

How Data Analytics is Changing the Sport of Football

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

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Spring, 2022

On my honor as a University Student, I have neither given nor received
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Implementing Data Analytics in Football

The future of American entertainment is going to be drastically different from the current status quo. Approximately 55 million Americans watch live sports on television at least once per month, but, by 2025, it is projected that viewership will reach around 90 million (Lange, 2021). Football is the most popular sport in America (Gallup, 2020), with 37% claiming it to be their favorite sport in 2017. It is imperative that the sports world begins to harness innovative technologies to elevate the viewers' experience and data analytics offers the perfect vice. Ramon Alonso, a sports data analytics expert, stated that “gathering, processing, and use of data and statistics are an important aspect of the business, analysis, and appreciation of sports” (Alonso, 2012). Data analytics, particularly in the sport of football, will change not only how Americans enjoy sports entertainment drastically, but also their faith in the future success of the sport.

Over recent years, many concerns have been raised about the direction of the sport, namely in the fields of safety and player health. Many parents and fans have expressed concern over concussions and brain injuries which have become a common occurrence amongst players in the sport. Even former President Obama stated that if he had a son, he would not let him play football until fundamental changes have been made to improve player safety (Welsh, 2013). Many other influential figures have echoed the same sentiments, including NBA superstar LeBron James and performing artist Justin Timberlake. Data analytics can act as an alleviant to these concerns as scientists have begun to develop algorithms to predict, and consequently prevent, sports-related injuries (Fiscutean, 2021).

Demand has also grown in the amateur community for access to the same performance enhancing technologies that the professional athletes utilize. While not all software and programs are financially viable options for the general public, performance data is an affordable, accessible

option. Applications have become available which can track game statistics, passing lane angles, and even the success to fail ratio of different routes (Schroer, 2022). Most of these apps offer free platforms with additional services for small fees which include more detailed analysis. Making innovative technologies, like data analytics, more available to the general public allows for greater relations between professional and amateur sports as well as better development and identification of promising, young athletes.

Discourse Analysis for Utilizing Data Analytics in Football

There are many aspects of the sport of football that have and will continue to improve through the usage of data analytics, including player health and safety, recruiting and personnel management, and in-game decision making by coaches, but is the impact of these applied changes great enough to save the sport from being defunct?

Numerous sources are used to analyze the usage of data analytics in all aspects of the sport of football. These sources include medical journals, published studies, media polls, research articles, and academic papers, and information is extracted through discourse analysis. The research is organized into three categories- player health, on-field performance, and in recruiting and talent assessment- with subsections referring to which STS framework each source is helping to address. The information can then be analyzed to make quantitative assessments on players and performance as well as projected influence on the sport as a whole.

History of the Evolution of Football

Football is one of the oldest sports in America. First being played in 1869 (Staff, 2013), the game has captivated the attention of many generations. The sport has proven to be uniquely unifying in that it has endured polarizing American time periods such as the Jim Crow era, the Great Depression, both World Wars, the Civil Rights Movement, and the Vietnam War. It has

also managed to become one of the most highly anticipated seasons of the year. Football is the most popular sport in America (Gallup, 2020) with 37% of Americans claiming it to be their favorite sport in 2017. Since its creation, football has evolved in a variety of ways. While equipment, rules, and compensation are ever changing, football stays a staple in American sports and entertainment.

As society has progressed since 1869, the sport of football has evolved alongside it. Inventions such as radio broadcasting, jet engines, the internet, computers, developments with materials such as plastics, rubbers, and metals, and innovations such as improved camera, audio, and video quality have all increased the popularity and success of the sport of football. These innovations have improved viewing quality and accessibility but few have succeeded in bridging the resource gap between professional and amateur athletes as well as the knowledge gap between viewers and members of football programs. Data analytics are used by all 32 professional NFL teams and over 75% of all NCAA football teams (PFF Team Services). It is also used by the NFL to attract the attention of fans and viewers alike and improve their gameday experience, whether that be attending games at the stadium or watching through a multitude of different methods at home.

