3	**Card Discover** 2	**Thief** 2	**Explorer** 5
At the end of your turn, give a random Ally +150 gold.	**Call to Arms:** Draw the last card added to your collection.	Whenever **Thief** destroys a Minion, add a copy to your collection.	**Call to Arms: Pick** a card your alliance doesn't have.
3 Attack Hitpoints **4**	**1** Attack Hitpoints **4**	**3** Attack Hitpoints **2**	**4** Attack Hitpoints **4**

BASIC ALLIANCE CARDS

Minionate has simple cards that interact with allies and their collections directly. Each player starts with one of these four cards written above. Each interacts with the allies' collection.

Money Maker appeals to advancement, teamwork and relationships by giving players a shortcut through the typical grind of collection-building in CCGs. Gold is used to get new packs of five cards—each pack costs 150 gold. In Minionate, it takes 15 wins to earn 150 gold.

Money maker is a simple *quest.* The goal is to play it, and the reward is 150 gold for allies. Besides its powerful stats (health, attack and defense), it provides no immediate value to the player who deploys it. But it does something very nice for an ally, earning them a card pack. Ordinarily games charge real-world cash for gifts for other players. In Minionate, gifting things to

players involves playing cards like Money Maker. It helps players build relationships with each other through gameplay by facilitating gifting without cash. Money Maker can also help players build their collections; since all allies share a collection, the deploying player of Money Maker benefits as long as gold is used to buy packs. Together, these dynamics represent a quest to grow a collection that multiple players straightforwardly complete together, satisfying meaningful player motivations.

Card Discover appeals to *mechanics* and *teamwork:* what if players controlled what is and is not added to their collections in order to draw a powerful card? This card creates *storytelling:* it always gives a card, which is a valuable thing. But used carefully, that card could be exactly the right card for the situation. Its power is highly dynamic, and it requires coordinating with other players, since anyone in an alliance can add a card to the alliance's collection. Players like to exploit various systems in the game, and this card satisfies this motivation.

Thief appeals to *mechanics* and *competition*: it uses the alliance mechanics in a way that interacts with opponents. Since its power responds to what an opponent plays, and teammates may want specific cards that other opponents use often, it encourages the dynamics of storytelling.

When opponents have interesting options in reaction to a card, the card is described as "interactive;" opponents have to "play around" the consequences of the card. Thief changes which cards an opponent may play, especially if an opponent has particularly rare cards, in order to protect the opposing alliance's advantage of rare or powerfully-quested cards. This card demonstrates an interactive alliance mechanic.

Explorer is a *quest* alliance card. Its power changes as teammates grow the alliance's collection. It usually provides a great benefit: the best cards are often the cards you do not have.[48] As the alliance's collection grows, the number of random outcomes declines, making the card more powerful through specificity.

These four cards introduce players to the alliance mechanic with a combination of storytelling and questing mechanics. They appeal our motivations for advancement, mechanics, teamwork and competition. As the most accessible cards in the new Minionate mechanics set, they are an effective introduction to the new kinds of meaningful play in Minionate.

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[48] Friedman, D., 2015. How to collect every Hearthstone card you need (While saving cash and gold) [WWW Document]. Polygon.

NEW MECHANIC: PERSISTENCE

Persistence describes cards that remember things that have happened to them. As a mechanic, they support cooperative play around cards, either through goals (quests) or interesting tradeoffs (storytelling). Players can satisfy their motivations for cooperative and competitive play by working together to improve cards they use in one-versus-one matchmaking.

Persistence borrows from board games that use "legacy" mechanics[49] and video game crafting mechanics.,[50,51]

Minionate adapted legacy mechanics because they encouraged interesting cooperative dynamics. Mechanically, legacy games raise the stakes for player decisions by making players permanently alter a costly board game. Pandemic Legacy, the most groundbreaking title in the genre, communicated clearly to players that "there's no going back."[52] Players would organize practice games and engage in long-term planning together: exactly the dynamics Minionate sought.

Minionate borrows the logic behind crafting to make the permanence system accessible. Crafting systems use an inventory item as a marker of progress. The hierarchy of ingredients used to build more complicated items communicates an intuitive notion of power. In Minionate, however, items aren't combined. The user experience of crafting is notoriously cumbersome[53] and not reproduced here. Instead, some cards transform into stronger ones after a certain numerical condition or progress is met; the basic logic of crafting without combining ingredients. As an old game system, crafting is a good place to start for player expectations around upgrading inventory items.

