Character Balance in MOBA Games

Faculty of Arts
Department of Game Design
Authors: Emanuel Palm, Teodor Norén
Bachelor’s Thesis in Game Design, 15 hp
Program: Game Design and Programming
Supervisors: Jakob Berglund Rogert, Masaki Hayashi
Examiner: Mikael Fridenfalk
June, 2015
Abstract

As live streaming of video games has become easier, electronic sports have grown quickly and they are still increasing as tournaments grow in viewers and prizes. The purpose of this paper is to examine the theory Metagame Bounds by applying it to League of Legends and Dota 2, to see if it is a valid way of looking at character balance in the Multiplayer Online Battle Arena game genre. The main mode of both games consist of matches played on a map where a team of five players is up against another team of five players. Characters in the games generally have four abilities and a number of attributes, making them complex to compare without context. We gathered character data from websites and entered the data into a file that we used with the Metagame Bounds application. We compared the graphs that the data yielded with how often a character wins and how often it is played. To examine whether the characters were balanced we also played the games and analysed the characters in depth. All statistical data gathered was retrieved over the span of a few hours on the 21st of April 2015 from the websites Champion.gg for League of Legends and Dotabuff for Dota 2. Sirlin’s (2001) definition of multiplayer game balance is “A multiplayer game is balanced if a reasonably large number of options available to the player are viable – especially, but not limited to, during high-level play by expert players.” and with the data we see that these games are balanced in terms of characters according to that definition. Overall we believe that Metagame Bounds is a valid way of looking at balance within the genre, but the data is not completely reliable on its own and should be compared with other statistics.

Keywords: computer games, MOBA, League of Legends, Dota 2, characters, balance, eSport.
Definitions

MOBA – Multiplayer Online Battle Arena, a computer game genre.

Meta/Metagame – A level of strategy outside the game itself influenced by knowledge of what is popular or what your opponent may do. The act of metagaming is the use of out-of-game information or resources to affect one's in-game decisions.

Experience Points – Often shortened to EXP or XP. Used to level up something such as a character in a game.

Level up – Increase the level of a property, usually a character. Example: “I earned enough experience points to level up.”

DotA – Defense of the Ancients, a modification for the game Warcraft 3. DotA is largely responsible for popularising the MOBA genre.

CSV – Comma separated values. The file type .csv can save values separated by commas. It can be read by different programs such as text editors and Microsoft Excel.

Pick – Picking a character means to choose a character for a match. Pick rate is how often that character is chosen.

Counter – A character that has an advantage against another character. If A has an advantage against B, A is B’s counter.

Crowd Control – Crowd control, or CC, is a term originally used in Massive Multiplayer Online Role-Playing Games (MMORPGs) to refer to the ability to limit the amount of enemies actively fighting during an encounter. In MOBA games it is a category of abilities to limit an enemy player’s actions such as preventing them from using abilities or reducing their movement.

eSport – Electronic sport is a term for multiplayer video game competitions. The most common genres of games in eSport are real-time strategy games, fighting games, first-person shooter games and MOBA games.
Table of Contents

1 Introduction ................................................................................................................................. 4
2 Description of the Games League of Legends and Dota 2 .......................................................... 6
  2.1 League of Legends .................................................................................................................. 7
  2.2 Dota 2 .................................................................................................................................. 8
  2.3 Characters in League of Legends and Dota 2 ....................................................................... 8
    2.3.1 League of Legends Character Roles .............................................................................. 8
    2.3.2 Dota 2 Character Roles ............................................................................................... 9
  2.4 Purpose ................................................................................................................................ 10
3 Theories and Methods .................................................................................................................. 11
  3.1 Balancing in Games .............................................................................................................. 11
  3.2 Metagame Bounds .............................................................................................................. 11
  3.3 Win Rates Comparison ....................................................................................................... 13
  3.4 Pick Rates Comparison ..................................................................................................... 13
  3.5 Analysing the Games by Playing ....................................................................................... 14
4 Results ...................................................................................................................................... 15
  4.1 League of Legends .............................................................................................................. 15
    4.1.1 Win Rates ..................................................................................................................... 16
    4.1.2 Pick Rates .................................................................................................................... 17
    4.1.3 Metagame Bounds ....................................................................................................... 18
  4.2 Dota 2 .................................................................................................................................. 19
    4.2.1 Win Rates ..................................................................................................................... 19
    4.2.2 Pick Rates .................................................................................................................... 23
    4.2.3 Metagame Bounds ....................................................................................................... 27
5 Analysis .................................................................................................................................... 28
  5.1 League of Legends Data ....................................................................................................... 28
  5.2 Dota 2 Data .......................................................................................................................... 31
  5.3 Metagame Bounds as a Theory ............................................................................................ 34
6 Discussion ................................................................................................................................ 36
7 Conclusion ................................................................................................................................. 37
References ................................................................................................................................. 38
1 Introduction

In a multiplayer game such as a Multiplayer Online Battle Arena (MOBA) it is important to have a balanced game so that the most skilled player is the winner. Ernest Adams suggests that in the most general sense, a balanced game is fair to the player if it is neither too easy nor too hard, and if it makes the skill of the player the most important factor in determining his success (Adams, 2010).

As live streaming of video games has become easier, eSport, computer games played as sports and spectator events, have grown quickly and many developers are trying to make their games the next big hit. The most popular games have tens of millions of players worldwide (Riot Games, 2014) and the numbers are still increasing as tournaments grow in viewers and prizes.

![Figure 1: Tournament Earnings for eSport games (Aron Ambrosiani, 2014)](image)

The purpose of this paper is to examine the theory Metagame Bounds. Metagame Bounds is a balancing theory proposed by Alexander Jaffe at Game Developers Conference, 2015. It is a theory to look at balance between asymmetric characters in games. By applying it to the games League of Legends (Riot Games, 2009) and Dota 2 (Valve Corporation, 2013) we will see if Metagame Bounds is a valid way of looking at character balance in the MOBA genre. We will examine the character balance in the two games using the following definition:

“A multiplayer game is balanced if a reasonably large number of options available to the player are viable – especially, but not limited to, during high-level play by expert players.” Sirlin (2001).

