



# WPI

## Sports vs Esports:

A Comparison Study of Industry Size, Viewer Friendliness, and  
Competitiveness.

An Interactive Qualifying Project Proposal Report

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## **Abstract**

Traditional sports have been popular for decades, but esports have recently risen and begun to see similar successes. Despite their similarities, a detailed comparison of sports and esports has not been made. Our project seeks to directly compare key elements of sports and esports. We researched and analyzed industry sizes, viewer friendliness, and competitiveness of popular sports and esports and made graphs to visualize data. Based on our analysis, sports industries are generally larger than esports, but viewership and prize pools can be larger for esports than sports. Esports are generally more complex than sports, but feature more live action per game, and are generally more competitive than sports.

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## Abbreviation Table

<b>CS:GO</b>	Counter Strike: Global Offensive
<b>EPL</b>	English Premier League
<b>LCS</b>	League Championship Series
<b>LOL</b>	League of Legends
<b>MLB</b>	Major League Baseball
<b>MLS</b>	Major League Soccer
<b>NBA</b>	National Basketball Association
<b>NFL</b>	National Football League
<b>NHL</b>	National Hockey League
<b>OWL</b>	Overwatch League

## 1. Introduction

Traditional sports, like American football, baseball, and soccer, have become the only representation of the word ‘sport’ for most people today. This is certainly understandable, given the large audiences for traditional sports, as well as their presence in cultures around the globe. For example, the National Football League (NFL) Super Bowl in North America is a massive event, with over 103 million viewers in 2018 [1], and has great impacts on American culture and economy. For example, for the 2018 Super Bowl, the economic impact report commissioned by the Minneapolis Super Bowl Host Committee -- taking into account the extra tourists, bookings for the hotels, public transportation, and jobs created by the Super Bowl -- stated there were over five-thousand jobs created and a net incremental spending of \$343 million, which left a net gain of about \$29 million after the costs of building the stadium and hosting the event [2].

Other major sporting events in North America, like the Major League Baseball (MLB) World Series and the National Hockey League (NHL) Stanley Cup, have similar effects, and are also significant parts of North American culture. On an international level, the Federation Internationale de Football Association (FIFA) World Cup, which pits soccer teams from around the globe against each other, draws massive amounts of viewers and attendees from all around the world (562 million in 2014, on average for the final game) [3]. A similarly significant cultural impact has been made by the summer and winter Olympic Games, which have each been held every four years for over a century and feature athletes from over 200 different countries in a global competition that also serves to boost international relations.

Within the last couple decades, a new phenomenon has been emerging: electronic sports, or esports, which could redefine the modern meaning of the word ‘sport.’ Esports are the competitive play of video games for a spectator audience. As traditional sports have continued to grow in size, esports have also been growing in popularity and have been garnering significantly increased viewership and participation in recent years. Some of the more popular types of esports are Multiplayer Online Battle Arenas (MOBAs) like League of Legends (Riot Games, 2009) and Dota 2 (Valve Corporation, 2013), First Person Shooters (FPSs) like Overwatch (Blizzard Entertainment, 2016) and Counter Strike: Global Offensive (Valve Corporation, 2012), Real-Time Strategy games (RTSs) like Starcraft II (Activision Blizzard, 2010), and more recently Battle Royales like Fortnite (Epic Games, 2017) and Apex Legends (Respawn Entertainment, 2019).

While many video games played a part in the growth of professional esports, today only a select few are played on a large enough scale to be able to compare them to professional sports. Examined esports were chosen based off of the definition of an esports, as well as their popularity at the time of writing this. The definition of an “esport” this study uses, from the Oxford Dictionary, is “a multiplayer video game played competitively for spectators, typically by professional gamers” [4]. As such, this will be excluding other forms of professional video gaming that do not pertain to this definition, such as speedrunning. Based on this criteria, the esports researched were Overwatch and League of Legends. We decided against other popular esports such as Fortnite, Starcraft or CS GO, because despite their impressive numbers, they simply did not have industry size to compete with professional sports.



This work looks to explore the growth and popularization of modern esports, as well as address their similarities and differences to conventional sports with regard to three main topics: industry size, viewer friendliness, and competition. Though traditional sports have been around significantly longer than esports, they are both similar, each featuring different leagues, multiple teams, and dedicated fanbases. Despite the similarities between the two, the different platforms raise questions, such as which is more viewer friendly, which features a higher capacity for competition, as well as how the limitations and rules of each affect how the game is viewed. To compare these three topics, several different methodologies were needed. Some of the major methods we used are data aggregation and presentation, as well as public surveying and analysis of gameplay.

For this study, the biggest professional sports of North America were researched. This includes the NFL, MLB, NHL, NBA, and the MLS. Additionally, we chose to examine the EPL soccer league as well, which is primarily based in Europe, because of the significant cultural impact it has globally, along with how closely it compared to the data from the MLS. The definition of a sport used in this project is from the Oxford Dictionary, defining a sport as “an activity involving physical exertion and skill in which an individual or team competes against another or others for entertainment” [5].

Esports have been around since the 1970’s and have seen consistent growth in popularity. An example of growth in the esports community are the prize pools. The first documented tournament with a prize presented a subscription to the Rolling Stones magazine to the winner [6]. Now, prizes can reach upwards of \$11 million [6]. Just this past year, the Dota 2

International (world championship) prize pool was over \$25.5 million. Along with this, one of the first esports events held by Atari had an audience of over 10,000, while today stadiums are sold out for esports events, with spectator numbers up to 20,000 [7]. The prominent professionally played video game is League of Legends has viewership numbers up to 33 million for the world finals [8], which surpassed the 2017 NBA finals' 20 million total viewers [9].

The first component researched was the size of the professional sports and esports industries. This is an important aspect to compare because of how the size of each industry relates to its economic impact. We gathered publicly available data through the Internet and compiled graphs to visually compare the results. Overall, this led to a general trend of sports having larger industry sizes than esports.

The next component we looked at was the viewer friendliness of professional sports and esports. The enjoyment of watching a sport or esports and the overall viewer experience are important for gaining and maintaining viewership. This increases industry size, making viewer friendliness another important component to compare. Information was gathered through surveys and by comparing the rules of the different games in an effort to determine complexity. The trend of these results showed that people generally understood sports like the MLB better than more complex esports like League of Legends.

The last component compared was the competitiveness of different professional sports and esports. If a game is not competitive, it can become clear who is going to win, diminishing the overall viewer experience. Additionally, it is less fun for the players if they cannot expect to

come back after falling behind. To research competitiveness, we gathered statistics on game outcomes and scoring events throughout different esports matches and compared them to previously gather sports data. This led us to find that the NBA and MLB generally are less competitive compared to the OWL and LCS, which are more competitive.

The rest of the report provides depth on each of these topics. Chapter 2 provides more information about the history of sports and esports, as well as background information on the project itself. Chapter 3 is based on industry size and will present specific numbers for each league, as well as graphs comparing the different industries. Chapter 4 covers viewer friendliness, with data gathered and analyzed in order to define game complexity. Chapter 5 studies competitiveness to see which sport or esports holds the most capacity for competition. Chapter 6 summarizes our conclusion on sports and esports. Lastly, Chapter 7 provides potential future work to extend it to other sports and esports not examined here.

## **2. Background**

This chapter goes in depth on the history of sports and esports. Section 2.1 provides specific definitions for sports and esports used in this project. Section 2.2 is a brief summary of the history of professional sports. Section 2.3 is a similar summary of the history of professional esports. Lastly, Section 2.4 gives some background for the research of competitiveness in sports performed by Wills et al.

### **2.1 Definitions**

The definition of a sport we used in this project is from the Oxford Dictionary, defining a sport as “an activity involving physical exertion and skill in which an individual or team competes against another or others for entertainment” [5]. The sports we analyzed are played competitively at a professional level. We focused on sports with widespread popularity and organized leagues, namely the National Football League (NFL), National Hockey League (NHL), National Basketball Association (NBA), Major League Baseball (MLB), Major League Soccer (MLS), and the English Premier League (EPL). The definition of an “esport” in our project, from the Oxford Dictionary, is “a multiplayer video game played competitively for spectators, typically by professional gamers” [4]. This will be exclude other forms of professional video gaming that do not pertain to this definition, such as speedrunning.

### **2.2 Sports History**

Sports have been around for centuries, and the five sports associated with the six leagues we are focusing on have all had their inception after 1830. Baseball was created in 1839, making it the earliest of the sports to be created in the United States, and was the first to have

professional players and a league [10]. In 1846, the first organized baseball game was held in New Jersey [10]. By the 1860's, athletes were recruited to play, win games, and attract customers [11]. In 1869, about a dozen professional teams existed, the first of which was named the Cincinnati Red Stockings. By 1871, the first professional league was formed as the National Association of Professional Baseball Players (NA) [11]. However, it was not until 1903 when the World Series was first established that the American League and the National league, the two major leagues at the time, merged together [12], and today's MLB was formed.

Since the MLB was the first sport to have a successful league, it became the model that the other sports leagues followed when they were created. The NHL was founded in 1917, and three years later, in 1920, the American Professional Football Association was founded, which later changed its name to the National Football League in 1922 [11]. Both leagues slowly gained popularity, but the NFL struggled, as college level leagues were older, larger, and more attractive to audiences. Later on, the NFL faced competitors, which they either merged with eventually or outlasted. But both struggled around the time of the Great Depression and World War II [11]. However, after the war, the leagues once again started to gain popularity, and unlike the NHL, which had the Stanley Cup before it was founded, the NFL lacked a championship or playoff game until 1966, when it merged with the American Football League to create the Super Bowl [13]. Similarly, basketball had many leagues fighting for control since its conception in 1891. It was not until 1946, with the Basketball Association of America (BAA), later changed to the NBA in 1949, that professional basketball was popularized, following the model of the MLB. Like the NFL, the NBA struggled to find audiences early on against college level leagues and

had to undergo major changes to gain the popularity it has now [11]. Soccer, on the other hand, has struggled within the United States and only recently has had success with the most recent league, the MLS, which was founded in 1996 [14]. Elsewhere in the world, Soccer is a major sport and has been since the World Cup was founded in 1930 [15]. However, it was not until 1992 that a major league was formed to take advantage of the sport's massive success with the founding of the EPL [16].

### **2.3 Esports History**

While the history of traditional sports spans centuries, the history of esports spans only the past few decades. The first recorded esports event was a tournament held at the Stanford Artificial Intelligence Laboratory in October 1972 [6]. The tournament was sponsored by the Rolling Stone magazine, and featured Stanford students playing the game Spacewar to compete for a subscription to the magazine. The tournament was a small scale event, featuring only a group of students at Stanford. The first massively multiplayer esports event was the Space Invaders Championship in 1980. The event was held by Atari and had over 10,000 players [6]. This esports event set a precedent for the rest of the 1980's where video games would be used for competitions via their high scores. There was even a national team created in the US with the purpose of promoting gaming and breaking world gaming records [6], making them essentially the first esports team in history. It would not be until the following decade that esports take a step closer to the size and shape that they are today.