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[49] Various, 2014. Legacy | Family | BoardGameGeek [WWW Document]. BoardGameGeek. URL https://boardgamegeek.com/boardgamefamily/25404/legacy.

[50] Ray, D., 2014. The State of Balance: Weapon Gems. BlizzPro's Diablo.

[51] Hammill, D., 2016. Crafting - Minecraft Wiki Guide [WWW Document]. IGN. URL http://www.ign.com/wikis/minecraft/Crafting

[52] Hall, C., 2015. You have exactly 12 months to play one of the year's best board games [WWW Document]. Polygon

[53] Francis, B., 2015. 7 crafting systems game designers should study [WWW Document]. Gamasutra.

Sourcing Specialist 7	Calamity Egg 2	One Upper 3	Rabid Canine 2
Call to Arms: Hire the last minion Sourcing Specialist destroyed.	**Call to Arms:** Pick an Adaptation. You always have the same choices. **Permanently** cast it on Calamaclopse.	**Guard. Revenge:** If this minion has the lowest attack on the battlefield, permanently gain **+1 Attack.**	**Storm. Transform** into **Ancient Hound** after dealing 40 damage.
6 Attack Hitpoints **3**	**1** Attack Hitpoints **4**	**2** Attack Hitpoints **3**	**1** Attack Hitpoints **4**

BASIC PERSISTENCE CARDS

Like the alliance mechanic cards, these persistence cards illustrate different kinds of questing and storytelling. They remember something that happened to them in order to trigger strategically distinct effects.

Sourcing Specialist is a highly interactive (opponent play-aroundable), powerful storytelling card. If Sourcing Specialist destroyed a weak minion, the card hires (summons) the weak minion, and has mediocre value; if Sourcing Specialist destroyed a strong minion, the card has amazing value.

Every time Sourcing Specialist is hired, players can face many interesting dilemmas about what to attack with it. Suppose Sourcing Specialist last destroyed a weak minion: Should the owning player hire Sourcing Specialist at all? If the player does, the player could improve its value by hiring it in a situation where it can destroy a strong minion and become a valuable card again. Conversely, when Sourcing Specialist last destroyed a strong minion, it might be forced into a situation where it destroys a weak minion next. With guard[54] minions, opponents can force Sourcing Specialist to destroy something of low value, improving its interactivity for opponents.

Since Sourcing Specialist remembers the same minion it destroyed for all allies, players must carefully consider how their allies might use it. Novices will play against weaker minions on average, while experts will play against stronger ones. Savvy alliances will exploit this dynamic to transfer very powerful opposing minions into novice's battlefields. With interesting tactical and strategic dilemmas that interact with allies and opponents, this card appeals to mechanics, teamwork and competition motivations.

[54] Guard minions must be targeted first. This mechanic is equivalent to taunt in Hearthstone.

Example Adaptation

Give **Calamaclopse**
+1 Attack, -1 Hitpoints

Power

Calamity Egg is another storytelling card that more explicitly relies on multiple players for its power. Calamaclopse is a game-ending card with a very powerful attribute: it cannot be targeted by powers, usually ones that would destroy it before it could attack. An Adaptation is an improvement with a simple self-balancing tradeoff, like gaining +1 Attack and losing 1 Hitpoints—if it has zero hitpoints, it dies when it is hired.

Since players discover the same adaptation every time they play Calamity Egg, each player has a unique contribution to improving Calamaclopse. Players can repeatedly play Calamity Egg to further pump the tradeoff presented by the adaptation. But smart play involves the right combination of players and adaptations.

With these two cards (Calamaclopse and Calamity Egg), each alliance gets a unique *story*: a game-ending card whose power varies widely across time and alliances. With this dynamic of unique player contributions and strategy for a game ending card, it appeals to the mechanics, role-playing, teamwork, advancement and competition motivations.

One Upper is a questing card that improves permanently when its simple goal is fulfilled: to become more powerful, it must be the weakest card on the battlefield when it dies. As it gets stronger, it is more rare that it dies as the weakest card on the battlefield. The more players who hire One Upper, the more likely it will be the weakest card on the battlefield; as it gets stronger, it's better to play. The simple, linear improvement in its power and ease of its use make it a straightforward quest. It appeals to player motivations for advancement and teamwork.