Metagame Bounds lets you calculate the optimal play rates of characters in a community of a game based on character win rates in matchups, one versus one. We will apply this theory to League of Legends and Dota 2 and see whether the results can still be valid in a five versus five game with over one hundred characters.
Jaffe originally took the fighting game genre as an example when explaining the theory, so the data from Metagame Bounds may be inaccurate because of how the games are five versus five instead of one versus one.

In addition to the Metagame Bounds we will then look at these characters’ win rates and pick rates and see if there are any extremes in the graphs of these statistics and to compare it with the Metagame Bounds results to test the theory. We will look at the reasons for these extremes from a game design perspective and try to understand what might be the cause of them.

This paper was written for the course Degree Project in Game Design at Uppsala University, Campus Gotland during April through June, 2015, by Emanuel Palm and Teodor Norén.
2 Description of the Games League of Legends and Dota 2

League of Legends and Dota 2 are team based games based on a modification for the game Warcraft 3: Reign of Chaos (Blizzard Entertainment, 2002) called Defense of the Ancients, or DotA. The main mode of DotA consists of matches played on a map where a team of five players is up against another team of five players. The map is divided into two parts, one side for each team. There are three lanes that lead out from each teams’ base. The most effective strategies involve sending different characters to different lanes on the map, depending on the characters’ strengths and weaknesses. Every lane has 3 towers. The towers serve as defense structures for each base and need to be destroyed in order to take down the base.

![Classic example of a MOBA map layout (Raizin and Sameboat, 2013)](image)

Each lane periodically generates non-player characters that walk along the lane and meet with the opposing team’s non-player characters. These non-player characters grant gold when killed by player characters from the opposing team and they grant experience points to
everyone close when they die. The gold can be used to buy items that make the player characters more powerful. The experience points increases the level of the player character when it reaches a set threshold. When a player character levels up the player they can choose an ability to learn or make an already known ability stronger. The abilities are varied and depend on character but include effects like dealing damage to a character from the opposing team, or moving a large distance.

Defeating a player character will reward the players with gold and experience points. The defeated player character is dead for a period of time and will revive in its teams base when that period of time is over.

The goal for both teams is to destroy the opposing team’s base. To make that possible a variety of strategies can be employed. Some focus on eliminating characters from the opposing team, while others apply a divide and conquer type strategy. When a team destroys the opposing base the game ends and they win.

2.1 League of Legends

League of Legends is a game developed by Riot Games for PC. Riot Games coined the term MOBA as a genre and the game is largely based on the original DotA. Steve Feak was a developer on the original DotA but left development to Icefrog, the current lead developer of DotA and Dota 2. Feak joined Riot Games and was part of the founding team for League of Legends which is generally considered a spiritual successor to DotA.
2.2 Dota 2

Dota 2 is a game developed by Valve Corporation. It is a direct copy of the original DotA with very few gameplay changes. The current lead developer for DotA, Icefrog, works for Valve and is responsible for many of the balance changes in Dota 2. Icefrog continues to update the original DotA to this day.

2.3 Characters in League of Legends and Dota 2

Characters in the games are known as champions or heroes in League of Legends and Dota 2 respectively. They generally have four abilities and a number of attributes such as health, a resource for their abilities, physical defense, magical defense, movement speed and damage. These can all be increased by buying items during a match for gold.

Characters fill different roles in the team. The roles range from fragile characters that need help from their team to stay alive in fights but deal a lot of damage to the enemies, to durable characters who stay in the midst of battle and take the damage in place of their allies. Depending on the character, players buy different items throughout a match to reduce their characters’ weaknesses and/or increase their strengths.

2.3.1 League of Legends Character Roles

League of Legends have six roles: Assassin, Fighter, Mage, Support, Tank and Marksman.

Assassins are agile characters that specialise in taking down important characters on the opposing team. They generally have a lot of mobility to be able to get to their targets, take them out and then be able to escape.
Fighters are close range combatants that have a mix of offensive and defensive abilities. They do not have as much utility or defense as a tank or as much damage as an assassin, but they add up to become a threat in a fight over time.

Mages are typically characterised by being fragile, by their long range and by their magic spells that have high utility to help their team, or an area of effect to disrupt or damage enemies.

Support characters help their team by enabling their allies to win by using healing or by using crowd control on the enemies. They try to create advantages for their team by disrupting enemies and keeping their teammates alive.

Tanks are durable characters that can lock down enemies and start fights. They are usually the ones choosing the times to fight and initiate aggression but can also choose to protect their more fragile teammates with crowd control.

Marksmen are ranged attackers who generally sacrifice defense and utility to deal high damage to single targets. They are typically weak in the early parts of the match to become stronger later on. They rely on help from their team to make up for their lack of defense, but in return they deal the most single target damage in the team.

### 2.3.2 Dota 2 Character Roles

Dota 2 has ten character roles or attributes defined in the game as: Carry, Disabler, Lane Support, Initiator, Jungler, Support, Durable, Nuker, Pusher and Escape.

Carry is defined as: “Will become more useful later in the game if they gain a significant gold advantage.” (Dota 2 Wiki, 2015). Carries are mostly weak early in the game, but gain a significant advantage when they have gathered enough gold, often in the later stages of the match.

Disabler is defined as: “Has a guaranteed disable for one or more of their spells.” (Dota 2 Wiki, 2015). A disabler is a character that has crowd control. These characters can reliably crowd control one or more characters, depending on their abilities. A disabler is often a support.