The 1990's marked the growth of today's most prominent esports platform: the PC [7]. PC gaming presented many new opportunities for games that had never before been

implemented. In 1996, id Software released Quake, a first-person shooter (FPS) game that was one of the first games to popularize online multiplayer [17]. Due to its fast growth in popularity, the first nationwide online video game competition, the Red Annihilation tournament, was held one year later in 1997 in the US. It featured just under 2000 total players competing online, with 16 making it to the in-person finals. The winner was a man named Dennis Fong, who was awarded the id Software CEO's 1987 Ferrari 328 GTS for his accomplishment. This marked the first time someone got rewarded in a national esports tournament, making Fong the first official pro gamer [17].

In 1998 Blizzard Entertainment released *Starcraft: Brood War*. This proved to be a significant event due to the way the game accelerated the growth of the esports scene in South Korea. The game was not a first-person shooter game like Quake, but a real-time strategy game (RTS), featuring highly strategic gameplay and complex decision making that made watching the game appealing to its heavily South Korean audience. This led to the creation of South Korea's first professional gaming league that very same year [17].

Since 2000, esports have grown rapidly. Two more esports competitions launched in 2000: the World Cyber Games and the Electronic Sports World Cup [17]. In 2002, the Major League Gaming organization was formed and began awarding large amounts of prize money, with prizes exceeding \$200,000 [6]. The biggest games in esports today were also released after the 2000's, with Riot Games' League of Legends (LOL) released in 2009, Blizzard's Starcraft II in 2010, and Valve's Dota 2 in 2013 [17]. Lastly, esports has had many landmark events in more recent years. In 2013, the U.S. government began recognizing esports athletes as professional

athletes [17], and as of 2015, esports have been recognized by the Korea esports Association (KeSPA) as a 2nd-level Olympic Sport, alongside Chess and Polo [6].

## **2.4 Competitive Analysis**

Part of our project is analyzing and comparing the competitiveness of sports and esports, but methods of doing this are not commonly known. Prior work by Craig Wills et al. [18] helped build a foundation to analyze competitiveness in sports. Wills et al. quantifies at the competitiveness of games in six professional sports leagues and uses multiple metrics to analyze the competitiveness in each game. In order to measure competitiveness, they obtained the scoring events in each game played in one or more seasons of each sport, then segmented these games based on time. Baseball, however, was divided by the current inning and number of outs. With these segmented times, they analyze score margin, the amount of time a team has held the lead, and the final game outcome, all of which lead to the overall competitiveness comparison of the leagues. This premise is that the longer a team holds a lead over the course of an entire game, the less competitive it becomes. We plan on using their sports data and methodology in order to calculate the competitiveness of esports.



### **3. Industry Size**

In this chapter, we compare the industry sizes of professional sports and esports. Section 3.1 addresses the methodology we utilized in order to collect, visualize, and compare our data. Section 3.2 discusses our results and displays the graphs created to visualize these results. Lastly, Section 3.3 summarizes the information this chapter covers.

#### **3.1 Methodology**

In order to compare the sizes of the conventional sports and esports industries, we researched the revenue, salaries, team and player counts, viewership, and growth rates of each industry and compared them using visualizations such as graphs and timelines. The statistics were primarily taken from the North American sports and esports industries, with some consideration given to the industries on an international level.

First, we examined the revenue generated by the professional sports and esports industries. The amount of money an industry makes is typically the metric by which industry sizes are measured. Researching this shows the value of a given industry, particularly in an economic context. To do this, we searched the Internet for sites reporting the earnings of different major professional sports and esports organizations in the year 2017, as well as some projections of revenue for 2018. We gathered our information primarily from Forbes, Statista, and NewZoo<sup>1</sup>.

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<sup>1</sup> Forbes:  
<https://www.forbes.com/sites/maurybrown/2017/08/25/exclusive-inforgraphics-show-nfl-mlb-nba-and-nhl-sponsors-hip-growth-over-last-decade/#64e69f85d907>  
Statista: <https://www.statista.com/markets/409/sports-recreation/>  
NewZoo:  
<https://newzoo.com/insights/articles/newzoo-global-esports-economy-will-reach-905-6-million-2018-brand-investment-grows-48/>

The next monetary statistic we researched was player salaries. This shows how lucrative the industry is for a given person or team, with the notion that a bigger industry can yield greater profits for a person or team. For this, rather than specific player salaries, we looked at the average salary for major professional sports and esports. We gathered this data in a fashion similar to revenue, searching online for sites reporting the average salaries of sports and esports players. We gathered data primarily from Spotrac.com and Forbes<sup>2</sup>.

Our last monetary measure of industry size was prize pools and award money from major professional sports and esports tournaments. In addition to a player's individual salary, the whole team receives money for winning a tournament, making this data comparable to player salary when considering how successful the sports and esports industries are. This data came from a variety of sports news sites, as well as EsportsEarnings.com for most esports tournament prize pools.

Another major aspect of industry size we examined was the number of teams and players that comprise each professional sports and esports league. This allowed for a measurement of the physical size of each industry, showing just how many people are involved in the professional play of sports and esports. We were able to gather this data from official league and team

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<sup>2</sup> Spotrac: <https://www.spotrac.com/nfl/rankings/average/> with nfl changed to nhl, mlb, nba, epl, mls, as needed.

Forbes:

<https://www.forbes.com/sites/darrenheitner/2018/05/02/a-look-inside-riot-games-from-320000-player-salaries-to-using-esports-as-a-catalyst-for-sales/#4e95bb6f2c6a>

websites, which included rosters of the different teams in each league and different players on each team.

Lastly, we gathered data on the number of viewers of major professional sports and esports events. This shows the size of each industry based on how many people watch the championship games. In addition to finding the number of viewers for a specific year for both sports and esports, we gathered data to examine their growth in viewership over time, giving us a way to visualize the growth in popularity of different sports and esports. This data was taken from official league viewership reporting sites for different sports and esports, as well as esc.watch, a site researching esports and streaming trends.

### 3.2 Results

For each major section, data was analyzed, creating different graphs to aid in the visualization comparing sports and esports. In many of the following graphs, sports are represented in a solid blue, while esports are in a hashed red. Any other colors are clearly labeled.

Revenue plays a large part in showing how much money a given league makes and comparing them shows the approximate size of that industry. Figure 1

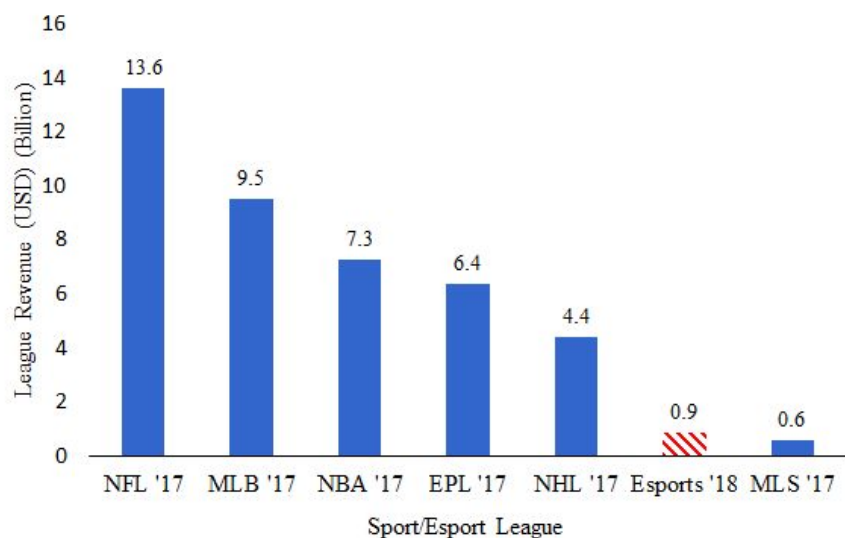


Fig. 1. League Revenue for Various Sports and Esports

shows the results of comparing the most recently available league revenues of major sports and esports. The x-axis represents the different professional sports and esports leagues we examined, with the corresponding year listed next to each one. The y-axis is the revenue earned by each league, in billions of USD, for the given year. While each sports league displays how much they make in a given year, esports leagues typically do not show this data. To allow for comparison with sports, we used the total amount of esports revenue, which was set at around \$0.9 billion for the year 2018. From the graph, the NFL makes the most, at around \$13.6 billion in 2017, while the MLS makes the least with only \$0.6 billion. The second highest revenue is the MLB, which makes around \$9.5 billion and is above the NBA's \$7.3 billion and the EPL's \$6.4 billion. Though esports as a whole have more revenue than the MLS, the next highest sports industry is the NHL, making \$4.4 billion over the \$0.9 billion of the esports industry.

Figure 2 compares the results of the average player salary in the 2018 season for the

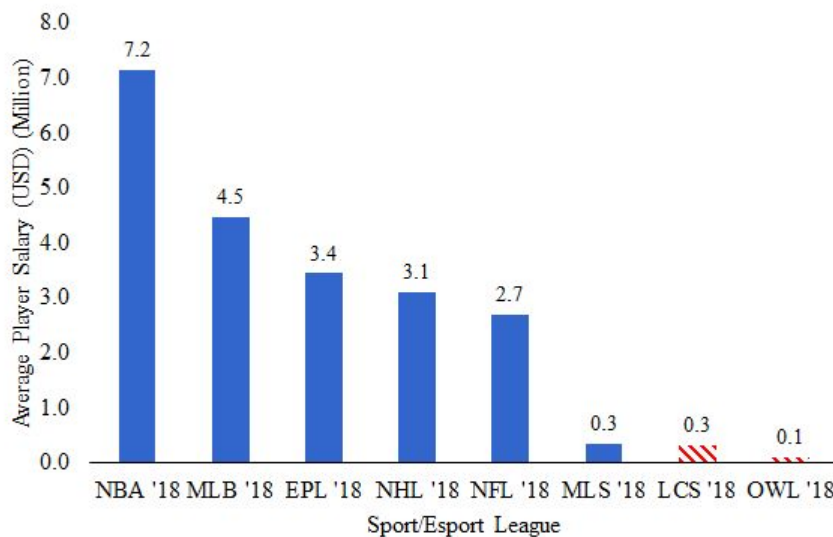


Fig. 2. Average Player Salary for Various Sports and Esports

various leagues. Similarly to Figure 1, the x-axis represents the different professional sports and esports leagues examined, with the corresponding year listed next to each. The y-axis represents the average of the different player

salaries, in millions of USD, within each league. Based on the information gathered and the resulting graph, sports leagues' average salaries are much higher than those of esports leagues, with the OWL salaries being the lowest at around \$0.1 million. On the other hand, the NBA players make the most on average with \$7.2 million, and MLB players making \$4.5 million, putting that league as the second highest. The EPL and NHL are in the middle of the sports with \$3.4 million and \$3.1 million, respectively. While many sports have average salaries much higher than esports, the MLS sports league and LCS esports league make roughly the same amount at around \$0.3 million, far from the next highest of the NFL at \$2.7 million.