Ancient Hound 6	**Cerberus** 8
Storm. Guard. Transform into **Cerberus** after dealing 75 damage.	**Storm. Guard. Select One: Supersonic** or **Blastproof.**
5 Attack Hitpoints **5**	**6** Attack Hitpoints **6**

Rabid Canine is a more difficult-to-achieve quest card that transforms into increasingly more powerful cards—Ancient Hound, followed by Cerberus. Their quest focuses on total damage it has dealt over their lifetimes. The goal amount of damage is too large for a single player to complete. Multiple players must use the card to achieve its goal.

The strength of the card is straightforward, gaining very powerful attributes (Storm, Guard, Supersonic and Blastproof) as players fulfill its quest. Like One Upper, it doesn't present too many choices. It pays off for players immediately, but it relies on many to actually become more powerful. This card appeals to advancement and teamwork.

While storytelling cards have more interesting cooperative and competitive dynamics overall, the accessibility of questing cards ensure players always have a rewarding experience in their alliances. As said before, players don't like getting kicked in the pants; they won't play cards that involve too many complicated tradeoffs. Quest permanence cards innovate on existing mechanics in CCGs without overwhelming the player. Together, the storytelling and questing cards allow players to engage with their preferred amount of sophistication, keeping with the spirit of Hearthstone, legacy mechanics and crafting mechanics as accessible advancement systems.

NEW MECHANIC: BAG-RANDOM

Bag-random describes an effect where random outcomes are pulled out of a *bag*. As the bag empties, the remaining outcomes become more likely to occur. When the bag is emptied, it is refilled. The bag is permanent; bag-random introduces persistence to "RNG"—random number generator, or random outcome gameplay.

Bag-random is familiar to card players. On the one hand, it expands the notion of decks to a particular card—certain things are drawn out of a "deck" of possibilities. But its main influence is pity algorithms.[55] Pity algorithms describe a reward system in Hearthstone and other games that give a player a reward after a long string of losses in a lottery system. It is so named because it takes *pity* on a player who loses too much in a lotto. In other words, the best outcome becomes more likely over time—a version of the gambler's fallacy[56] that turns out to be true, not false.

Formally, the likelihoods of pulling a particular item or sequences of items from the bag as it depletes follows a hypergeometric distribution, since it is a form of sampling without replacement.[57] There is an intuitive corollary to the hypergeometric distribution: as the bag empties, the remaining outcomes become more likely.

This intuitive form of randomness makes sophisticated gameplay. Texas Holdem's flops and opposing hands work the same way. Leading research into that game's strategies show that good players develop a "gut feeling" about what could happen, while considering all the possible things that could happen can become computationally intractable.[58] Bag-random's objective is to get the same level of sophistication while appealing to a player's gut, rather than math skills.

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[55] Treubel, C., 2016. Pity Timer on Packs Opening analysis[Kinda proofed] • r/hearthstone [WWW Document]. reddit.

[56] Investopedia Staff, 2006. Gambler's Fallacy/Monte Carlo Fallacy [WWW Document]. Investopedia.

[57] "Expected Number of Cards to Achieve Success," p. 233, Epstein, R.A., 2012. The Theory of Gambling and Statistical Logic. Academic Press.

[58] Moravcík, M., Schmid, M., Burch, N., Lisý, V., Morrill, D., Bard, N., Davis, T., Waugh, K., Johanson, M., Bowling, M.H., 2017. DeepStack: Expert-Level Artificial Intelligence in No-Limit Poker. CoRR abs/1701.01724.

Treasure Chest 1	**Russian Roulette 4**	**Juggler 2**	**Evolvenator 3**
Pick a **bag-random** power. Draw it. **Select One: Permanently** remove the power from the bag; or **add (2) copies** to the bag.	Deal a **bag-random** amount of Damage (**3, 6** or **9**)	At the end of each player's turn, hire a **bag-random** minion for that player.	**Permanently** cast a **bag-random** Adaptation on this minion. Add (1) to its cost.
Power	**Power**	**0** Attack Hitpoints **4**	**2** Attack Hitpoints **2**

BASIC BAG-RANDOM CARDS

Treasure Chest demonstrates a bag-random effect where players must carefully consider how their decisions affect their allies' performance in other matches. It is a storytelling card, presenting interesting dilemmas for a player every time it is used.