Lane Support is defined as “Helpful in the early-game laning in protecting your team’s carry.” (Dota 2 Wiki, 2015). A lane support is a character that many times helps the team’s carry to survive the early stages of the game. They do that by keeping enemies away with their attacks, or by helping the carry survive through crowd control or health restoration.

Initiator is defined as “Good at starting a teamfight.” (Dota 2 Wiki, 2015). Initiators are characters that can start a teamfight from a distance to catch the enemy team off guard. Initiators can often deal large amounts of damage in a short period of time or are able to crowd control the enemy team long enough for allies to follow up with their abilities.

Jungler is defined as “Can farm effectively from neutral creeps inside the jungle early in the game.” (Dota 2 Wiki, 2015). Junglers are characters that can kill non-player characters in the jungle from the very start of the game, without any problems. Some of those characters can also take control of those non-player characters and use them to their benefit.
Support is defined as “Can focus less on amassing gold and items, and more on using their abilities to gain an advantage for the team.” (Dota 2 Wiki, 2015). A support is similar to a lane support in the sense that they both often have crowd control or health restoration abilities that can aid the team. What differentiates a support from a lane support is that the support can be in another lane with a character that is not a carry.

Durable is defined as “Has the ability to last longer in teamfights.” (Dota 2 Wiki, 2015). A durable character either has more health, more physical defense, more magical defense or one or more abilities that increase the chances that the character will survive confrontations with the enemy team.

Nuker is defined as “Can quickly kill enemy heroes using high damage spells with low cooldowns.” (Dota 2 Wiki, 2015). Nukers are characters that have the ability to deal a lot of damage in an area of effect or to a single target. These abilities are used to both defeat enemy player characters and non-player characters.

Pusher is defined as “Can quickly siege and destroy towers and barracks” (Dota 2 Wiki, 2015). In Dota 2 a barrack is a structure in each team’s base. Pushers excel at bringing down structures through various means. Some characters boost their non-player characters with damage or physical defense, others create their own non-player characters and some characters have abilities that directly damage structures.

Escape is defined as “Has the ability to quickly avoid death.” (Dota 2 Wiki, 2015). Escape characters have one or more abilities that can teleport them to a new position, make themselves invisible or increase their speed a large amount.

These roles used to be more visible in the Dota 2 game client, but have now been removed from some places, for unknown reasons.

2.4 Purpose

The purpose of this analysis is to find out if the characters in both games are balanced. We chose League of Legends and Dota 2 as games to analyse the character balance in because they are both very complex games and have large player bases. Both games have the data from each match available to the public. This means there is also a large collection of data for every character. We also have a good understanding of the games, because we have played them a lot. This aids us in analysing the games.

Because of how complex the games are we chose to focus our analysis on a single part of the games’ balance, the characters. It would be a monumental task to compare all of the games’ elements at the same time and see what is balanced and what is not. The data that is available is primarily character data, which is also why we chose to investigate the characters.
3 Theories and Methods

To explore whether Metagame Bounds is a viable theory for balancing characters in the MOBA genre we used a number of theories and methods.

We gathered data from websites and entered it into a Comma Separated Values (CSV) file that we used with the Metagame Bounds application. We compared the graphs from the data with Win Rate and Pick Rate graphs taken from the same websites and then analysed whether the characters were balanced or not, and whether Metagame Bounds is a valid way of looking at character balance in MOBA games. To examine whether the characters were balanced we also played the games and analysed the characters in the graphs in depth.

3.1 Balancing in Games

Balance in games can be compared to how fair it feels for the player. If a game feels unfair, it is less enjoyable.

Because many factors in asymmetric games are incomparable, characters can have their own strengths and weaknesses. If two characters are not designed to do the same thing, how can a player without knowing the situation say that one is better than the other? This is also true for the designer, and another reason that the balance of the game is incredibly important. If a character would be good in every situation, it would be considered a dominant strategy to pick that character. Dominant strategy is a term that comes from game theory. It means that the strategy reliably produces the best outcome of a scenario no matter what an opponent may do. A dominant strategy does not mean that a player is always going to win, but it means that it is superior to all other strategies.

Even symmetric games like Chess have imbalances; at the highest levels of play going first as white has an advantage (Chessgames.com, 2015).

“To be enjoyable, a game must be balanced well – it must be neither too easy nor too hard, and it must feel fair, both to players competing against each other and to the individual player on his own.” (Adams, 2010)

3.2 Metagame Bounds

Metagame Bounds is “a new way to think about asymmetric strength” (Jaffe, 2015). We used the application that Jaffe had produced to test this theory and see if it applied on the MOBA game genre as well as the fighting games which he used as an example.

The application calculates the play rates that a certain character can be played in any metagame while still finding success. It does this by taking a CSV file of a matchup chart between the characters you want to examine and then outputs a PDF file with a graph showing the optimal minimum and maximum pick rates those characters should be played in any metagame.

Jaffe talks about how this lets you find problems in the balance and explains three categories of characters to look for: Always Excluded, Sometimes Dominant and Always Dominant characters. We focused on these characters in the results of the graphs. We interpreted the
category Sometimes Dominant as having a minimum pick rate of at least 40 to 50 per cent, but focused on the characters that stood out in the graphs.

**Table 1: Example of a Matchup Chart**

<table>
<thead>
<tr>
<th>Matchup Chart</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>50%</td>
<td>65%</td>
<td>50%</td>
<td>90%</td>
<td>60%</td>
</tr>
<tr>
<td>B</td>
<td>35%</td>
<td>50%</td>
<td>40%</td>
<td>90%</td>
<td>75%</td>
</tr>
<tr>
<td>C</td>
<td>50%</td>
<td>60%</td>
<td>50%</td>
<td>90%</td>
<td>40%</td>
</tr>
<tr>
<td>D</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>50%</td>
<td>40%</td>
</tr>
<tr>
<td>E</td>
<td>40%</td>
<td>25%</td>
<td>60%</td>
<td>60%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 1 shows an example of a made-up matchup chart, where A through E could be characters in a game. A character on a row from the left wins a certain percentage of the time against a character in a column from the top.