Salaries are not the only way for players to make money. Prize pools for different tournaments are also major sources of income. Unlike salaries, which favor sports in terms of

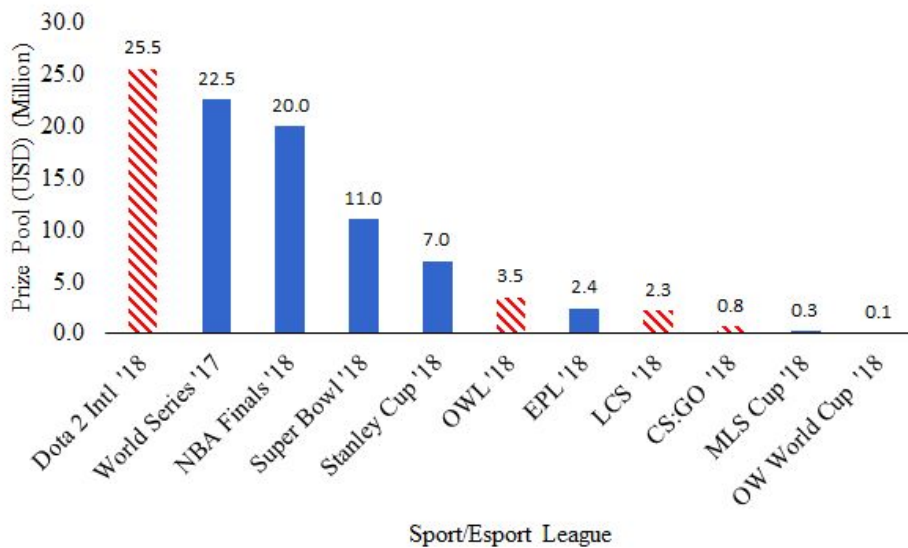


Fig. 3. Championship Prize Pool Amounts for Various Sports and Esports

and esports leagues. The x-axis represents the list of championship events observed, with the corresponding sport/esport and year listed. The y-axis is the number of USD in millions that

higher averages, prize pools are much more varied in amount across industries. Figure 3 shows different championship prize pools across professional sports

were awarded to the winning team of each championship. From the graph, esports have both the highest amount at \$25.5 million for the Dota 2 International tournament in 2018, and lowest amount with the Overwatch World Cup at only \$0.1 million for the winning team. The MLB World Series, NBA Finals, NFL Super Bowl, and NHL Stanley Cup fill out the top 5 with \$22.5 million, \$20 million, \$11 million and \$7 million, respectively. The OWL Grand Finals have a prize pool of \$3.5 million, while the international EPL gives \$2.4 million to the team that wins its regular season (there is no championship game). The LCS follows with \$2.3 million, while the CS:GO esports league, the ESL, has \$0.8 million, with MLS having the lowest sports prize pool of only \$0.3 million split between members of the winning team. Based on the data, sports leagues have much larger prize pools than esports with the exception of the MLS, while the Dota 2 International tournament is able to claim the biggest prize pool above all other sports and esports leagues.

Size of an industry is not all about monetary values. Another approach to comparing

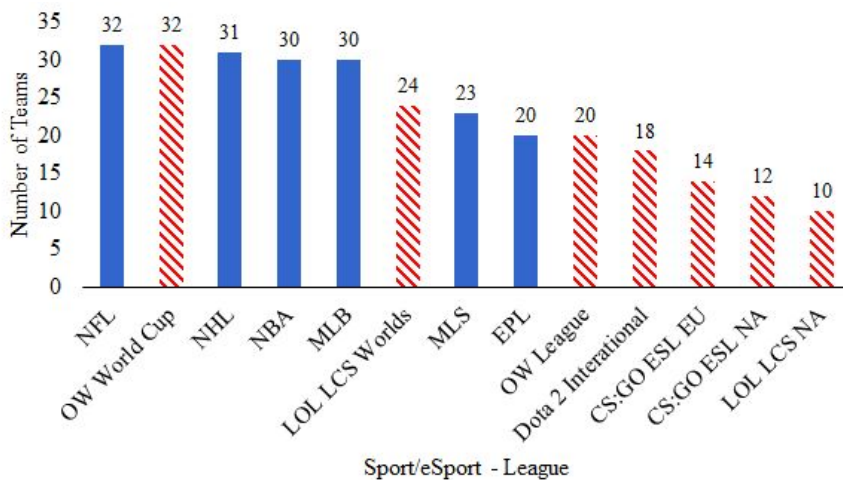


Fig. 4. Number of Teams per League for Various Sports and Esports

industry size is looking at the physical size, showing how big a league is in terms of its player count. Figure 4 shows the number of teams in a given league in 2018. The x-axis is the

different sports and esports leagues examined. The y-axis is the number of different professional teams that compete within each league. The OWL has 20 teams, however only 12 were present for the first season, while the additional 8 were added after its inaugural season (which has currently been its only season). The NFL and Overwatch World Cup both have 32 teams, with the NHL close behind with 31 and the NBA and MLB with 30. The LCS World Championship has 24 teams, while its North American counterpart has only 10. MLS and EPL have 23 and 20 teams, respectively. The final esports are the Dota 2 international with 18, and CS:GO ESL with 14 teams in its European league and 12 teams in its North American league. Based on this data, many of the esports leagues have fewer teams compared to sports leagues.

Similar to team count, the amount of active players is also a measure of physical industry size. Figure 5 shows the same teams as Figure 4, but the x-axis is the number of active players rather than number of teams. We considered an active player as one currently playing or on the field, outside of

situations regarding fouls, such as the penalty box in the NHL. So an NFL football team will have around 22 players in a starting

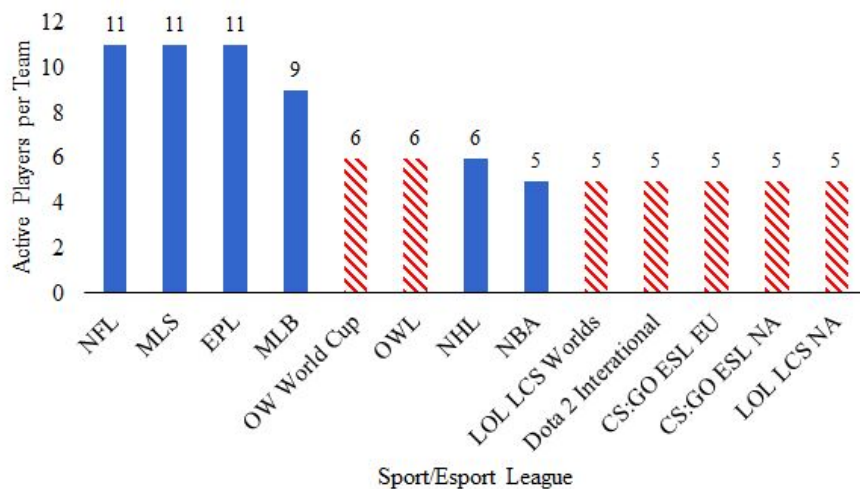


Fig. 5. Active Players per Team for Various Sports and Esports

lineup, but only 11 of those are ever on the field at once. Therefore, the NFL has 11 active

players on a team. The only exception is the MLB. In baseball, when a team is batting, those waiting or on deck are not actively playing the game. However, the active player metric for this particular sport is counted during the fielding portion, giving the MLB 9 active players. Based on the data, the NFL, MLS, and EPL all have 11 active players, followed by the MLB with 9, and the Overwatch World Cup, OWL, and NHL with 6. The rest, including the NBA, Dota 2, and variations of the LCS and ESL, all have 5 active players. Figure 5 shows that esports leagues have a much lower number of active players than most sports and are on par with sports leagues like the NHL and NBA.

The last major aspect of industry size we looked at was the viewership of various leagues' finals or championship games. Figure 6 shows the average viewership numbers for these championship events, using average concurrent viewers (CCV) as the metric for the

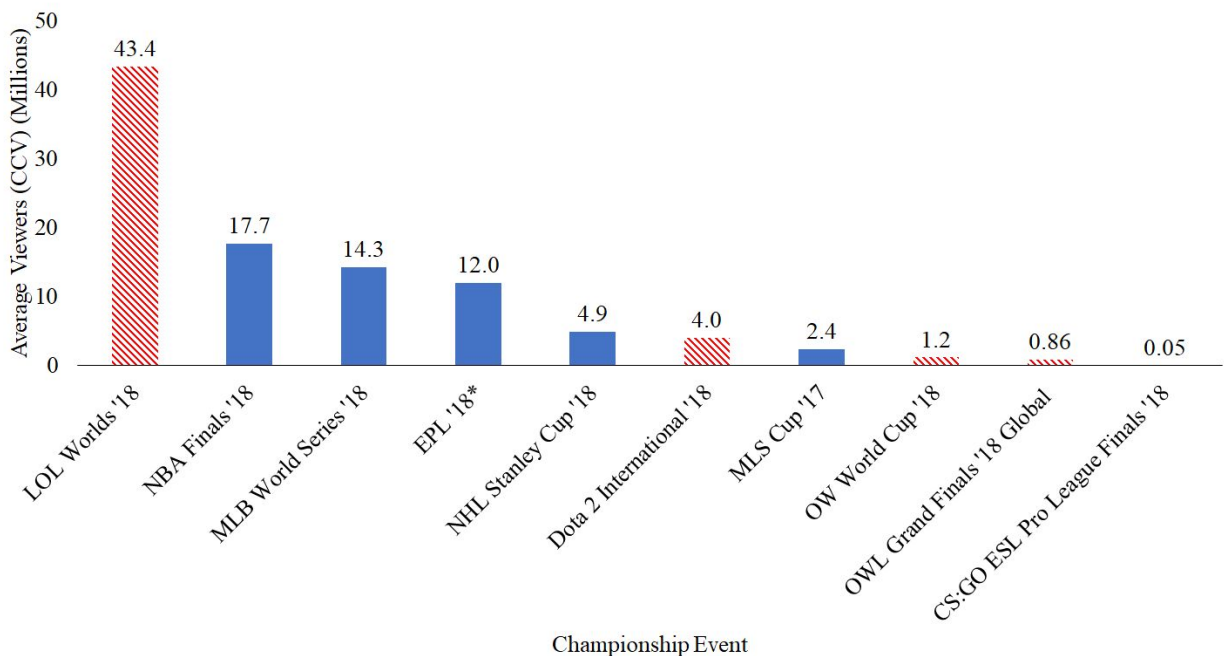


Fig. 6. Average Concurrent Viewers for Championship Events for Various Sports and Esports



number of viewers. Excluded from the graph are events like the 2014 FIFA World Cup, as its viewership numbers vastly exceed all others at 562 million viewers, making it dwarf other data points. Similarly, the 2018 NFL Super Bowl had 103.4 million viewers, which is why it is also not shown here. Outside of those two events, the LCS World Championship is highest at 43.4 million viewers worldwide. The next highest include the NBA Finals, MLB World Series, and EPL at 17.7 million, 14.3 million, and 12 million viewers respectively. The NHL Stanley Cup attracted 4.9 million viewers, followed closely by the Dota 2 International at 4 million, with the MLS Cup as the lowest sport at 2.4 million viewers. The final 3 include the Overwatch World cup at 1.2 million, OWL Grand Finals at 0.86 million, and the CS:GO ESL Finals at 0.05