The NFL and college teams that have utilized sports analytics to the highest extent have been extremely successful in their pursuits of championships. Examples include perennial college football dynasties such as the University of Alabama and Clemson University, as well as NFL teams the New England Patriots and the Baltimore Ravens. Of the NFL teams surveyed, 96% stated that they utilized player data to build and use metrics to influence decisions (Walder, 2020). However, very few, if any, NFL teams have fully unlocked the potential that data analytics can bring, which Rudly Raphael attributes to age and risk-averse methodologies

(Raphael, 2020). This sets the stage for data analytics to take on a bigger role in decision making and indicates that there is a lot of potential for this methodology to grow in a professional setting, like the NFL.

Technological Determinism

The theory of technological determinism is thought to have originated from American sociologist and economist Thorstein Veblen (Communications, 2018). It states that a society's technology drives its' social and cultural values. This theory can be extended further to either of two thoughts: technology influences the methods that are used in society, or that technology is the most influential aspect of a society, and any change with technology drastically changes how society functions. Some critics of this theory have issues with causation and correlation. Some critics state that society causes the advancements in technology through witnessed needs, and other critics state that there is no correlation between the advancement of technology and the change in values in society, as they are independent, and both would occur without the other.

In this application, the specific society that is referred to is the society of football coaches, players, staff members, and fans. Of the two aforementioned thoughts within the technological determinism STS framework, both are relevant and applicable. Overall, the first theory is the more relevant one, in which technology has influenced football over the years. More recently, technology has become the most influential aspect within football, so the second thought is more applicable in the present and moving forwards into the future.

In a 2021 research article written by Marc Schmid, Patrick Blauburger, and Martin Lames, technological determinism is alluded to in order to explain and model movements within certain aspects of the game of football. This paper is slightly aligned with the one written by the three authors from the Technical University of Munich. Those three authors used technological

determinism to speak to developments with strategy and assessing players. This paper builds on the scholarship provided by Schmid, Blauburger, and Lames, but includes analysis from a wider lens and includes general elements of the game instead of specific movements in a certain part of the sport, in order to account for greater context.

Paradigm Shift Theory

Paradigm Shift Theory is an STS framework that was created by Thomas Kuhn, an American physicist and philosopher, in his book *The Structure of Scientific Revolutions* in 1962. Paradigm Shift Theory is defined as a fundamental change in basic scientific practices and concepts. Some critics of this theory state that change is natural both in the world and in science, and that it is not an effective framework in analyzing both decisions and events. An article written at Pennsylvania State University speaks to the many different paradigm shifts that have occurred in the sport of football since its' inception, including technology, American culture, and competition (Wilhelmy, 2013). This paper builds on the scholarship provided by Wilhelmy but additionally includes analysis from a wider lens in order to go deeper into the true shifts that have occurred and to account for greater context.

How Data Analytics Changes Football

The implementation and adoption of data analytics in the sport of football will not just save the sport, but also elevate the entire football community. Increased utilization of analytics in the specific areas of player health and safety, personnel management, and in-game decision making are sufficient to preserve the integrity and popularity of the sport. The fundamental benefit is the same as it is for any application - predictability and efficiency in decision making. Positions requiring widespread decision-making, like a football coach, must daily make decisions that impact the success and prosperity of their franchises and teams for decades. In

1989, prior to the emergence of data analytics, the Minnesota Vikings traded four players and eight NFL Draft picks to the Dallas Cowboys. They acquired running back (RB) Herschel Walker, who was widely considered as one of the best players in the NFL at the time. Walker played only two seasons for the Vikings, who did not qualify for the NFL playoffs either year, before leaving the team in free agency. The Cowboys used one of their gained draft picks to select RB Emmitt Smith, who quickly became a household name for his success. The Cowboys parlayed their assets received in the trade to build a dynasty and to become perennially one of the best teams in the league, including winning 3 Super Bowls in the years following the trade. General Managers in the NFL make high risk decisions daily and using analytical measures, such as Expected Wins Added (EWA) and Wins Above Replacement (WAR), can maximize their chances of better outcomes. The Minnesota Vikings discovered the implications of making an emotionally-driven decision the hard way.