**Figure 5: Example of a Metagame Bounds Graph**
Figure 5 shows an example of a Metagame Bounds graph made with the data from Table 1. We can see that the three categories of balance problems are found in this graph.

A is Always Dominant, having a minimum pick rate of 35 per cent and a maximum of 100. This means that A could be in every single match and a player can do nothing about it because A has an advantage against all the other characters. The minimum pick rate of 35 per cent means that the community needs to play A in at least 35 per cent of all matches to be optimal.

C is Sometimes Dominant since the maximum pick rate C can have is as high as 59 per cent. As with A, this means that C can be in more than half of all matches and still find success. For a game with only five characters, that may be more than the games’ designers want.

D however is at an incredible disadvantage and is categorised as Always Excluded, with only being able to play around 2 per cent while finding success. E and B are also slightly weak, having a minimum pick rate of 8 and 6 per cent respectively.

We made matchup charts with data from the websites Champion.gg for League of Legends and Dotabuff  for Dota 2 character statistics. Because the data was entered manually and not through an automated process, there is a possibility that the data has typographical errors. In addition, the data was collected from the websites over a few hours. This means that the statistics for each character might have changed slightly due to new data being collected by the websites.

Champion.gg did not have data of every single matchup in the game, so we chose to only analyse the data from characters that play on the middle lane on the map. The data from Champion.gg is also from matches with more skilled players compared to the data from Dota 2 which is from all matches.

3.3 Win Rates Comparison

Win rate is the percentage that a character wins an amount of matches. A win rate over 50% means that the character wins over half of the matches on average. Specific win rates between characters are used in the Metagame Bounds application to calculate which characters are the most and least desirable in a meta.

We compared the raw win rates of characters to the results from the Metagame Bounds application to find if there are characters that are ranked highly on the Metagame Bounds application that do not have a high win rate, or conversely, if there are characters that are ranked low in the Metagame Bounds graph that do have a high win rate.

3.4 Pick Rates Comparison

Pick rate is the percentage of an amount of matches that a character gets chosen in any of the teams. A pick rate of 25% means that the character on average shows up in every fourth game.

We compared the data from Metagame Bounds with pick rate to see whether the games’ players are picking the “optimal” characters.
3.5 Analysing the Games by Playing

We have played the games extensively and analysed the characters in detail to be able to compare them with the Metagame Bounds, Win Rate, Pick Rate and to draw conclusions about the character balance in the games.
4 Results

All statistical data gathered was retrieved over the span of a few hours on the 21st of April 2015 from the websites Champion.gg for League of Legends and Dotabuff for Dota 2. The data was over 14 000 data points, or win rates as percentage values, manually written into a CSV file to be used by the Metagame Bounds application.

4.1 League of Legends

The statistical data for the League of Legends characters was gathered from the site Champion.gg. The data used for the graphs are all from players ranked Platinum and above, which is 11.2% of the players (LeagueOfGraphs.com, 2015).

For League of Legends we did not find a website that had data of every character’s win rate against other specific characters in the game, also known as matchups, so we chose to analyse the data of the characters that play on a specific lane instead.

Some of these characters are played in other roles and positions of the game as well but this data is specific for middle lane. There are also other characters in the game that theoretically can play on the middle lane of the map, but they are not used enough in that role to be considered middle lane characters.
4.1.1 Win Rates

This is the win rates graph for all characters played in the middle lane in League of Legends.

![Win Rate Graph](image)

**Figure 6**: League of Legends Middle Lane Character Win Rates (Champion.gg)
4.1.2 Pick Rates

This is the pick rates graph for all characters played in the middle lane in League of Legends.

![Pick Rate Graph](image)

**Figure 7**: League of Legends Middle Lane Character Pick Rates (Champion.gg)
4.1.3 Metagame Bounds

This is the Metagame Bounds graph for all characters played in the middle lane in League of Legends.

Figure 8: League of Legends Middle Lane Metagame Bounds
4.2 Dota 2

The statistical data for all the Dota 2 characters was gathered from the site Dotabuff. The data used for the graphs are from players of all skill levels. The data is from one month of matches, from 21st of March 2015 to the 21st of April 2015.

4.2.1 Win Rates

This is the win rates graph for all characters in Dota 2.
Figure 9: Dota 2 - All Character Win Rates (Dotabuff)
4.2.2 Pick Rates

This is the pick rates graph for all characters in Dota 2.
Figure 10: Dota 2 All Character Pick Rates (Dotabuff)
4.2.3 Metagame Bounds

This is the Metagame Bounds graph for all character matchups in Dota 2.

Figure 11: Dota 2 Metagame Bounds
5 Analysis

Using Sirlin’s definition of multiplayer game balance we can see that these games are balanced in terms of characters. They are not perfectly balanced, however.

There are many outside factors that change how much people play a character in both of the games. What the professional players are playing, what kind of cosmetics the character has and how easy it is to play the character all affect how much it is played by the games’ communities, as well as many other factors. What role the character fits also affects the pick rate of a character, since players have their own preferences. Is it a character that supports the team through healing, or a character that deals a lot of damage?

Win rate is also affected by all of these factors to a certain degree, depending on the person and the level of play. A player who plays only to win and to improve might not change his choice depending on cosmetics or difficulty to perform well with that character, while a new player that is not focused purely on winning, might.

It is important to remember that win rates are not absolute, however. Win rates are an average over a collection of matches against many different characters, team strategies and choices. If a character has an advantage against a few of the characters with highest pick rate, that character will consequently have a high win rate, even if that character has weaknesses against many other characters, with lower pick rates. This means that in a specific match a character with high average win rate will not necessarily have an advantage, therefore win rate might be a misleading statistic on its own. “You never face an average opponent, you face other strong opponents who are themselves defined by their ability to face strong opponents.” (Jaffe, 2015). This is where Metagame Bounds can be beneficial as an additional tool to gauge character strength in asymmetric games.