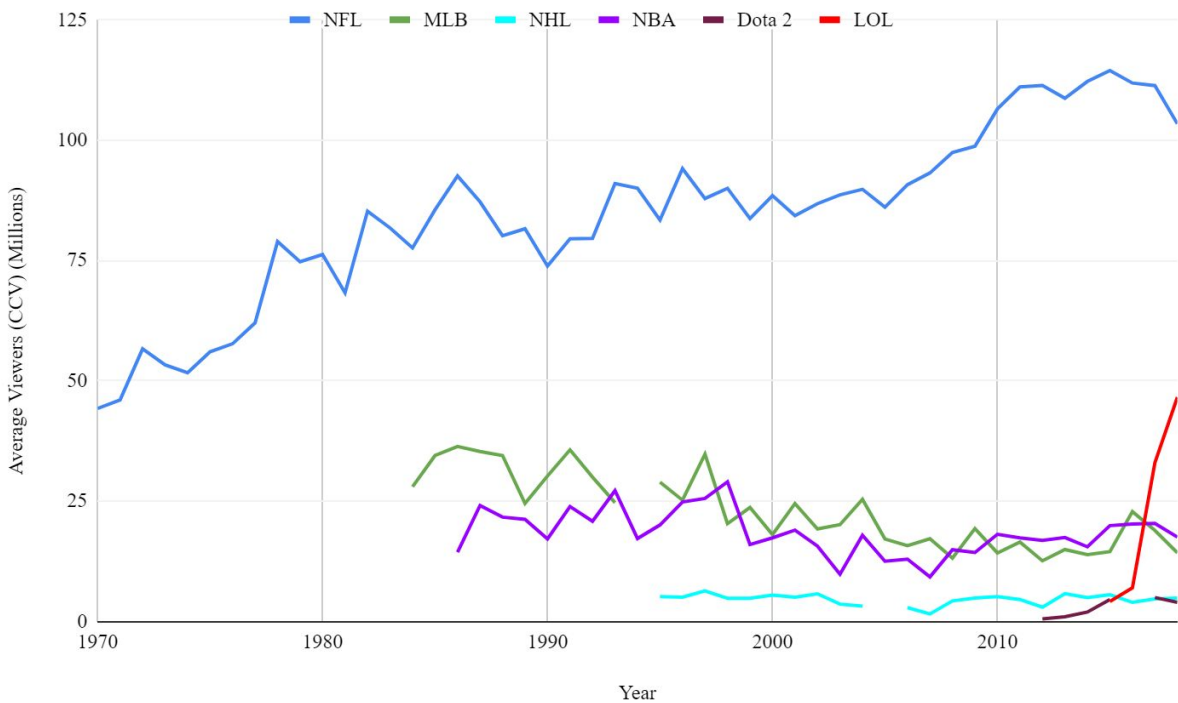


Fig. 7. Viewers Over Time for Various Sports and Esports

million. Based on this data, sports can be seen as the dominant leader in viewership; the Super Bowl and FIFA World Cup, while not shown here, attract far more viewers than major esports. But certain events in esports leagues, like the LCS World Championship, attract more viewers than most sports events.

While Figure 6 showed the most recent viewership of different league championships, Figure 7 shows their growth over time. The x-axis represents years, and the y-axis represents average concurrent viewership, in millions, of the championship event of that year for each sport and esports. The OWL is not included because at this time there has been only one season. The MLB and NHL have small gaps, which are due to strikes where the the season or finals were canceled. In the case of Dota 2, the 2016 year had no viewership data reported that corresponded to concurrent viewership. In Figure 7, we can see an upward trend for the NFL increasing over time, establishing it as the most watched sport outside of the FIFA World Cup, which is not reported. Leagues like the NBA, NHL, and Dota 2 have fairly straight and consistent lines. The MLB has a slight downward trend showing its loss of viewers over time. Lastly, the LCS has a large spike, putting it above most other leagues. Based on this data we can see that the NFL has had a long time to grow into the titan of industry it is today, while the LCS has gained a massive following very quickly, propelling it to the top of the esports scene and even surpassing some sports.

### **3.3 Summary**

Overall, there are significant differences in industry size between professional sports and esports. The largest amount of money made by the NFL is a staggering \$12.7 billion more than

the total money of the whole esports industry. The player salaries see this same difference, with the largest sports salary totaling \$7.2 million, while the largest esports salary only reaches \$0.3 million. Surprisingly enough, some esports do surpass some sports in prize pool totals. The largest prize pool in esports is the Dota 2 International tournament in 2018 with a total of \$25.5 million, with sports following with a \$22.5 million prize in the MLB World Series. Other categories that sports dominate are team size and active players. Lastly, viewership stats vary for each individual sport and esports. The top two are easily held by the FIFA World Cup and the NFL Super Bowl with 562 and 103.4 million viewers each. The next top, however, is the LCS World Championships with 43.4 million viewers, which is more than double the amount of viewers that any of the other sports categories received.

## **4. Viewer Friendliness**

When it comes to watching professional sports or esports, a positive viewer experience is important if the sport or esports is to grow in size and popularity. The more enjoyable the experience is for viewers, the more people will come back and watch more games. In this chapter, we examine different aspects of each professional sport and esports league in an effort to determine which is more viewer friendly. Section 4.1 describes our methodology for measuring viewer friendliness, Section 4.2 presents our results, graphs, and tables, and Section 4.3 summarizes the chapter's findings.

### **4.1 Methodology**

We researched game rules, performed surveys, and analyzed game downtime to gather the data necessary to measure the game complexity and overall viewer friendliness for each sport and esports.

First we looked at viewer friendliness in professional sports and esports by comparing the complexity of the games being played, assuming gaming complexity is inversely related to viewer friendliness. For a first-time viewer of a sport or esports, understanding what exactly is happening can be key to enjoying the experience. With this in mind, we examined the games played by our biggest sport and esports leagues, the NFL and LCS, to determine complexity. Examining a few different, directly comparable aspects of the two games: the core rulesets of football and League of Legends, found at [rulesofsport.com](http://rulesofsport.com) and [na.leagueoflegends.com](http://na.leagueoflegends.com), respectively. We used [rulesofsport.com](http://rulesofsport.com), as opposed to the rules listed on the official NFL website, because [rulesofsport.com](http://rulesofsport.com) focused more on the core gameplay from the viewer

perspective for understanding the game, whereas the official NFL rules focused more on technical aspects of the game and league-specific rules. We compared the word count and reading level of each rule set. We also compared the number of different roles and positions in each game (found at [protips.dickssportinggoods.com](http://protips.dickssportinggoods.com) and [na.leagueoflegends.com](http://na.leagueoflegends.com)), as well as the number of “special cases” that are helpful for understanding gameplay, but not necessarily required. The “special cases” were the different penalties in football (found at [operations.nfl.com](http://operations.nfl.com)) and the different Champion Abilities in League of Legends (found at [na.leagueoflegends.com](http://na.leagueoflegends.com)).

We also created two surveys (one about football and League of Legends, and the other about baseball and Overwatch) where users rated their experience with the sport and esports (on a scale of 1-7), then watched a video clip from each game and answered basic comprehension questions about what they saw ( e.g. “which team was winning”). Afterward, the survey-takers were asked to rate (on a scale of 1-7) their understanding of the clip, the complexity of the clip, and the complexity of the game as a whole.

Lastly, we examined how much live game action is in a given broadcast of each game. To determine was just how much of each professional broadcast consisted of actual gameplay. We consider live action in a broadcast to be footage showing players capable of scoring; i.e. when the ball is in play in sports or when players are actively pursuing the objective in esports. For example, in an NFL broadcast, in addition to gameplay, there are replays, gameplay analyses, commercials, shots of the cheerleaders, etc. This same idea applies to each of the sports and esports analyzed here. We gathered data from studies done by the Wall Street Journal for some

sports [48, 49] and from professional broadcasts of the LCS [59] and OWL [60] manually determining how much time in each broadcast was spent on live gameplay.

## 4.2 Results

The following graphs feature sports in blue and esports in red with hashes, where applicable, and unique colors tied to specific leagues in other cases.

Table 1. Rule Complexity

Attribute	NFL/Football	LCS/LOL
Basic Rules Word Count	753	689
Reading Level	9th - 10th Grade	College
Game Roles	3	6
Game Positions	14	5
Special Cases	56 Fouls	715 Abilities (50 Abilities in each Game)

Table 1 shows the results from our analysis of game complexity based on game rules. Football has 753 words in its rules and was written at a 9th/10th grade reading level. LOL has fewer words, with 689, but was written at a college reading level. The game roles indicate different player playstyles the viewer should be aware of in the game. There are 3 different roles for football ( Offense, Defense, and Special Teams), and 6 different roles for LOL (Tank, Assassin, Mage, Marksman, Fighter, and Support). For the game positions, a subset of game roles, the position determines a specific playstyle (such as throwing the ball as the Quarterback) that supports the main role (such as scoring points on Offense). The more positions a game has, the more specific player goals the viewer has to understand. Football has 14 different positions

(counting groups like the Offensive Line as one position, as shown in Table 2) and LOL has 5 different positions (Top, Jungle, Mid, Support, and Bot).

Table 2. Football Roles and Positions

Role	Positions
Offense	Quarterback, Running Back, Fullback, Offensive Line, Wide Receiver, and Tight End
Defence	Defensive Line, Linebacker, Cornerback, Safety
Special Teams	Kicker, Punter, Return Specialist, Long Snapper

Table 3. League of Legends Roles and Positions

Role	Positions
Tank	Top, Jungle, Support
Fighter	Top, Jungle
Assassin	Jungle, Mid
Mage	Mid, Support
Marksman	Bot
Support	Support

Lastly, we examined “special cases” in each game. Based on the NFL’s official rules, there are 56 different penalties. In LOL, most Champions have 5 abilities: 1 Passive, 3 Basic Abilities, and 1 Ultimate (there are a few Champions that have more than 5 abilities, but we used 5 as our average). As of 28 February 2019, there were 143 different Champions available for play in LOL, so 715 different abilities to understand. However, while there are 143 different

Champions in total, only 10 different Champions can be present in a single game. This means that for one game, a viewer would need to understand 50 unique abilities.

The second major way we examined game complexity was through a comparative survey. The first survey compared football and LOL, through the NFL and LCS. We received 56 total responses, but discarded 7 due to an incomplete submission, questionable answers, or too short a time to accurately complete the survey. Out of the 49 results remaining, 2 were ages 25-34, 2 were 45 and older, and 45 were ages 18-24. Also, 10 were female and the other 39 were male. The second survey, compared baseball and Overwatch through the MLB and OWL, received 42 responses, but we discarded 6 due to similar reasons above. 33 of the 36 responses were ages 18-24, and 1 person from each age range 25-34, 35-44, and 45 and older. 8 were female, 26 were male, and 2 preferred not to answer.

The survey focused on how complex the given sport or esports was for the viewer. The complexity was

rated on a scale from 1 to 7, with 1 being not complex and 7 being very complex. Figure 8 shows the results of the two surveys.