To understand this card, consider how picking[59] a power[60] can be valuable. A deck has a *hero class*, like Cyborg or Resurrector, that corresponds to one of the nine playable heroes. Every card belongs to one of the nine hero classes or it is neutral—playable in the decks of any hero class. There are no neutral powers. Picking a power that belongs to a hero class different than your deck's class can create extremely powerful synergies. This makes Treasure Chest very powerful.

By making its outcomes bag-random but controllable, Treasure Chest can become more or less powerful depending on the choices the player makes. By permanently removing a power from the bag, later players will never get the same power. Every power is useful in some way. But if all the decks in the alliance never synergize with a particular power, players make Treasure Chest more powerful by removing that unwanted outcome. If a player instead adds two copies of the power to the bag, it becomes more likely the player and her allies will get the power in the future. The odds compound; since more copies have been added, a player will be more likely to get the choice of adding two copies in the future.

Treasure Chest is an extremely flexible way to transfer a power from different hero classes. But if players in the alliance want to try new decks, a too-specific Treasure Chest will be useless. In order to refill the bag, the alliance would need to remove all the copies, one by one.

These dynamics make every alliance's experience of Treasure Chest unique. Each copy tells its own story, shaped by the players who used it; players can write their own story of gameplay through the card. With bag-random mechanics, this card appeals to motivations for teamwork, mechanics, competition, and advancement.

Russian Roulette is a questing card whose power increases as the bag is emptied. When it is first played, the card has an expected payoff of 6 damage for 4 energy. Should the player target a minion, betting it will only deal 3 or 6, or target the opponent's hero, betting that it will deal 9?

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[59] Picking is the equivalent of discovery in Hearthstone. The player is presented three cards representing powers. The player chooses one of the three cards and draws it.

[60] A power is the equivalent to a spell in Hearthstone and Magic the Gathering.

The tactical considerations vary widely as the bag is depleted, changing the expected payoff significantly and rarely down.

Players must consider how their allies might rely on a Russian Roulette whose bag is (6, 9) or just (9), because those higher-payoff damages for 3 energy can synergize in very powerful ways with other cards. Some decks may only be viable with a 3 energy, 9 damage power; some allies may want to *save* Russian Roulette (9)-bag for the most challenging one-versus-one competitions, like tournament championships. The dynamics of the card appeal to teamwork, competition and mechanics. Russian Roulette takes the simple mechanic of dealing damage and introduces cooperation to its play.

Juggler is a storytelling card where the opponent plays a role in the story. It's an interactive (play-around) card. Every turn, both players face an interesting dilemma: bet that Juggler will give a good minion from the remaining items in the bag, or destroy Juggler to deny further minions.

Since the possible outcomes decline, both players get better control later in the lifetime of the card. Just before the bag is emptied, the hiring player knows precisely which minion will be hired. Since most minions cost more than 2 energy, Juggler is a powerful card as is. Fewer cards may work out to be a higher-payoff (average minion cost) bag, increasing the power of the card. Conversely, as Juggler gets very close to emptying, an opponent may avoid destroying juggler in order to empty and refill the bag during the match, denying the hiring player its biggest strategic benefit—control over its outcome. This dynamic works best in a tournament setting, where players may face off repeatedly. By expanding the dynamics of long-term play, Juggler appeals to the most competitive players.

Allies must also consider how to use Juggler throughout the lifetime of its bag. When the bag is nearly full, Juggler is hard to control. Its strategic role is limited. As the bag decreases in size, more experienced players can execute better plays with its better controlled (and higher-value) outcome. Like the opponents, allies too have to be careful with how long Juggler stays on the board or whether it is played at all. Good teamwork makes a good Juggler.

Suppose that players don't engage with Juggler's competitive or teamwork dynamics. Juggler can also just be fun. Juggler's design is modeled after Lorewalker Cho, a Hearthstone card so delightfully random and absurd a stream dedicated a series of videos to it, called "The Cho Show."[61,62,63,64,65] Like other "random number generator"-heavy cards, Juggler can entertain. It

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[61] CountJinsula Gaming, 2016. [Hearthstone] Wowhobbs' Cho Show Deck Review (Mill Priest).

[62] wowhobbs, 2016. Double Mill Cho Show ~Hearthstone Heroes of Warcraft The League of Explorers Video.

[63] wowhobbs, 2016. The Cho Show Buff Deck ~ Gameplay from Stream ~ One Night in Karazhan ~ Hearthstone.