5.1 League of Legends Data

We did not find data for every matchup of every character in League of Legends, so we decided to look at a single lane in the game where there is usually a one vs one matchup. This also helped us to compare the ways of using the Metagame Bounds, if using it on a single lane with a one versus one would return more reasonable results than using it on every character.

For this purpose we chose the middle lane, which is located in the middle of the map and therefore has the most opportunity of the lanes to impact the other places of the map and get advantages for the team. As a single lane we reasoned the middle lane would give us the most accurate result. The middle lane is primarily occupied by characters whose roles are mages or assassins.

Riot Games balances League of Legends for both professional play as well as the average player. Sometimes characters that are difficult to play at an optimal level might not have a high pick rate in lower ranks but are played by professional players a lot, or the other way around.

An example of this was the character Elise who was played frequently with great results in professional play, but less in lower ranks. Ryan Scott is the lead designer of League of Legends. When discussing balancing for both professional play and lower ranks, he talks about how Elise had a pretty low win rate in ranks lower than Diamond and how you needed
to have a coordinated team or be skilled with Elise in a sense more than other characters. “It wasn't as if she had a slope that was really sharp. She had a slope that went straight up once you got to the professional level and it was such a problem there.” (Gamespot, 2015) He then explains how they made changes to Elise even though they knew it would end up having effects on lower levels of play, and how that choice was tough since they would not be able to know if it was the right one.

With this we can see that there are different characters played in different skill levels of the game, with different rates of success.

Looking at the Metagame Bounds graph (Fig. 8) we can see that there are no characters who could be categorised as Always Excluded or Always Dominant. All of the characters can be played to some degree and find success. There are however a few characters in the top that could be categorised as Sometimes Dominant characters, these are Talon, Annie, Malzahar, Heimerdinger and Morgana.

Talon is an assassin character in League of Legends. He has the highest result on the Metagame Bounds graph showing that he should be played up to 62 per cent of all matches (Fig. 8). Talon also had the 5th highest win rate (Fig. 6) of the middle lane characters, with 53.19 per cent. His abilities deal a lot of damage very quickly, as well as letting him get close to his target, which gives him an advantage against mages. This is likely the reason he is in the top of the specific middle lane Metagame Bounds graph. Talon is not picked more than 4.09 per cent of matches (Fig. 7), however, even with his strong advantage. This might show that other highly picked characters counter him.

More than half of the characters in the middle lane are mages, which results in an advantage for Talon in this graph which is isolated from the rest of the characters in the game. Assassins thrive on taking out fragile targets such as mages, but has a disadvantage against more durable characters. If the remaining characters in League of Legends would have had data of all matchups as well, chances are he would not be as high in the graph.

Annie, the second on the Metagame Bounds graph, is a mage with only 3 per cent less than Talon in maximum pick rate (Fig. 8). She has a lot of damage and can crowd control enemies with a stun either on a single enemy or multiple ones, preventing them from doing anything for a short duration. She is fragile, being a mage, but not as much as many other characters. Her strength lies in being able to reliably crowd control any enemies within a small area instantly, this lets her bring a lot to her team without having a huge disadvantage. She is also at 53.46 per cent win rate as the 4th highest win rate of the middle lane characters (Fig. 6).

Annie’s 9.17 per cent pick rate (Fig. 7) is closer to the Metagame Bounds than Talon’s, which might depend on her ability to always be useful to her team with crowd control. While Talon mostly brings damage, Annie can help her team and stop enemies from moving, even if she falls behind the enemies in gold and levels, unlike Talon.

Malzahar is the 3rd highest character of the Metagame Bounds graph, with a maximum pick rate of 55 per cent (Fig. 8). Looking at the pick rate graph, however, we see that he is only at 4.72 per cent (Fig. 7). He has the second highest win rate in the middle lane at 54.64 per cent (Fig. 6) but is still not as popular as middle lane characters like Ahri, Zed and LeBlanc in terms of pick rate. A common factor in these three highly picked middle lane characters is their high mobility. They can all move around quickly to reposition themselves in fights and they are all assassins.
Malzahar on the other hand has low mobility. His strengths lie in dealing a lot of damage to a single target very quickly. One of his abilities crowd controls an enemy by suppressing them. Suppression is the strongest category of crowd control which works like a stun and stops a character completely, but compared to a stun which can be removed in several ways, suppression can only be removed by buying a specific item, or by interrupting the character using the suppression. Malzahar’s suppression does however require him to stand still during the duration of the ability, which leaves him vulnerable in fights with multiple enemies, but makes him a very strong duelist.

Heimerdinger is the 4th character on the Metagame Bounds graph with a maximum pick rate value of 54 per cent (Fig. 8). He has the highest win rate at 54.81 per cent (Fig. 6) but he is almost never picked compared to many of the other characters (Fig. 7). Heimerdinger is a character that builds turrets around him that shoot enemies. He can build three at a time but they can be destroyed easily. He has a strong advantage against anyone that needs to fight him in close combat because of his turrets helping him, but if he does not have his turrets he becomes vulnerable. His role in a team is to deal damage over time to anyone who comes close to the area, and he has a crowd control ability that blinds enemies to make them miss attacks, or stuns them for a short duration if he hits enemies with the center of the ability. He is easy to play and learn since the turrets do most of the damage for him and part of why he has such a high win rate might be just because he does not have a high pick rate, with enemies not knowing exactly how Heimerdinger works or how to handle playing against him.

