

Optimizing the Game Day Experience at The University of Virginia's Scott Stadium
(Technical Paper)

The Ethics of the Concussion Protocol in the National Football League
(STS Paper)

A Thesis Prospectus Submitted to the
Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia
In Partial Fulfillment of the Requirements of the Degree
Bachelor of Science, School of Engineering

Alexandra Labus

Spring, 2023

Technical Project Team Members

Haley Austin

Abigail Freed

Brendan Lynch

Joseph Mastrullo

Julia Sharff

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

ADVISORS

Joshua Earle, Department of Engineering and Society

Robert Riggs, Department of Engineering Systems and Environment

Introduction

One of the most popular sports today in the United States is professional American football. Game day is a term that not only refers to the day of the actual contest but to the festivities and events surrounding the game as well. To be successful, a lot of planning is required and hundreds of workers, including police officers, ticket scanners and concession workers, are needed. Thousands of fans pour in from various locations, often causing gridlocks in traffic, which can deter attendance. Once inside the stadium, the movement around the stadium can be very tight and long concession lines can require a significant amount of time. Currently, there is an issue with the moving pieces of game day specifically in Charlottesville, with an emphasis on the struggle of traffic around Scott Stadium and the struggle of finding easily accessible concessions. As a result, the objective of this technical project is to develop an optimized game day schedule for traffic and layout for concessions for the University of Virginia to create a smoother and more successful process.

Beyond the spectator aspect of football, there is a serious issue of injury for the players that raises an ethical question to the safety of the game. One of the most common injuries is a concussion. A concussion is a blow to the head that can lead to brain injury, resulting in negative cognitive symptoms and lack of ability to perform basic motor functions. In the past decade, there has been an average of two hundred concussions per season in the National Football League (NFL); around 11% of players in the league suffer a concussion annually (Johnson, 2022). There has been increasing uproar and debate over the amount of head trauma that occurs in the league, with medical professionals being concerned over the growing evidence of chronic traumatic encephalopathy (CTE) in professional football. CTE has more severe consequences beyond just a brain injury, and is often caused by having multiple concussions in a lifetime. As a

result of increased attention, there has been a rise in protest and demand for change in how the National Football League screens and evaluates players who may have suffered from some form of head trauma. The mandated agreement that the NFL must follow is called the “Concussion Protocol,” and it is evaluated each season, and sometimes mid-season, to be considered viable to use. The NFL works with the National Football League Players Association (NFLPA) to construct these agreements. The NFLPA is a union that stands to protect players' health, rights and family. The NFLPA has a designated sector, the NFL Head, Neck, and Spine Committee that crafts the protocol for neurological damages (Concussion Diagnosis and Management Protocol, 2022). This group consists of neuroscientists and other medical professionals that work diligently on researching injuries associated in the head, neck or spine.

Now, more than ever, professional football teams are looking for ways to minimize the negative public opinion of concussion damage caused by the game. Not only is negative press an issue, but there is also an issue in rosters staying stable through injury. Professional teams are looking for ways to prevent concussions without causing a disruption to the teams roster and altering how the team functions. The Miami Dolphins were the catalyst for the most recent change in concussion protocol and an increase in the conversation of concussions in the NFL. Due to a lack of strict concussion rules, the Miami Dolphins started quarterback Tua Tagovailoa in spite of him facing what appeared to be potentially serious head trauma. As a result he suffered further injury that was ultimately handled poorly by the medical staff of the Dolphins based on the loose concussion rules (Louis-Jacques, 2022). Another case was the study of Hall of Fame player Mike Webster and his time in the NFL, in which he experienced numerous concussions, which affected his life afterwards. Previous research has shown that football players have much higher rates of acute cognitive disturbances that can lead to depression, mood

changes and even personality disorders (Didehbani, 2013). Where is the line drawn on the dangers of concussions? Is it acceptable to allow players to put themselves in danger? This STS proposal will address the ethics behind concussion protocols in professional American football by looking at the two case studies of Tua Tagovailoa and Mike Webster.

Technical Project: The Optimization of Game Day at the University of Virginia

The University of Virginia's Scott Stadium has a capacity of 61,500 people and hosts 6-7 home football games a year. The average attendance of fans in 2021, the last complete season, was 42,439, or only 69.2% of what the stadium was designed to hold. Ultimately, this is a negative statistic for UVA football, being one of the lowest attended Power 5 conference teams in the country. There has been an increase in disgruntled fans, many who are focused on the struggles it takes to actually get to Scott Stadium on a game day. The stadium stands tall in the middle of Grounds, which creates a historical and beautiful environment but also makes it particularly difficult to access. If you choose to not spend money on a parking pass, the closest parking options are Fontaine Park and John Paul Jones Arena, both of which are approximately one mile away (Carey, 2022). The long walk can deter fans who are incapable or unwilling to walk that distance. For those who park at Fontaine, there are no bus routes or wheelchair accessible walkways between there and the stadium, making the distance a big issue. In order to increase accessibility to the stadium, and to raise attendance, there needs to be a reevaluation of the process of traffic flow and enjoyability of game day experiences. There has been minimal study on how to improve the traffic flow in Charlottesville, and there needs to be an analysis of how to better the entire system.

Beyond traffic flow, there is also an issue of people traffic within Scott Stadium. Typically, there is a line at every stand that leads to congestion in the tunnel walkways within the

stadium. A large sum of profit for a football team comes from concessions sold during game-time, and there needs to be a better roadmap for how to space concessions to gain the optimal amount of revenue for the stadium. The athletic department for the university is looking for easier traffic patterns to encourage game attendance and better concession layouts to raise productivity during each game. Entry into the stadium also has been delayed due to tailgating and fans not feeling an urgent need to see the kickoff. There needs to be more incentive to enter the gates early and efficiently.