Many NFL teams have adopted data analytics in their decision making, most notably the Cleveland Browns. In a poll of all NFL teams with an analytics department, the Cleveland Browns were named the most analytically advanced team in 2021. In 2021 the Browns improved from a record of 6-10 to 11-5, largely in part due to their usage of data analytics. Under the power and rule of Paul DePodesta, the Browns pivoted to frequently utilizing data analytics in their decision making. DePodesta is famous in the sports world for his work in baseball, most notably his work with the Oakland Athletics of Major League Baseball in the early 2000s. These Athletics teams were some of the first in all major sports to utilize data analytics as a tool instead of relying solely on the eye of scouts and other evaluational personnel. This methodology is deeply detailed in the book and film *Moneyball*, which displayed the organizations newfound practices and its results on the baseball field. DePodesta was an assistant within the general

manager's office, and his practice there of utilizing data analytics and sabermetrics helped turn the Athletics from a bottom dweller to a perennial championship contender. DePodesta's transition from baseball into football was unheard of, as the status quo for front office personnel was to have played the sport of football and spent time in other office roles such as the departments of scouting. This unprecedented career path and subsequent generationally unheard-of success bears witness to the change of the standard of operations in the sport of football. This has continued recently, with another member of DePodesta's staff coming into a major role in the NFL. Kwesi Adofo-Mensah, an Ivy League graduate with experience as a commodities trader on Wall Street, was recently hired as the general manager of the Minnesota Vikings. This trend has turned into a revolution within the NFL, with the Jacksonville Jaguars and executive Tony Khan launching the largest analytics department in the league. With all these instances in consideration, it is evident that a shift is taking place. A shift from brawn, sole athleticism, and tangible measurables to brain power, efficiency, and intangible qualities.

This paradigm shift occurred due to visible success that teams who utilize data analytics have had. A notable analyst whose team had breakthrough success noted that with success comes all other teams in the NFL attempting to replicate their processes to attain similar levels of success (Fox, 2021). This paradigm shift is relevant in the efforts to save football from becoming defunct as a sport due to the shift in important characteristics. With data analytics, values such as intelligence and niche characteristics that allow both players and coaches to win individual battles are weighted with higher importance. Contrasted with the outdated values such as physical toughness, capability to play with serious injuries, and ability to injure other players, the paradigm shift to involve data analytics allows more people with different backgrounds to be

involved with and have perennial success in the sport. This allows for a greater number of people to be interested in, follow, watch, and enjoy the sport.

This shift is also occurring on the field as well, with the desirable qualities of head coaches changing. Previously, coaches that were desired had years of playing experience, who ‘knew how to win’ and knew how to push players to their limits in order to win. Currently, desirable head coaches are younger, less experienced people who are strategic, efficient, and utilize analytics. Coaches such as the Los Angeles Rams’ Sean McVay, who led his team to victory in the 2022 Super Bowl, and the Cincinnati Bengals’ Zac Taylor, who led his team to a Super Bowl appearance, are 30 and 31 years old, respectively (Rolfe, 2022). Using data analytics, both McVay and Taylor led their teams to unexpected turnarounds, with Taylor leading the Bengals to a win increase of 8 wins in his first 2 years, and McVay leading the Rams to a win increase of 9 wins in his first 2 years (Cleveland/Los Angeles Rams Team Encyclopedia). One of the most important statistics used by both coaches is Expected Points Added (EPA). Expected Points Added is essentially a probability equation using the probability of success and failure of a decision on any given play, being respectively multiplied by the number of points that would be gained with the result of each decision. This trend was first popularized under coach Doug Pederson and the 2018 Super Bowl Champion Philadelphia Eagles. Using this strategy, the Eagles led the NFL in 2-point conversion attempts, including famously using one in the final minutes of the Super Bowl to seal their championship victory. The Eagles’ head analyst Ryan Paganetti stated that “The way the NFL works, when one team wins the Super Bowl, the other 31 teams spend the offseason trying to find ideas to copy from that team” (Fox, 2021). Naturally, since the Eagles won the Super Bowl that year, the rest of the