Morgana is the last of the five Sometimes Dominant characters in the Metagame Bounds graph. She has a pick rate of 4.26 per cent (Fig. 7) and the third highest win rate at 53.73 per cent (Fig. 6). Just like Annie, Malzahar and Heimerdinger she has crowd control. She has two abilities that crowd control, the first one is a root. Rooting is a form of crowd control that roots the affected to the ground in some form and prevents them from any movement. They can still use abilities and attack, as long as it does not require them to move. The second ability creates chains between her and any close enemies, damages them and reduces their movement speed. If she manages to stay in range of any target for three seconds it stuns them and deals the same damage again.

Most of the characters that are high ranked on the Metagame Bounds does have some sort of crowd control. Annie, Malzahar, Heimerdinger and Morgana all have crowd control that can stop the movement and actions of an enemy character. Talon does not have a crowd control that completely stops a character, but his advantages against mages make him the character highest ranked on the Metagame Bounds. There does not seem to be a stronger connection than that between the characters that are high on win rate and Metagame Bounds, though, and other characters lower on the graph have crowd control as abilities as well. As for the characters with high pick rate, it seems that the most popular characters in the middle lane all have mobility. The five characters in the top have some ability to increase their movement speed, dash forward or jump to a position nearby.

It seems that using Sirlin’s definition and looking at both win rates and Metagame Bounds, the characters played on the middle lane of League of Legends are balanced. The majority of the options in terms of characters are all played to a certain degree and they all win roughly half of their matches. This is only an isolated case and does not necessarily mean that the characters in the graph are balanced in comparison to the rest of the game’s characters.
5.2 Dota 2 Data

For Dota 2 we were able to find data for all characters.

The Metagame Bounds graph for Dota 2 (Fig. 11) shows that while there is a portion of characters that have higher pick rates, the vast majority of characters are neither Always Excluded nor Always Dominant. At a glance this seems to fulfill the conditions of the balance definition. However, because there is a character that is Always Dominant this means that even though there are many viable characters, the dominant character is theoretically better, meaning that Dota 2 may be imbalanced, character-wise.

Omniknight stands out as the character that ranks highest in the Metagame Bounds graph (Fig. 11), and is the only character that is Always Dominant. The graph shows that Omniknight should be played a minimum of 46 per cent of all matches. If players do not pick Omniknight that often, playing him will be advantageous. The graph also shows that even if Omniknight was played 100 per cent of the time, every single match, no character picked could make that into an advantage. This means that even if a player knows his opponent is going to pick Omniknight, the player cannot do anything to counter it with a character that has an advantage against him. It turns into an inevitability, where the players of Dota 2 will in either case have to play Omniknight a certain amount to be optimal.

Omniknight also has the absolute highest winrate of 58.71 per cent (Fig. 9) as well. His pick rate is not as high as the Metagame Bounds suggest it should be, however, with Omniknight holding only the 48th most picked spot out of the 110 characters (Fig. 10).

Omniknight is a supportive character that can make any one character in the team invulnerable to magic for a period of time and he can grant invulnerability to physical attacks to potentially his entire team. He has a heal that restores a large amount of health to an ally and deals an equal amount of damage to any enemy character near the ally healed. Lastly, he has a passive ability in an area of effect around himself that slows the movement and attack speed of all enemy characters inside that area.

One major factor for Omniknight being picked very little is probably because he is a support character. This is supported by the fact that out of the top ten picked characters, only one can be considered to be supportive in nature, Earthshaker, and he is the 10th character out of the top ten picked characters. This points towards supportive characters being less popular.

All of Omniknight's abilities are very strong in their own right and do not need to be used in a certain combination to achieve a high degree of effectiveness. The abilities that grant immunity from magic and physical can however be nullified by certain other characters. This is not immediately apparent for newer players, and, because the data collected is from all players, we believe the data is almost certainly skewed toward the less skilled majority of the player base. When it comes to professional play, Omniknight is not a character that is picked a lot either, as 60th out of all the characters, nor does he have a winrate over 50 per cent (Datadota, 2015). Probably due to the professional players recognising his weaknesses and knowing how to play against him. This might point toward that teams that are less coordinated have difficulties to defeat an enemy Omniknight to prevent him from protecting the rest of his team. This leads to a big win rate discrepancy between the total win rate and competitive win rate of Omniknight.
If we now look at one of the characters at the bottom of the Metagame Bounds graph, Io, we can see that it is a character that should only be picked much more rarely. Io can only be picked up to 4 per cent of the time while still being successful, according to the graph (Fig. 11). Io is picked 2.8 per cent (Fig. 10) of the time according to the overall data, placing 105th out of 110 characters. This is fairly close to the Metagame Bounds calculation, unlike Omniknight. Win rate wise, Io is last with a win rate of 39.87 per cent (Fig. 9). This is in stark contrast to professional play where Io is number 19 in pick rate and has a win rate of 53 per cent (Datadota, 2015).

Io is a supportive character that works in close tandem with another ally. It can tether to an ally for a duration. During the tether, the ally gains health and the resource used for abilities equal to the amount Io gains. Both Io and the ally also receive additional movement speed. Any enemy character that passes through the tether is slowed for a duration. The tether will break after a set time period, or if Io is too far away from the tethered ally. The second ability sends out five orbs that orbit Io. These orbs detonate on contact with enemy characters dealing damage. The orbit of the orbs can be altered for further precision. The third ability increases resistance against all damage and increases attack speed at the cost of Io’s current health and ability resource. If Io is tethered to an ally, the ally also gains the damage resistance and attack speed, without the ally losing any health or ability resource. The last ability lets Io go anywhere on the map for a short period. After that period is over, Io returns to its position just before the ability was used. If an ally is tethered to Io, that ally will go with Io to the new position for the duration returning when the time is out, or stay there, if the tether is broken.