[64] wowhobbs, 2015. -165 Overkill Cho Show ~ Hearthstone Heroes of Warcraft ~ The Grand Tournament TGT.

[65] wowhobbs, 2015. 1408 Cho Show ~ Hearthstone Heroes of Warcraft Blackrock Mountain new Decklist.

tells a compelling story throughout the lifetime of the alliance, as different players experience different (possibly wild) outcomes. Like these Hearthstone streamers, expert Hearthstone players can engage their allies and spectators at large with smart or absurd plays of Juggler. Juggler illustrates how bag-random can build relationships through entertaining play.

Evolvenator illustrates a storytelling bag-random card that takes on a permanent and unique identity for every alliance. Evolvenator permanently changes based on the player's choices of which adaptation to apply. Since the number of choices decline as players pull adaptations out of the bag, each subsequent play is guaranteed to be a unique decision compare to the last. Yet every alliance may get a different order of adaptations; or, alliances may decide on different strategies of which of the three pick options a player should choose when presented

Bag-random in Evolvenator combines persistence and "RNG" gameplay to make a character arc around the card. This storytelling dynamic appeals to teamwork, role-playing and relationship motivations.

Summary of Results

Persistence and bag-random mechanics introduce motivation-appealing, novel gameplay to traditional competitive CCGs. By using persistence and bag-random mechanics to introduce meaningful cooperative decision-making, and by connecting novices to experts through alliances, these mechanics satisfy the two key design objectives: make players feel part of another (great) player's journey, and to give players the ability to write their own stories.

Minionate aspires to make concrete intuitions developed over decades of playing games with people of different skills. In the opinion of this author, gaming is best enjoyed as a cooperative experience; yet, the most meaning is often earned by defeating an opponent. Today's games tend to increase complexity, not reduce it. They tend to be less inclusive, not more. For future generations of gamers, the thesis presents a framework for novices to become part of an epic, player-driven expert's story. It addresses the straightjacket of Elo-based matchmaking to provide a meaningful connection between novices and experts with new mechanics. CCGs are just the start of a new way to play games together.

Appendix

AAA User Experience	Easy Card Design	Low Cost
A high performance client with high quality art, animation and sound	An accessible domain specific language for writing cards	Fully hosted on the AWS platform to take advantage of $10,000 in AWS credit
24/7 availability of secure and low latency hosted game services	A framework to validate new mechanics in code prior to deploying to users	2D art, looping music, licensable sound effects
Product should feel like it was Quality Assured and well documented (a good FTUE)	Single player support for testing (an AI opponent)	Only existing game engines for the client and the server

Engineering

Minionate's specifications were chosen to support a commercial/AAA-quality user experience; maximum flexibility for card design; and a low implementation cost. As written earlier, CCGs are uniquely capable of meeting these specifications.

AAA UX greatly improves engagement with new games; implementing novel mechanics depends on easy card design; and the realities of a academic research project necessitate low costs.

In short, "Good isn't enough."[66] These specifications describe most marketable, groundbreaking or intellectually compelling games. Because players have so many options, Minionate must compete against other games even if its objective isn't to earn money or grow.

This section briefly explains how the specifications were met and why by looking at the engineering products individually.

A COST EFFECTIVE AND FLEXIBLE MULTIPLAYER BACKEND DESIGN

Minionate adapted the MetaStone open source project[67] to kickstart the design of the server backend. The project had no multiplayer or networked functionality. The thesis created a scalable multiplayer backend with accounts, inventory and analytics services using the vertx platform.[68] This choice ensures the application is low latency and well-tested.

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[66] West, D., 2015. "Good" isn't good enough - releasing an indie game in 2015 [WWW Document]. Gamasutra.

[67] demilich1, Katz, D., Czikmantory, A., kairos4242, mayuso, Jain, S., Berman, B., n.d. MetaStone [WWW Document]. GitHub. URL https://github.com/demilich1/metastone (accessed 5.11.17).

[68] vertx-web: HTTP web applications for Vert.x, 2017. vert-x3.

The continuous integration system runs 1,500 gameplay and networking tests to keep the game glitch free. It relies on common utilities in the Java ecosystem for integration testing.

COMPETENT ONE-TURN HORIZON COMPUTATIONALLY TRACTABLE AI OPPONENT

The AI opponent makes it possible for a single designer to quickly test cards against an opponent, greatly reducing iteration time. It also provides a basic opponent for players to learn the game.