The x axis is the

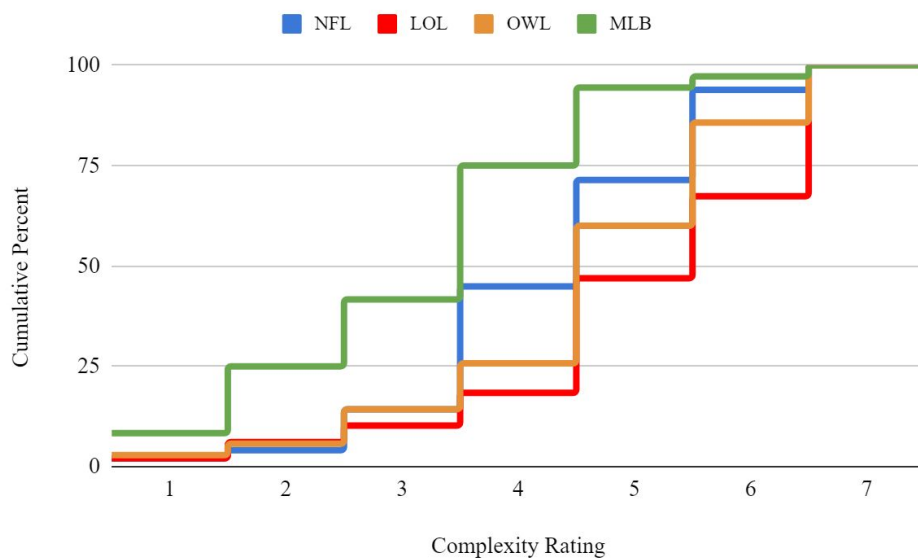


Fig. 8. Cumulative Distribution of Complexity Rating for Survey Results



complexity rating and the y axis is the total percent of responses. From the graph, the MLB had the lowest complexity ratings, with 75% of responses being at or below a complexity of 4. This is followed by the NFL, with just under 50% of responses being at or below a complexity of the 4. The OWL has 25% and the LCS has under 25% at or below a complexity of 4, making the LCS the most complex. Also, the MLB, NFL, and OWL have at least 85% of their ratings six or under. While the LCS has only around 67%; 33% of all responses for the LCS complexity are at the highest possible rating of 7.

While Figure 8 only shows the complexity ratings, it is also important analyze how well a person understands a sport or esports. Along with rating complexity, participants rated their

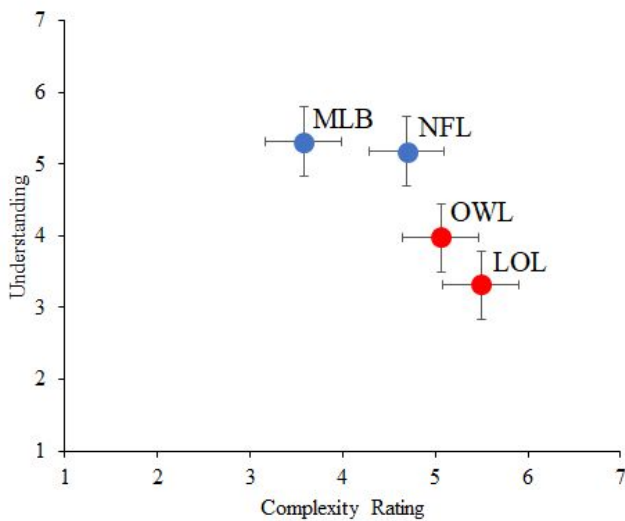


Fig. 9. Complexity Rating Compared to Understanding of Various Sports and Esports

understanding of the sport or esports.

Figure 9 shows the average rating for game complexity versus the average rating for personal understanding of the game. In this figure, the y axis is the average understanding, while the x is average complexity, with the error bars representing the standard error. The MLB has the lowest average complexity at

around 3.6 with the highest average understanding at around 5.3. The NFL has a similar understanding at around 5.2 on average while its complexity is 4.7, over 1 rating higher than the MLB. Following the NFL is the OWL, with an average understanding of around 4 with a

complexity around 5.1. The LCS has the highest average complexity of 5.5 and the lowest understanding of 3.3. In general, the data suggests an inverse relationship between understanding and complexity.

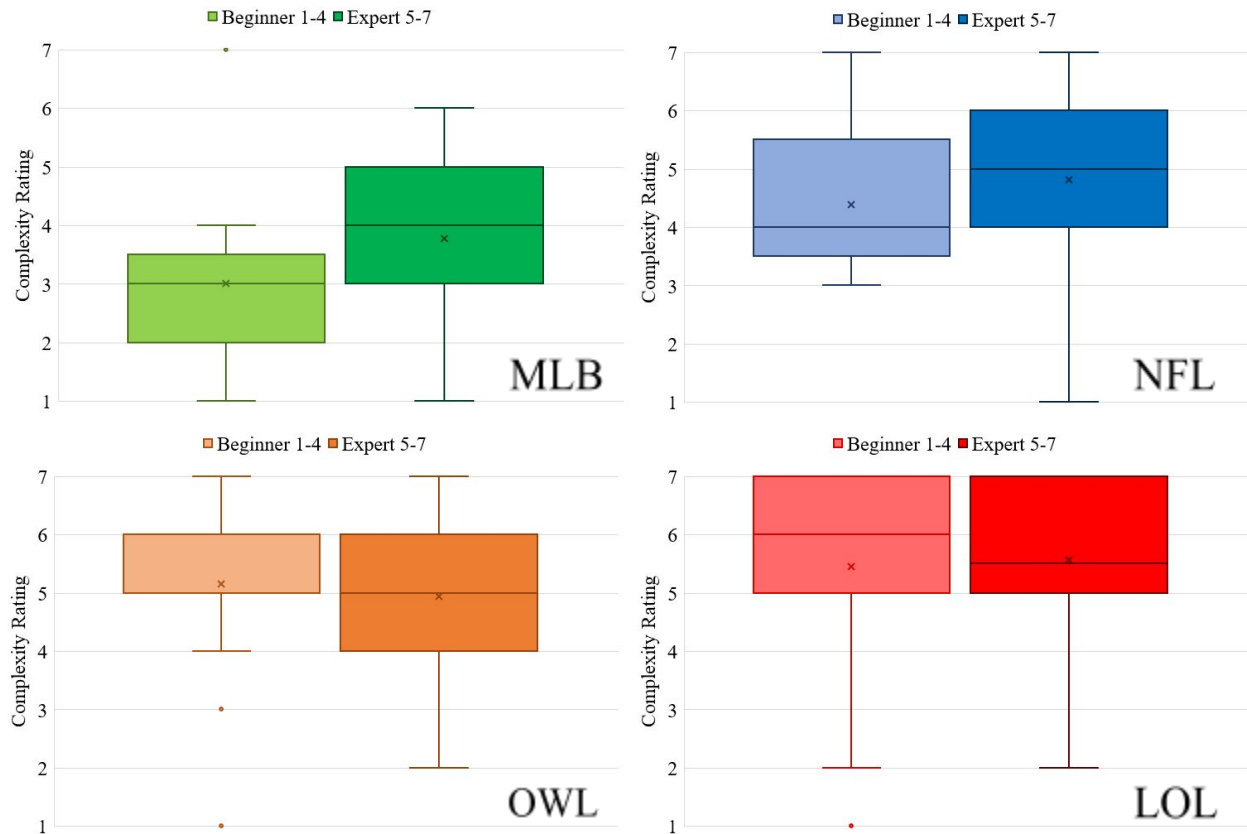


Fig. 10. Complexity Rating Based on Understanding for Various Sports and Esports

For each game, we split the participants into two groups: a beginner group, with understanding ratings from 1 to 4, and an expert group, with understanding ratings from 5 to 7. Figure 10 features four graphs with the complexity rating on the y axis, while the lighter-colored box on the left is the beginner group, and the darker-colored box on the right is the expert group. The top left graph of Figure 10 looks at the lowest complexity league, the MLB. The beginner

group has 9 responses, while the expert group has 27. The beginners rated the MLB fairly low, with the majority of the data being below the 4th complexity rating, with the exception of one outlier at 7, and both the median and mean are 3. For the expert group, the upper limit is 6, while 75% of the data resides at or below a complexity of 5. The median is 4, while the mean is just below it. Overall, the expert group has a slightly higher complexity rating, but the data for both groups are close, with only the difference of one rating between all four averages.

The second lowest complexity rating was for the NFL, and its data can be seen in the top right graph of Figure 10. The beginner group featured 13 total responses, with 36 in its expert group. The beginner group ranges from 3 to 7, with 50% of the data being between 3.5 and 5.5, with a median of 4 and mean about 4.5. The expert group, however, ranges from 1 to 7, although only 25% of responses are between 1 and 4. The median is 5, with the mean slightly below it. Both boxes are similar, only the expert group has slightly more lower scores, and the four different averages all range over one complexity rating.

The bottom left graph of Figure 10 shows the differences between the beginner and expert groups for the OWL. Of the total 36 responses, 20 are in the beginner group, and 16 are in the expert group. The beginner group has a majority of the data ranging from 4 to 7, with two outliers at the ratings of 3 and 1. Half of the data is either a 5 or 6, with a median of 5 and a mean just above it, showing a majority of the data is at a 5 complexity rating. The expert group ranges from 2 to 7, with 50% of its data between 4 and 6. Its median is the same as the beginner group at 5 with its mean located just beneath it. Based on the data, an expert is more likely to rate the

complexity lower, but all four averages are located right around the same complexity across groups.

The bottom right last graph in Figure 10 shows the highest rated esports, the LCS. There are 31 responses in the beginner group and 18 in the expert group. Both graphs are almost identical, ranging from 2 to 7, with only the outlier at 1 for the beginner group lying outside the range. Both graphs have at least 25% of the data giving a complexity rating of 7. For the beginner group, the median is at 6, while its mean is situated around the 5.5 mark. The expert group has its median at the 5.5 mark, with its mean only slightly above it, making all four means within half a complexity rating of each other.

Game complexity is not the only aspect to the viewer’s experience -- the time a game takes to play out is also important. Figure 11 looks at average broadcast length for sports and esports, with the y axis featuring the various leagues, and the x axis featuring the broadcast length. The NFL and MLB

have the highest average broadcast times, with 3 hour 6 minutes for the NFL and 3 hour 5 minutes for the MLB. This is followed by 2 hour 19 minute NHL games, and 2 hour 15 minute NBA games. The two soccer leagues have the same length at 1 hour 55 minutes. This puts both esports on the

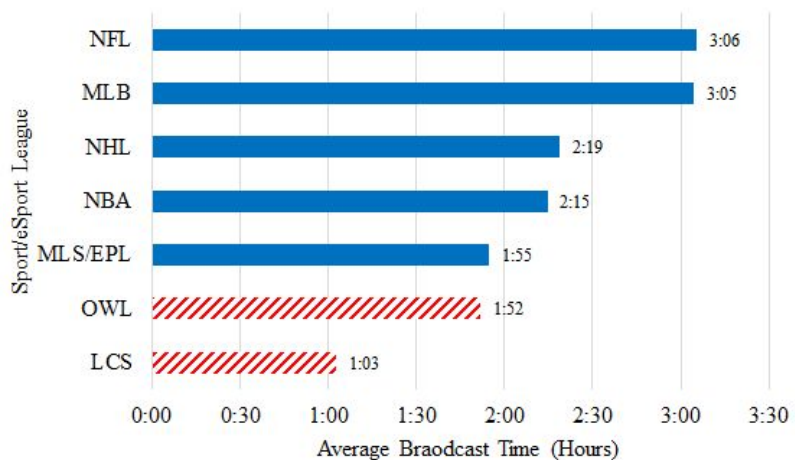


Fig. 11. Average Broadcast Time for Various Sports and Esports Games

The two soccer leagues have the same length at 1 hour 55 minutes. This puts both esports on the

lower range, with the OWL lasting an average of 1 hour 52 minutes and the LCS lasting 1 hour 3 minutes. In the OWL, it is also important to note that one game between two teams features 4 different matches.