This is almost a reversed case when compared to the character Omniknight. The skill and execution required to make the character Io function on an successful level is seemingly so great that only the most experienced players can do it. There are many complex and intricate interactions that can be achieved with Io that just are not possible for a character like Omniknight as well. For example, in a scenario where an ally character is low on health, Omniknight would heal that character for a set amount, Io on the other hand, can tether to the ally, grant it damage resistance, and at the same time use a consumable item bought with gold on itself to gain life which gives the same amount of life to the friendly character. Another example later in the match could be where both Omniknight and Io would have unlocked all of their abilities and are trying to save an important ally, a carry for example. Omniknight can make an ally character completely impervious to damage for a short duration. If the character that is impervious is surrounded, however, chances are he will still be surrounded after the short duration is over. In Io’s case Io would act as a sacrificial lamb to save the important ally, by tethering to the ally and repositioning it to a safe place on the map. The important character would be left in a safe place while Io is returned to the spot where he saved his ally, maybe to be defeated by the enemies he saved the ally from. It is apparent that the effort required to effectively use Omniknight is far smaller compared to the effort of Io. It is however a bit of an unfair comparison, because few characters match Io in complexity, but it demonstrates that there is a range of differently complex characters that shape how much they are picked. One character that may be effective in the average match, is not certain to do well in the hands of a professional player playing against other people of the same skill level.

Necrophos is 2nd in ranking according to the Metagame Bounds graph (Fig. 11) and also considered Sometimes Dominant according to the Metagame Bounds. He can be picked 56 per cent of the time in average matches and still find success. Necrophos is picked 28th highest out of all 110 characters with a pick rate of 10.85 per cent (Fig. 10), pointing towards
that the community has not found the optimal pick rate of this character, according to the Metagame Bounds graph. Necrophos wins 4th most of all characters, with a win rate of 56.51 per cent (Fig. 9). The reason he is ranked higher in the Metagame Bounds is because he is more powerful against the other high ranking characters.

Necrophos is a character that becomes stronger the longer the match goes, a carry. He can heal allies for a small amount and damage enemies for a larger amount in an area of effect every few seconds, this makes him durable. He has a passive ability that removes health from enemy characters based on their total health. The ability works in such a way that a character with 500 health will die as fast as a character with 200 health. The third ability is a passive ability that restores health and resource used for abilities, over time, but only whenever Necrophos defeats an enemy. The last ability is an ability that targets a player character, dealing damage to them based on the amount of health they are missing. If a target is defeated by this ability, they will stay dead for 30 additional seconds before they return to life.

The most powerful aspect of Necrophos is to be able to, in the late parts of the match, defeat an enemy character with the ability that deals damage equal to the amount of health missing and have them stay dead for potentially two minutes, before they return to life. This is highly likely to be the reason Necrophos is winning more than average. Removing an enemy character from the match for a long time means that the team with Necrophos has plenty of time to attack the enemy base, or to find more enemies to defeat, increasing the advantage for Necrophos’ team. Necrophos is not picked very much in competitive play, but when he is picked he wins exactly 50 per cent of the time (Datdota, 2015). This may indicate that compared to Omniknight, even professional players find it difficult to combat the increased death time, or that they have not played against him enough to figure out a proper way to handle Necrophos. As for why Necrophos is not picked more often by the overall playerbase we can only speculate. Perhaps it is because the character only has two activated abilities and the two others are passive, meaning it is not very engaging or interesting to use Necrophos in a match. Another reason could be because many new players often confuse Necrophos’ ability to heal with supporting, decreasing the chance he will be played in an average match, due to the lower popularity support characters have in general.

One final character that we want to bring up is the character Troll Warlord. Troll Warlord is the 5th most picked character with a pick rate of 26.35 per cent (Fig. 10), a win rate of 56.98 per cent (Fig. 9), placing him 3rd out of all 110 characters’ win rates and places 4th in the Metagame Bounds rankings with a percentage of 43 (Fig. 11), meaning he is Sometimes Dominant. Troll Warlord is the statistically strongest character. What we mean by that is that of the characters that win more than him, they do not have higher pick rate or Metagame Bounds ranking than him. The same goes for pick rate where no character that is picked more than Troll Warlord wins more than him, or has a higher ranking in the Metagame Bounds graph. This is unusual because when a character is picked a lot it will often have a lower win rate because of the sheer number of players that play that character. A large amount of players playing a single character will often decrease the win rate of that character since less popular characters might be played by players who know how to play them.

In Troll Warlord’s case he persists with a high winrate because of his ability to be useful throughout the entire match, even though he is classified as a carry. We believe this is because of Troll Warlords versatility as he can switch between ranged and close combat at will. He has the ability to fight almost any character one on one and still win, even if he is behind in gold and experience points. Troll warlord can also grant a bonus to all allies and himself that
helps do more damage to enemy player characters, non-player characters and towers. Because he gives himself and allies more damage it means that Troll Warlord and his allies can focus more on items that increase durability, instead of buying items that grant more damage. This not only gives Troll Warlord himself more of an advantage but also his entire team, which may be a large factor to Troll Warlord being so dominant in all three graphs.

If we are to look at the overall character balance in Dota 2, with the Metagame Bounds as one of the guidelines along with pick rate, win rate and with Sirlins definition of balance, we would like to propose that the average match of Dota 2 has balanced characters, as the highest ranked and only Always Dominant character is not picked very much by the player base, and because there are only a few Sometimes Dominant characters like Troll Warlord and Necrophos. A few of the characters are not picked a lot, but we think a reasonable amount of characters can be deemed viable based on the data we have gathered. We could not find any real relationships between the top characters in the Metagame Bounds, nor when it comes to win rate. Some characters are supportive, some better later and some are a bit of both. When it comes to pick rate, the most popular characters to pick are carries, the characters that become very strong some time into the match.