The AI opponent uses a Monte Carlo Tree Search-based policy algorithm[69] with a Cuckoo-optimized value function.[70] It is the AI that ships in MetaStone. The AI simulates millions of random sequences of actions and outcomes and determines which sequence brings it closest to a winning game state. It uses a value function, optimized by playing against itself, to prune sequences of actions that are unlikely to lead to victory. This AI is capable of accounting for the stochastic elements of the game, like which cards are drawn and which targets are chosen by random effects.

However, full MCTS comes at intractable computational cost. For the purposes of design testing and introducing players to the game, the AI only optimizes its current turn. Based on prior research, this AI is the best performing Hearthstone AI to date.[71,72]

A MULTIPLAYER CLIENT

The multiplayer client is a Unity3D application with support for quick play against an AI, matchmaking, and account management. It uses art created by the talented visual artist Mike Pappa, with sound by Gabe Donnay and Louis Weeks.

It supports new gameplay in a generic way, using instructions from the server to determine how entities like cards and minions move around and how to visualize events. The client is not aware of nor is capable of evaluating the game rules. Instead, it knows how to visualize changes to the board and attributes, using informative animations and particle effects to guide the player's attention to the right places.

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[69] Coulom, R., 2006. Efficient Selectivity and Backup Operators in Monte-Carlo Tree Search, in: Computers and Games. Presented at the International Conference on Computers and Games, Springer, Berlin, Heidelberg, pp. 72–83. doi:10.1007/978-3-540-75538-8_7

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[71] Taralla, D., 2015. Learning Artificial Intelligence in Large-Scale Video Games: A First Case Study with Hearthstone: Heroes of Warcraft. Université de Liège, Liège, Belgique.

[72] Zopf, M., 2015. A Comparison Between the Usage of Flat and Structured Game Trees for Move Evaluation in Hearthstone. Master), Technische Universität Darmstadt, Darmstadt, Germany.

Playtests

Number of Playtests	15
Average Players per Test	2
Total Players Tested	30
Cards Tested	231
Average Highest Hearthstone Rank Achieved	15.2 (75th percentile)
Median Collection Size in Hearthstone	210

SELECTED COMMENTS

- There are really complicated things I would do with Juggler, it fit into the the tournament format well and it was really fun and felt difficult.
- Sourcing Specialist put up some interesting choices but it seemed like a solid pick overall.
- Some of the missions on these cards seem too difficult.
- The game favors whoever has the strongest "opening." In fact, card games like Yu-Gi-Oh! emphasize rather long turns in return for games that often end within a few turns. Similarly, Hearthstone games can be decided simply based off mulligan and opening.
- While some scenarios balanced my opening and the AI's opening, other ones snowballed extremely easily.
- The preview set has too many unbalanced abilities. Although it ended up balancing out more often than not (as in, games weren't decided by this more than half the time), it would be good to have scaling up in the power/flashiness of abilities
- Whatever naming scheme we come to it should have some degree of predictability or memory to it. It would be a boon to game knowledge and re-playability if we provided a consistent naming scheme for certain cards.
- The mechanic which makes card games competitive, despite having an overwhelming influence from chance (compared to other games), is predictability gained as a skill.
- Having pure chance guiding cards will leave the game feeling like the Randomonium tavern brawl (i.e., a lot of what I tested felt like this). It's very fun for a bit, yet replayability declines rapidly as entertainment is replaced by frustration.
- I want some sort of "helping hand," to warp the probabilities of certain cards generating as the game goes on. This allows for a greater sense of predictability in the game.
- For higher level play, predictability is what separates good popular players from worse ones, something that should exist regardless of emphasis on hyping up an individual.
- One of the greatest problems with games that do have well-defined metas is that they often become bland. At the very least, playing through this was interesting because variety in card design left each game independent of the ones which preceded and succeeded it. This is something which is rather uncommon in many competitive card games, but definitely has its place in an environment which relegates competition to certain players.
- With regards to gameplay, decisions I made felt often like those I'd make in Hearthstone Arena (this is a good thing!). This kind of format measures a player's raw ability more than it does on deck construction. This emphasis often makes decisions that are difficult, as it calls upon more general card game ability than it does meta knowledge. I was carefully thinking over which stats were best, and which abilities were best, given the board state.

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