Broadcast length, however, still includes downtime, commercials, and many other aspects that are not actual live gameplay. The amount of action a viewer sees within a broadcast keeps the viewer engaged. As such, Figure 12 looks at the average amount of action in a game, as well as the game's length and its broadcast length. Once again, the y axis features the sports and esports leagues, while the x axis shows the time in hours. For the sports in this section, the

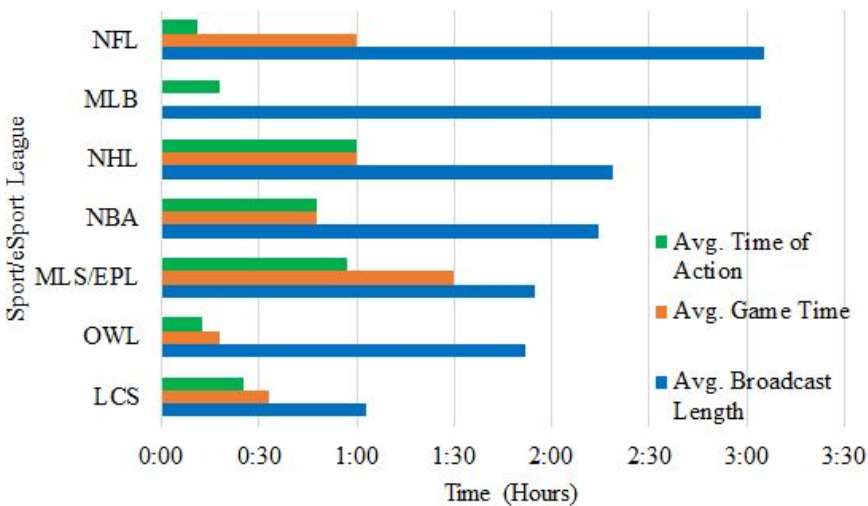


Fig. 12. Average Broadcast Length, Game Time, and Amount of Action for Various Sports and Esports

average game time is made up of the game's clock, so all games for each league are the same length. The esports often have varying game lengths, so start and end times were recorded and

averaged together to create the average game length. In this graph, the NFL has one of the lowest amounts of action, at around 11 minutes compared to its 60 minute game clock and over 3 hour broadcast time. The MLB is not far behind, with 18 minutes of action in over 3 hours of broadcast, and does not have a game time, as baseball has no clock within its game. The OWL

has 12 minutes of action, putting it below the MLB, but that 12 minutes is for an 18 minute match, and four matches are played in a game, so roughly 48 minutes of action are in one OWL broadcast of 1 hour and 52 minutes. This is preceded by the NBA and LCS at 48 minutes of action per 2 hour and 15 minute game for the NBA and 25 minutes per average 33 minute game and just over an hour long broadcast for the LCS. The MLS and EPL have 57 minutes of action per 90 minute game and hour and 55 minute broadcast length, and the NHL has 60 minutes per 60 minute game and 2 hour 19 minute broadcast.

Figure 13 compares the broadcast data and action per game to show relative action in a game’s broadcast. On the x axis are the sports and esports leagues, while the y axis is the percentage of action

in a broadcast. The

error bars are the

standard error and

are only available

for the data we

gathered on the

esports. The NFL

has the lowest

percent action per

broadcast, at only 6%, followed by the MLB at 10%. This is much lower than the next highest of

the NBA at 36%. The two esports leagues have some of the higher ratios at 40% for the LCS and



Fig. 13. Action per Broadcast for Various Sports and Esports

43% for the OWL, which is tied with the NHL. Lastly, the MLS and EPL have the highest action per game, with around 50% of the broadcast consisting of action.

Figure 14 shows the the data from Figure 12 and compares the game length to the action per game to show what it is like without commercials or other interruptions. Since the MLB does

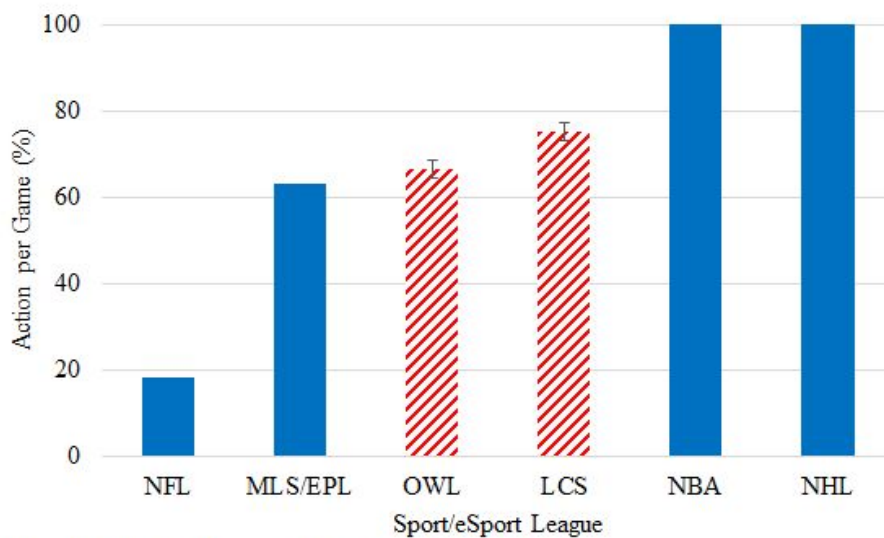


Fig. 14. Action per Game for Various Sports and Esports

not have a game clock, it is not shown in this graph. The x axis shows the league, while the y axis shows the percentage of action per game. It also shows the standard error for the

esports data. The lowest spot, at only 18% action per game, is the NFL, which is followed by the MLS and EPL at 63% action per game. The OWL and LCS take two of the highest positions at 67% and 75%, respectively. Both the NBA and NHL have 100% action per game, since in both sports, the clock will tick down only while the ball or puck is in play.

Figure 15 compares the action per broadcast versus the average broadcast length to better show how much time a viewer needs to invest in a game to watch the action. Figure 15's x axis shows the action per broadcast, while the y axis shows the average broadcast length. The closer to the top left, the better, as it means more action for less time, while the bottom right means less

action for more time. The LCS is the left-most point, with the best action to broadcast time. This is followed by the OWL and the soccer leagues, MLS and EPL, with the OWL having slightly

less broadcast time and the MLS and EPL having a bit more action. The NBA and NHL follow the same pattern as the OWL and EPL, only

slightly lower on the graph. The

last two, the MLB and NFL, have the worst action per game and the longest games, with the MLB slightly above the NFL in terms of action per game.

### 4.3 Summary

There are several different aspects of viewer friendliness in each sport and esports that can affect how accessible it is for new viewers, or how worthwhile it is for familiar viewers to spend their time watching. Esports are more complex than sports; in addition to the core League of Legends rules being on a college reading level compared to football's highschool level, our survey results found that beginner and experienced LOL viewers considered the game to be

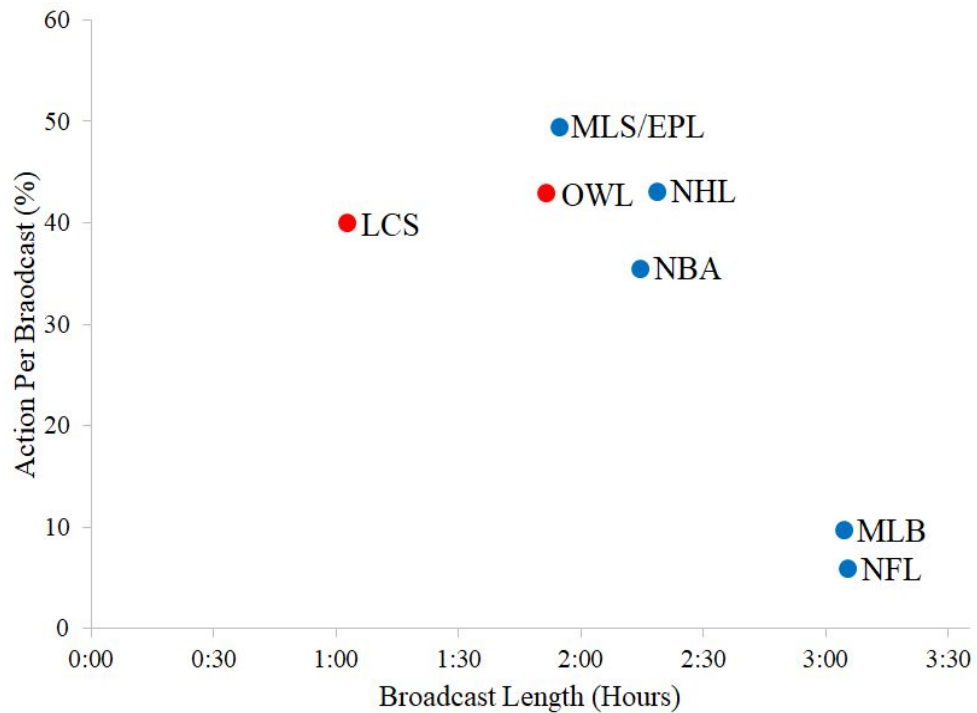


Fig. 15. Action per Broadcast Compared to Average Broadcast Length for Various Sports and Esports



complex, rating it between a 5 and 7 on a 1-7 scale, compared to football's 4 to 6 range.

Similarly for Overwatch, receiving a 4 to 6 range on complexity compared to baseball's 3 to 4 range. However, esports is better than sports in a comparison of action per broadcast. While only about 18% of the average NFL broadcast is actual live gameplay, the LCS and OWL spend 40% and 43% of their broadcasts, respectively, showing live gameplay. This, in addition to their overall shorter average broadcast times, makes them generally more time-efficient when it comes to how much action a viewer gets to see over the course of their time watching.

## **5. Competitiveness**

In this chapter we compare the competitiveness of various professional sports and esports, in order to figure out which league is more competitive. Section 5.1 is about the methodology used to gather the data, and some of the differences between the sports and esports leagues that factor into the competitiveness. Section 5.2 discusses the results by showing different graphs which display the data in various ways. Lastly section 5.3 summarizes the data covered in the chapter.

### **5.1 Methodology**

To compare competitiveness of esports and sports, we primarily targeted our data analysis to be comparable to results from a paper published by Professor Craig Wills et al. [18] that has researched the competitiveness in sports. With this, we looked at how often a team is in the lead, how often a team that is currently ahead goes on to win, and how often a team is ahead for good (meaning they never lose the lead and win). These three metrics were the same ones used by Craig Wills et al. [18], so we used his data on sports to compare the same metrics within esports.

Unlike most sports, the esports we looked at do not have a fixed game clock that counts down to the end of the game. League of Legends' clock counts up to show how long the game has lasted. On the other hand, Overwatch's clock counts down, but adds time when an objective is completed and can be stopped early if the main objective is completed before time runs out. Based on this, we did not follow Wills' method of dividing games into equal, minute-long segments to calculate when a team is leading, but instead used 2.5% increments of the the games

duration for both Overwatch and LOL. Note, this means that the time of each point can fluctuate across games for the esports, but provides a relatively equal measure across games.

Unlike most sports, these esports do not have sites that record when a team scores or takes the lead, so this data had to be gathered manually. Data was gathered manually by watching recorded games on the official leagues' Youtube channels<sup>3</sup>. While the sports have around 1,000 games for each league analyzed, only 30 LCS and 31 OWL games were analyzed, due to the manual time required watching and recording times. We recorded the start and end time of each game (to measure duration), as well as each time a given team took the lead or tied up the score. Along with the score time, the leading team was recorded, whether or not that team would lose the lead, and who would eventually win the game. For both esports, only times where a team could score counted for our measurement. In LOL there is about a 15 second time where the game is active at the start but both teams are unable to leave the spawn area, so this time was disregarded in our competitive analysis. Similarly in Overwatch, there is time where the offensive team cannot leave the spawn area while the defending team is able to set up defenses, which was disregarded for competitive analysis. It is only after the the offense is able to leave that the start of the game is recorded.