5.3 Metagame Bounds as a Theory

Because we did not find data for all matchups in League of Legends but did find it for Dota 2, it serves as a comparison for critical analysis of the theory Metagame Bounds. Since the theory was presented with the example of one versus one fighting games we realised that the lack of data could help us in seeing if the theory works in the MOBA genre. However, as we figured out, the data from League of Legends takes the data on who won the matchup in the middle lane from the overall game, so if character X had an advantage against his lane opponent character Y, but character Y won the game, it would count as a victory for character Y, regardless of how well character X did. This means that it is hard to draw a conclusion whether the theory works better for a single lane, or a match, because of how the actual outcome of the lane fighting might have not decided the match.

As both games are team games where characters have different roles the conclusions drawn from a theory that is based on one versus one are highly susceptible to error. For example, the pick rate of more popular character roles may skew the data in their favor, or vice versa. We have tried to highlight this in our analysis of the statistics for the two games, but it is important that this is reiterated. To really find out if Metagame Bounds is giving a reasonable view of the metagame in League of Legends and Dota 2 we would have needed to go through more testing with even more data points from different time periods, and compared that to win rates and pick rates from those same time periods.

Because the data for Dota 2 was for all skill levels, it means that although the average skill level should theoretically find that Omniknight would be the most effective character, we are unsure if there is such an average player group in reality. To further test this we could use data from different skill levels, which is available on some statistical sites to try and discern what characters are effective in different skill levels and try to see if the games are more balanced at certain skill levels and find out if the games are balanced toward that part of the player base.
If the games’ communities suddenly started to play all characters as much as the pick rate that the Metagame Bounds graphs show, the results might shift, because of the matchup win rates possibly being affected. This is because the application only takes data from one specific point in time. An improvement could be to input daily data and plot the Metagame Bounds for each day and try to extrapolate the data a week from the present, or edit the application to take more data into account for different points in time. While we do not possess to knowledge to do such a thing ourselves, it would be an interesting thing to try.

With the amount of data at hand from our own results, we believe Metagame Bounds is a reasonable theory to look at balance in MOBA games, as well as other multiplayer games with asymmetric balancing. The data from the League of Legends Metagame Bounds graph is not as reliable as the one from Dota 2 because of the lack of many characters. With this we can see that the theory mostly works when having all the different characters or options of the category examined, but possibly not as much when divided further. It is however important to not take it all at face value and utilise other means as well, such as win rate and pick rate, to see if the results from Metagame Bounds seem plausible.
6 Discussion

Overall we believe that Metagame Bounds is a valid way of looking at balance within the MOBA genre as well as the fighting game genre. It most likely works in other genres as well if they are multiplayer and asymmetrically balanced.

The data we collected should have been divided into categories. We should have taken data from professional League of Legends and Dota 2 and added into the Metagame Bounds application to generate graphs for professional play. This would allow for an easier comparison for the games and also serve as additional support to decide if the games’ characters are balanced.

We should have worked on the data collection itself and tried to find a way to gather the data by ourselves to be able to get exactly what we were looking for. Creating an automated program or process that gets the data for us would have been better, instead of saving webpages and manually enter them into a CSV file. It is hard to know whether it would have saved time since we do not have the knowledge of the specific way the program would work, but if we were not constricted by the time limits of the course we could definitely have had it as an option. Even a process that took two weeks to figure out would have saved us time in the long run, while also making it easier for others to replicate what we did, and repeat it with other data.

We should have considered focusing on a single game instead of trying to cover both and consequently get less data from each game. This is an artifact of what we had initially decided to be a comparative study between both of the games. Because we, as the authors play one of the games each we decided to keep it that way, possibly to the detriment of this study.

We realise that this study is merely a stepping stone for character balance in MOBA games and that the analysis barely begins to cover the copious amount of data that we have collected. We only look at a few of the characters when it would have been really valuable to look at all of them for a complete analysis. As it stands we were only able to scratch the surface of a few character’s strengths and weaknesses because of time constraints.

Another way to use Metagame Bounds would be to divide characters into their roles and look if the roles were balanced, or if one role is completely out of balance compared to the others instead of using all the characters. It is hard to tell whether it would have been a valid way to use to theory without testing it for ourselves.

For future research on MOBA game balance we would recommend dividing the game balance into different groups. One for the lower skill level, one for higher skill level and one for the professional level. This would make it more clear to see where the potential problems lie, if a character is Always Excluded in a higher skill level or if a character is Always Dominating in lower skill levels.
7 Conclusion

We investigated whether the theory Metagame Bounds could be applied to characters in the games League of Legends and Dota 2 to see if the characters of the games were balanced according to the definition:

“A multiplayer game is balanced if a reasonably large number of options available to the player are viable – especially, but not limited to, during high-level play by expert players.” Sirlin (2001).

We tried to investigate what might be the reasons for those characters’ graph results in the current metagame. We used a theory called Metagame Bounds which Alexander Jaffe proposed at Game Developers Conference, 2015, and we compared the results to pick rate and win rate. The theory was originally used in a fighting game where the players fight one versus one, and therefore the results of the five versus five games may be inaccurate.

We gathered statistical data of the characters from a website for each game but were unable to find win rates between characters, so called matchups, for all the characters in League of Legends. We input the data in the Metagame Bounds application and got graphs that we analysed to determine whether the characters were balanced or not.

In the analysis we looked at a number of characters that fit the categories defined by Jaffe as Always Excluded, Sometimes Dominant and Always Dominant and we explained why we thought they were in their current states. We arrived at the conclusion that the characters of both League of Legends and Dota 2 seem balanced according to the balance definition by Sirlin, at least to the extent we analysed them.

When it comes to the application and theory Metagame Bounds by Jaffe, we believe that it is a helpful tool for looking at character balance in MOBA games. However, because of the fact that it is not specifically designed for MOBA games it is difficult to endorse it fully without a more thorough study.

For future research on MOBA game balance we would recommend dividing the game balance into different groups. One for the lower skill level, one for higher skill level and one for the professional level. This would make it more clear to see where the potential problems lie, if a character is Always Excluded in a higher skill level or if a character is Always Dominating in a lower skill level.
References

Literature


Internet


Games