NFL has adopted the Expected Points Added metric, with varying commitment levels. (Greer, 2021). Pro Football Focus, a premier football data analytics site, indicates that they work with all 32 NFL teams to provide data and sabermetrics to coaches. The usage of metrics such as Expected Points Added again signals a shift in football from prioritizing brawn, raw strength, and experience to efficiency, intelligence, and strategy. This change helps capture the attention of differently minded people, including those who prioritize math and analytics over physical ability. This influence of data analytics in football is a great example of technological determinism. The presence and rising usage of metrics such as the statistic of Expected Points Added has shifted the desirable qualities in both head coaches and general managers into those who are young, analytical, and whose decision making is driven by numbers and facts as opposed to emotions and gut feelings.

One of the other large issues plaguing the sport of football is player health/safety concerns. Football is naturally a violent sport, and injuries are simply part of the game. However, many different companies and people in positions of power are working to eliminate unnecessary violence and injuries from the sport. The University of Washington, as well as other flagship universities across the country have partnered with the NFL as a part of their 'Engineering Roadmap' to help improve player health and safety. Within this partnership, a technically advanced mouthguard has been created that is equipped with sensors that monitor data such as force, direction, and severity of impacts. This data is utilized by the 4 universities, the NFL research and development department, as well as over 10 different NFL teams in an effort to protect from head trauma (Schlosser, 2021). These products and their incorporated technology indicate a change in status quo of equipment, a paradigm shift, from unsafe, fashionable, and player-preferred, to products that might be more uncomfortable and less flashy, but instead have

technology implemented to improve player safety. This paradigm shift is exhibited by the technology of Q-Collar, an up-and-coming sports technology whose product was made mainstream by former Carolina Panthers linebacker Luke Kuechly. The Q-Collar is an apparatus that is worn around the athlete's neck, with a focal point on the jugular arteries. The Q-Collar intentionally puts pressure on these arteries, forcing blood to accumulate in the brain and inside the skull. This increase of blood in the brain prevents the brain from moving, and as a result makes it more difficult for the brain to hit the side of the skull and become bruised, which is the medical definition of a concussion. In a study, Q-Collar determined that players who did not wear the Q-Collar for the entire season had significantly more brain damage than those who did, statistically significant at the .05 level (Research Briefing, 2022). In a time where player brain safety is at the absolute forefront of all player health and safety efforts, the invention and studies of the Q-Collar indicate that it is very possible to limit head trauma. This paradigm shift of importance in player safety is very important to saving football from becoming obsolete in the eye of the public. The shift of perception from football being dangerous to both players, fans, and children alike to football being a strategy-centric game like chess where injuries are a rarity is necessary to save the sport. These noted investments in player safety are a good baseline in efforts to completely eradicate seriously traumatic head injuries.

Additionally, the utilization of data analytics of athletic training can help prevent both muscle and ligament and tendon injuries. Researchers within the Cleveland Medical Center, working in a joint effort with the Cleveland Browns, performed a study that analyzed soft tissue injury in comparison to workload within football strength and conditioning training. This study utilized GPS and clinical data to gain a comprehensive understanding of the specific athletes and their training. The study concluded that with sudden increases in training workload, soft tissue

and muscle injuries were over 50% as common. (Li et al, 2020). Similarly, a study at the University of Birmingham concluded like results. Higher workloads and acute increases corresponded to more injuries. However, when workloads were progressed progressively, the injury risk was much lower (Bowen et. al, 2017). These multiple studies indicate the technologically deterministic component of strength and conditioning training. All players and coaches want athletes to remain healthy and using data analysis through GPS tracking allows coaches to monitor workloads and reduce the risk of injuries. Through data analytics and medical studies, serious injuries, including torn muscles, broken bone, and head injuries such as CTE can be a thing of the past, and football can be saved in this aspect.