In LOL, we counted the destruction of towers as the means by which a team scores a point. These towers need to be destroyed for a team to advance down the map to eventually destroy the opponents' Nexus. While it is possible to destroy more towers than the opponent and still lose (the first team to destroy the nexus is the winner, regardless of towers destroyed), it

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<sup>3</sup> Overwatch League: [https://www.youtube.com/playlist?list=PLwnBEhITAFhhJPLEj-XcJBAgM\\_yMaQpKs](https://www.youtube.com/playlist?list=PLwnBEhITAFhhJPLEj-XcJBAgM_yMaQpKs)  
LoL Esports: <https://www.youtube.com/playlist?list=PLPZ7h6L6LC7VDHdkxvfUADBLElPfu9T0m>

was the best metric to count the score because towers need to be destroyed to reach the nexus. Inhibitors also block a team from destroying the Nexus, but since they can respawn after being destroyed, they do not count towards the towers killed within the game and therefore do not count as a point for our analysis. Team gold and player kills were also considered, but in order for a team to truly advance in the game, towers need to be destroyed. So whenever a team had more towers destroyed than the other, they were considered in the lead.

Unlike LOL, which is one continuous game (with the exception of game pauses), Overwatch matches are multiple rounds where teams alternate which team is defending and attacking. As such, there is down time between rounds, which was recorded and subtracted from the overall game time. Also, Overwatch has four different game modes named Escort, Assault, Hybrid, and Control, which are all scored differently ingame and for our analysis.

In Escort, the attacking team must push the objective, referred to as the Payload, down a set track to the end. The Payload is pushed down the track as long as members of the offense are in close proximity to it and no defenders are in the area. Otherwise, the Payload slowly moves back towards the previous checkpoint. If both teams are near it, the Payload stays still. Along the track, there are three checkpoints (one of which is the final destination) which count as the points needed for scoring. Assault is focused around marked zones that the offensive team must capture by standing in the marked zone, with no defenders nearby, for a certain amount of time. Progress is halted if both teams are in the area, and is decreased if no attackers are present. A single game consists of two zones, each with three checkpoints. Once a checkpoint is reached, progress cannot be lost beyond that point. For measuring competitiveness, the act of reaching one of the

checkpoints counts as a point. Hybrid is a mix of the previous two game modes, where the attacking team must capture a control point, then push a Payload to the final destination, with only one other checkpoint along the track. Scoring in Hybrid was the same as the two previous modes.

The fourth game mode is Control, which is different from the other three. The other modes have an attacking and defending team, similar to the MLB. Control is more akin to sports like the NBA or MLS where both teams are trying to score at once and have the opportunity to do so at any moment. This makes the pacing of Control much different from the other modes. It features a best of three game mode where a single capture point is present, and the teams fight for control over it by being the only team present within its borders. While under control, a percentage bar slowly increases for that team. When it reaches 100%, that team wins. Data was recorded on matches of this mode, but it was not used in the competitive analysis and is not part of the 31 games we analyzed because of how different it is from the other 3 modes.

For the three game modes analyzed for this section (Escort, Assault, Hybrid), the teams alternate offense and defense to complete the objective of the game mode. If the first team is unable to fully complete that objective, the second team only needs to beat the first team's progress in order to win. Otherwise, the first team wins. If the second team is unable to beat the first team, but reaches the same checkpoints, then the resulting match is a draw. If the first team is able to fully complete the objective, and the second team is also able to complete the objective, the map is replayed, with each team's remaining time on the game clock. The team with less time goes first, and the match is replayed with the same rules. Lastly, if both teams use all of

their time and complete the objective, then the game is a draw. This is possible due to Overwatch’s overtime mechanic, where as long as at least one offensive player is currently on the objective, the game will not end. However, as soon as no offensive players are on the object, the overtime quickly runs out.

## 5.2 Results

The following data was analyzed and compiled into graphs to help compare the competitiveness of various sports and esports. The sports data was gathered by Professor Craig Wills et al. [18], while the esports data was gathered manually using the previously stated methods. The majority of the following graphs feature a unique color for each sport or esports, with esports either having a thicker line or dashed bar. Otherwise, sports are represented in blue and esports are in red.

Games with teams tied are often considered more competitive than when a team is the lead, because the outcome is more uncertain. Figure 16 shows the percentage of games where a team is in the lead over the timeline of a game’s duration for various sports and esports. The x-axis is the timeline percentage, where 50% is halfway

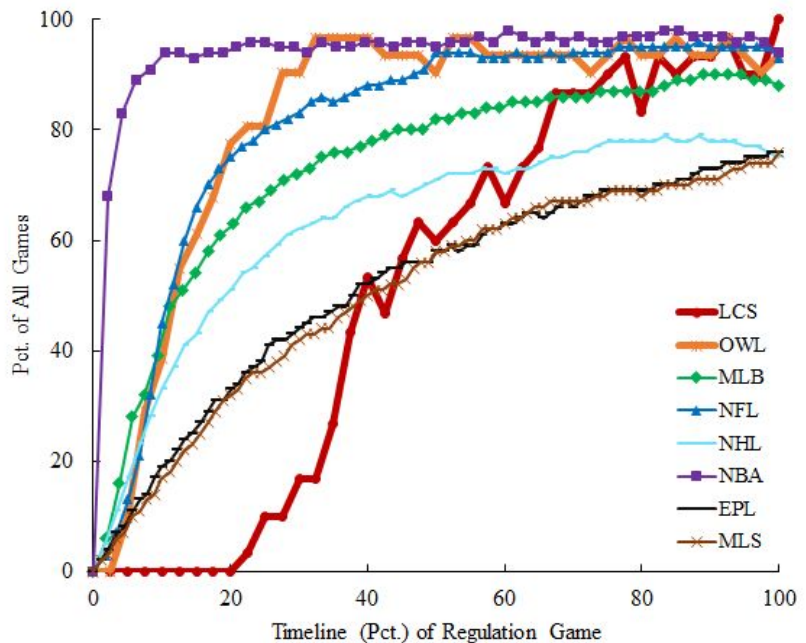


Fig. 16. Games with Team Leading Throughout the Timeline of a Game

through a game, and the y-axis is the percentage of all games for that league where a team is leading. The figure shows that NBA games are the least competitive by this metric, as more than 90% of all games have a team in the lead only 10% of the way into the game, and maintain that value for a majority of the game's timeline. Overwatch games reach similar values at around the 25% time mark, while NFL games reach around 90% of all games with a leader around 45% of the way through a game. This is followed by the MLB and then the NHL. The MLS and EPL have very similar lines, and by this metric are the most competitive. The LCS is the most competitive early on, as no game has a leader until around the 20% time mark, but rises quickly to have around 90% of games with a leader at 80% of a game. Also unlike any other sport of esports measured, the LCS does not have a decreasing game clock; the game simply goes on until one team's Nexus is destroyed, so all games result in either a win or a loss.

Figure 17 features a similar graph to Figure 16 with the same axes, but the y axis is

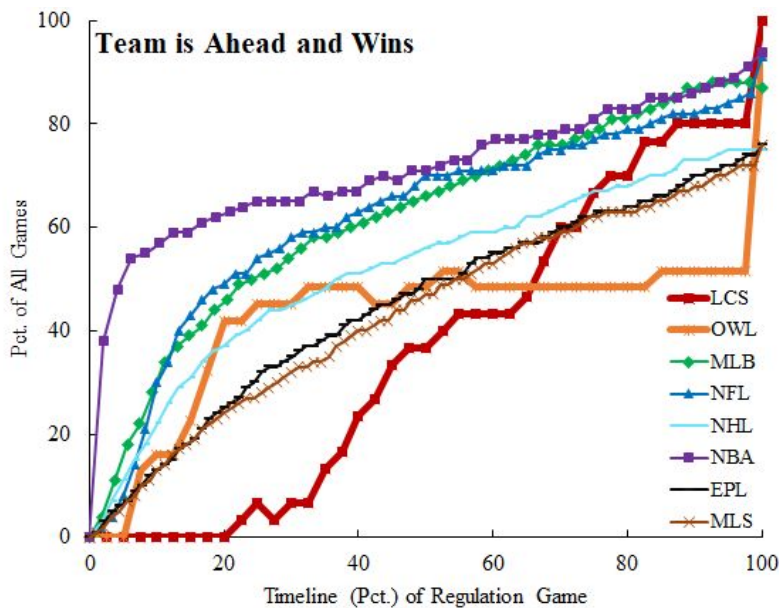


Fig. 17. Games with Team Ahead and Wins Throughout the Timeline of a Game

whether the team that is leading goes on to win the game. At this point, the team can lose the lead, but by the game's end, that team will win. Again, the NBA is the least competitive because around 70% of teams leading at the halfway point go on to

win the game. The NBA also has a high initial win rate, because by the end of the first 10% of the game, over 50% of teams leading go on to win the game. This is followed by the MLB and NFL, which cross at a few points, but around 60% of a game, 70% of teams leading go on to win. This is once again followed by the NHL and then the two soccer leagues with very similar numbers. Around the 30% time mark of an OWL game, around 50% of games' leaders go on to win, which, unlike any other sport or esports, stays fairly flat until the end. This makes it very competitive, as the outcome is not known for about 80% of the game until the very end. This is due to the nature of Overwatch's gameplay, as the first team will almost always take the lead, and as soon as the second team passes the first, the game ends, which accounts for the large spike at the end of the graph. It also shows that going first does not have a major benefit, as the first team almost always takes the lead and only around 50% of teams in the lead go on to win. The LCS, on the other hand, starts off more competitive but ends around the middle, as by the 85% mark of a game, 80% of leading teams will win. Within the last few minutes, there is a fairly large spike, showing

around 20% of games are comeback wins.

Figure 18 takes the data from the Figure 17 and averages them to show how much game time is spent with a team in the

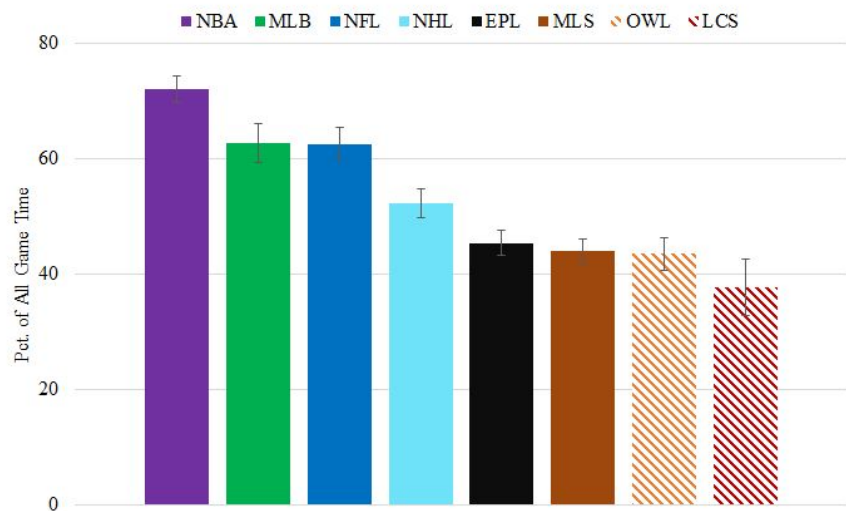


Fig. 18. Summary Percentage of Game Time with Team Ahead and Wins



lead that wins. The y-axis is the percentage of all games, and the x-axis is the different leagues. Based on this graph, 72% of an NBA game is spent with the team that will win the game in the lead. Both the MLB and NFL spend 63%, while the NHL spends only 52%. The EPL and MLS are very close at 45% and 44%, respectively, with OWL just slightly ahead at 43%, making it one of the the most competitive. The last point is the LCS, which has 38% of game time with the leader, but this is slightly skewed since the LCS has around 20% of the beginning of the game where no one takes the lead. Without this downtime, the LCS has around 47% of game time, which puts it between the EPL and NHL. This still makes it one of the more competitive games, only behind the soccer leagues and the OWL.