While player safety and in-game decisions are important in the sport, at its core football still involved making sure the right players are in the right positions on the right teams. With data analytics, the processes of recruiting and personnel management become much easier and more feasible for teams and programs to make better decisions. A prime example of this adaptation of data analysis into the sport is with the University of Virginia football team. As a former player within the program, the presence and incorporation of data analytics into the program was and remains to be one of the driving factors of the program's newfound success. Part of this success was due to the system that was established in a previous capstone to help analyze possible recruits and model success based on both tangible and intangible factors. This model, which remains in use, utilizes qualities such as physical skills, academic-based capabilities, and intangible factors such as grit and determination, as well as the likelihood that the prospect would commit to the University of Virginia. This model was implemented before the 2019 season, and since then the program has received invitations to bowl games 4 years in a row, after receiving only 1 over the 11 years previous. Receiving an invitation and playing in a bowl game

is a widely used metric of success that is used in college football programs across the country, so the analytical model directly correlated to team success in terms of win percentage. Another criterion of the model is finding recruits that have the academic capability to excel at the University of Virginia as well. Despite the University of Virginia being in the top 10 best rated schools with a Division One football program according to US News (Best National University Rankings), football student-athletes are amongst the top half of all Division One schools in being on-track to graduate, according to the NCAA's Academic Progress Rate metric (CollegeFootballNews.com, 2020). This combined academic and athletic success is nearly unheard of in college football. Most perennially successful teams such as the University of Alabama, the University of Georgia, Clemson University, and Ohio State University, are all outside of the top 50 universities in America and choose instead athletic success instead of strong academics. This strong recent performance from the University of Virginia, driven by data analytics, indicates the paradigm shift from prospects having to choose either academic or athletic success, to having the ability to be successful in all aspects, provided that the right student-athletes are in the right programs and schools. As referenced earlier in the Introduction section, the presence of 6-figure endorsement and licensing deals with college football players and companies has become much more common. This large influx of cash flow to young college athletes has corrupted the decision making of both the football players themselves as well as the colleges in which they represent. However, the technological determinism of advanced modeling methods like the ones utilized by the University of Virginia shifts the focus of desirable traits from money, fame, and popularity to academic success, grit, and determination. This shaping of the sport of college football by the modeling technology is enough to save the sport of college football from becoming an auction.

While some antiquated coaches and programs still rely on their scouts and the ‘eye test,’ a majority of college football has transitioned to using rankings with corresponding stars to determine the best prospects in America. Led by independent agencies such as 247Sports and Rivals, data analytics are extremely present in the generation of their player rankings. Prospects are assessed based on potential, performance, and strength of opponents faced in high school, and these values are weighted according to a private, unshared formula. Each prospect is ranked based on this score, with the top 32 prospects receiving a ‘5 Star rating’, the next top 10% are given a ‘4 Star’ rating, etc. These star-based rankings are the preference of most college coaches in determining which prospects are the best in any given year based solely off on the field performance. These data-driven rankings and evaluations signify the paradigm shift from the opinion of mere scouts to advanced, analytical assessments made by third-party professionals.

Next Steps for Saving Football with Data Analytics

The use of sports data analytics and democratization of the softwares can be enough to not only save football but also increase viewer enjoyment as well as amateur development. Recent problems have arisen in the sport of football due to player health and safety as well as resource equality between professionals and amateurs but, with the implementation of data-based research into evolving the rules and equipment of the game, many of these issues will continue to be nullified. The continued usage of data analytics in football will also attract new fans who take an interest with data and numbers and will add additional viewership experiences to a sport that already is the most popular in America.

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