Looking at what point the team that takes the lead will eventually win the game is not enough, as the fact the team might lose the lead and come back makes it an even more

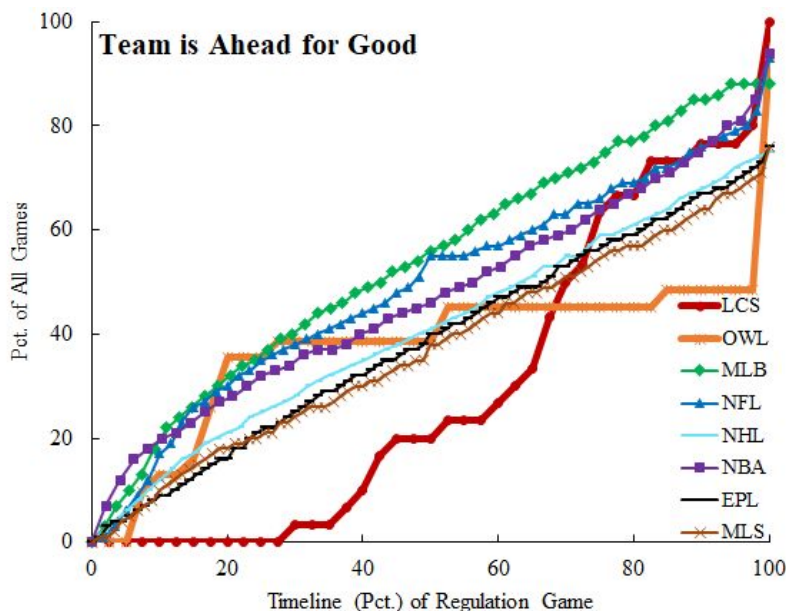


Fig. 19. Games with Team Ahead for Good Throughout the Timeline of a Game

competitive game. As such, we recorded when a team scores if they keep the lead and are ahead for good. This is shown in Figure 19, which uses the same axes as Figures 16 and 17 of percent of a game on the x axis and percent of all games on the y axis. With this graph, we can see a shift showing that

the MLB is the least competitive by this metric, with around 56% of games at the halfway point being led by a team that will not lose the lead. This is followed by the NFL around 54% and the NBA around 46% at the same halfway point of a game. The final three sports leagues, being the NHL, EPL, and MLS, share an identical line, with all three having about 40% of games at the midpoint feature the the leading team that is ahead for good. Overwatch follows a similar line to its previous one in Figure 17, maintaining a flat line that slowly goes up with a large spike, with just under 40% of games having a team ahead for good at a game’s midpoint. Once again, this is due to the fact that Overwatch will almost always have a leader, and when the game is tied, it is fairly quick for a team to take the lead. The LCS has the lowest percentage at only 20% at a games midpoint, but quickly rises up to be on par with the NBA and MLB near the end, making it one of the least competitive at a game’s end, while it is the most in the beginning.

Figure 20 does the same analysis as Figure 18 summarizing the data in Figure 19, showing how much game time is played with a team in the lead that is ahead for good. The MLB is the least competitive with 55% of game time having the winning team not lose the lead. This is followed by the NFL at 50% and

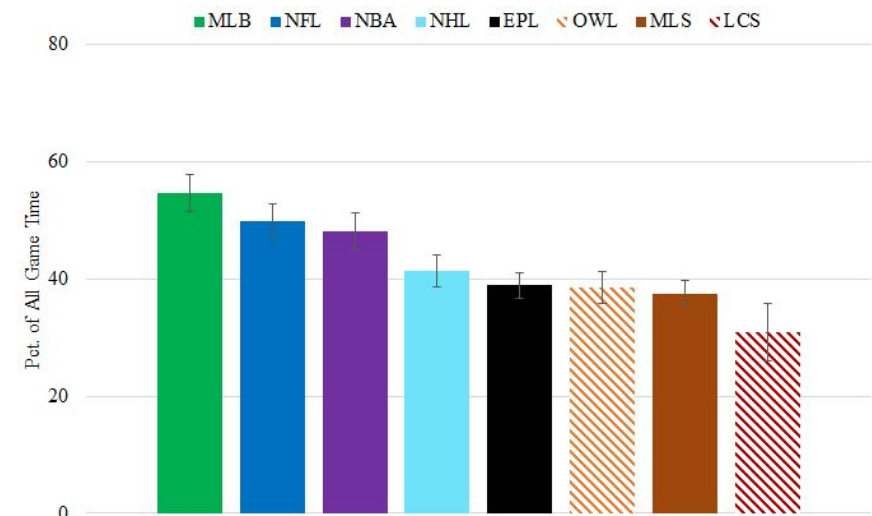


Fig. 20. Summary Percentage of Game Time with Team Ahead for Good

the NBA at 48%. This is a large shift from the 72% of Figure 18, showing the NBA has a lot of lead shifts. The next four are right next to each other, ranging for 41% to 38%, with the NHL at 41%, the MLS at 38%, and both the EPL and OWL at 39%. Once again, the LCS takes the most competitive slot, but is much lower due to the amount of time early on in games where no team scores, which slightly skews the data. Getting rid of the early game would put the LCS at 39% which is the same point as the EPL and OWL, and only behind the MLS by 1%.

The final graph compares the data found in Figures 18 and 20 through a scatter plot. In Figure 21, the x-axis shows the percentage of game time with a team in the lead for good, while



Fig. 21. Summary Percentage of Game Time with Lead for Good Compared with Lead and Win

the y axis shows the percentage of game time with a team in the lead that wins.

The NBA is the highest point, showing that based on these metrics it is the least competitive of all the games. This is followed by the

MLB, which is very

close behind, and then the NFL. The NHL sits in the middle, while the MLS, EPL, and OWL, are

all clumped up towards the bottom, with the OWL being the lowest, therefore making it the most competitive. Finally, the LCS is the lowest but uses the skewed data found in the previous figures. Using the modified stats puts the LCS just above the EPL and below the NHL. This adds it to the higher end of the clump at the bottom of the graph, which still makes it one of the most competitive of the sports and esports analyzed.

### **5.3 Summary**

Overall, there are significant differences in competitiveness between sports and esports. Based on the amount of teams that have a team in the lead, the NBA and OWL have the lowest competitiveness, compared to the highly competitive MLS and EPL. The first 20% of LCS games do not have any scoring activity, which often makes them very competitive for the first half of the game, but they become less competitive as the game goes on. Based on the amount of time a team in the lead wins, the NBA is the least competitive, with an average 29-34% more game time spent over the higher competitive games of the OWL and unmodified LCS. Similarly, for leagues with teams ahead for good, the MLB is the least competitive, having 17-24% more game time spent over the MLS and unmodified LCS. In the end, esports are often on par with the highest competitive sports leagues like the MLS and EPL, and often follow very scoring patterns for traditional sports.

## 6. Conclusion

Since esports have grown over the last decade, they have come to have similarities to traditional sports like American football and baseball. With traditional sports as a reference, we wanted to compare fundamental aspects of sports to esports in order to see what makes them individually popular and successful.

We examined industries size, viewer friendliness, and competitiveness by gathering data from the Internet, collecting statistics from game outcomes, and conducting a survey. Our analysis is in the form of graphs and charts that compare key elements of sports and esports.

For industry size, we researched league revenue, average player salary, prize pool size, number of teams, active players per team, average viewers for events, and viewers over time using Internet sources. The average League of Legends player salary is on par with that of players in the MLS, and the 2017 LCS World Championship drew more viewers than the MLB World Series and the NBA Finals of that same year. However, the entirety of esports' league revenue is the smallest of nearly all the individual sports league revenues. Thus, while the esports industry is growing, sports still generally dominates, with the exception of the MLS.

For viewer friendliness, we gathered data through conducting a survey, manually analyzing footage for game downtime, and analyzing game rules. We found broadcasts of sports like football and baseball last an average of about 3 hours, but show less than 20 minutes of live gameplay. On the other hand, esports, like League of Legends and Overwatch, spend about 1 hour and 2 hours (respectively) broadcasting with 25 minutes and 48 minutes (respectively) of live gameplay. Specifically, the NFL and MLB only have 6% and 10% live action per broadcast,

while the LCS and OWL have 40% and 43%. However, based on rule complexity and viewer opinions esports are generally more complex, suggesting they are less viewer friendly. Overall, sports are less complex with less action time, and esports are more complex with more action time.

For competitiveness, we manually analyzed esports game footage for scoring, comparing the data to previously gathered sports data [18]. Based on the percentage of game time with the winning team in the lead, sports are less competitive than esports. However, based on the percentage of game time with a team ahead for good, there is only a 25% difference between the top (MLB with 55%) and the bottom (LCS with 31%). Overall, esports have a higher competitiveness compared to sports.

## 7. Future Work

Future work could include continuing the analysis with more data. For competitiveness, much of the sports data had over 1,000 games for each league, while the esports data we collected was from about 30 games from each league. Continuing analysis beyond 30 games would provide a more statistically significant sample compared to the sports data. Additionally, similar analysis could be done for more esports, such as CS:GO (Valve Corporation, 2012) or Dota 2 (Valve Corporation, 2013) to better represent the esports industry as a whole. Decreasing the game length segment below 2.5% would also divide the esports games into increments more on par with sports, as some games have up to 60 or 90 segments.

Using more competitive metrics from Wills et al. [18] would give a better understanding of the overall competitiveness of esports when compared to sports. Such metric include how many points ahead a team is, score margins, performance over different seasons, and team specific statistics.

Additional future work could analyze more sports and esports for action per game to better represent both industries. Such analysis could be done by recording game lengths and downtimes within a game, similar to our methodology. However, what constitutes downtime may vary depending on the sport or esport, so a new metric for keeping track of downtime may be required.

Since many of the survey results we received were from males aged 18 to 24, expanding the sample pool would better represent society as a whole. Additionally, surveying new sports and esports would help understand and represent viewer friendliness for different leagues.

Future work could find a better approach to our user study than embedding videos so the decreased survey time gets more responses.

Lastly, updating the industry data for years beyond 2018 would better compare esports growth to sports. Leagues like the LCS have had an increase in viewers recently, and continuing a few more years would help understand trends. Likewise, the OWL has had only one season as of 2018, so continuing OWL analysis could also be interesting; in contrast the NFL has had a recent decrease in viewers. Unlike sports, new esports are also frequently being made and introduced, so a few years from now the composition of esports may be considerably different from today's.



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