The main objective of this technical deliverable is to provide a concise and optimized proposal to better traffic flow, concession sales and overall game day experiences. There has been minimal research on how to achieve this specifically at the University of Virginia. Data has been received that provides sources of struggle and can be crafted into a more detailed plan. There are also differing opinions with those involved within the game day experience to provide advice on how to better the system, such as Charlottesville police and athletic directors. These stakeholders will provide additional support to the evidence found in the data sets. This is a two-semester project that will begin with an initial review of the data, comments of staff and end with a proposal to the athletic department showing what changes could help raise attendance and enjoyability of a game day in Charlottesville.

STS Topic: The Ethics of Concussion Protocols in the National Football League

All athletics have been riddled with injury, from breakage to tears to wounds. One of the most common injuries of all sports is neurological trauma, which is particularly high in American Football. This consistency in concussion counts for the NFL has created a need for reimagined protocols and studies. The NFL has been facing immense pressure to change the processes of diagnosing and treating concussions due to the long-term impact these injuries have

on players. It is rare that there is not a concussion weekly during the NFL pre and regular season. A moral argument arises on whether allowing players who have been priorly concussed is ethically correct if there is research proving the negative impacts it may have on them.

Scientists and activists alike protest over how the NFL handles these concussions and the risks players face by playing with a head injury. The consequences of concussions have many stakeholders, such as players, coaches, team owners, trainers, doctors, and fans. This proposal will focus specifically on the detriment to players and their families and the effect of how the NFL handles neurological damage. The ethics of concussion protocols are debated; some believe players are making the active decision to play through these injuries of their own free will, and others think it is morally wrong to allow them to continue to injure themselves permanently. This paper will reference two case studies which focus on the ethics of concussion evaluation. First, the handling of injuries to player Tua Tagovailoa and the subsequent consequences that held, and secondly, the case of the death of Mike Webster.

In September of 2022, Miami Dolphins starting quarterback Tua Tagovailoa suffered a series of injuries. In the second quarter of their Week 3 game against the Buffalo Bills, Tagovailoa went down with an unknown injury that caused him to stumble and weave when he stood up and was incapable of holding himself up. Balance was difficult for Tagovailoa, and it was clear that he was severely injured. He was taken to the locker room and evaluated under the then current concussion protocol, was cleared of head trauma, and was classified as having a non-descriptive back injury that had minimal explanation. He proceeded to play the second half of that game with no further issues and overall performed well. Five days later, Tagovailoa started once again on primetime television. Soon after the game began, he hit his head on the turf and started twitching, was incapable of standing and held his hands in an odd position over his

face. After being assessed, Tagovailoa was diagnosed with a severe concussion, and there were signs that he was likely concussed the week prior despite passing the pre-existing concussion protocol (Louis-Jacques, 2022). Was this a complete misdiagnosis on the part of the concussion analysts for the Miami Dolphins or was this an issue of how the NFL handles concussions entirely? In response to Tagovailoa's injury the NFLPA and the NFL swiftly updated the concussion protocol, adding additional steps that will make the players undergo a more strict evaluation before returning to the game. The Miami Dolphins played Tagovailoa, despite signs of concussive injury, likely because they believed that he was their best chance at victory, not considering the dangers to Tagovailoa's long term health (Concussion Diagnosis and Management Protocol, 2022). This raises the question of whether it was fair that the Dolphins still played Tagovailoa after passing the protocol even though it seemed he had faced head trauma, insinuating that the current protocol was designed to benefit the teams, and not the players well-being.

Former NFL player Mike Webster died suddenly in his 50's from what was assumed to be a heart attack. Forensic pathologist Bennet Omalu performed the autopsy on Webster, and he discovered that Webster had faced many traumatic head injuries across the years he played in the NFL. He concluded that the human brain cannot withstand consistent impact, which is something that is hard to avoid when playing football. Through this research, Omalu determined this consistent brain trauma is what caused Mike Webster to have an early death. Omalu was in constant legal battles with the NFL over his findings and he stood by the fact that no matter what the NFL tries, these injuries are unavoidable in the game of football. The NFL argued that it is not always the case, and that Webster was an anomaly. Omalu found calluses on Webster's brain and a shelf of scar tissue that was lined right where his helmet would have fallen across his

forehead. It was revealed that Webster was in such a bad mental state near the end of his life that he found it difficult to even achieve the most simple of daily tasks, such as brushing his teeth (Lartey, 2015). This analysis of Webster's health led to an increase in studies on the brains of retired players, showing evidence that many of them result in signs of CTE. Mike Webster is often viewed as "patient-zero" in the analysis of what playing football can do to the brain and whether it is ethically correct to allow people to play football when they have faced multiple concussions (Hollin, 2021). He played year after year, despite suffering an exorbitant amount of head injuries.

Through my research of neurological damage in NFL players, the main frameworks that will be used in this report are case studies and the idea of social construction of technology (SCOT). SCOT is the methodology used to decide which aspects of this technology are successes and which aspects are seen as failures through human use. It determines whether there is an inherent issue with the concussion protocol, or if it is more in the hands of who implements it. The case studies are those shown above, Tagovailoa and Webster, and SCOT evaluates how technology does not determine human action, but instead human action affects technology (Bijker, 2018). Weak concussion protocols can lead to long-lasting, harmful effects on the health of these athletes, yet players follow them and the NFL keeps them implemented. This creates the question of the ethically correct process of handling concussions in the league.

Research Questions and Methods

"How does the NFL determine the limitations of the concussion protocols and what are the ethics behind this process? How are these ethics evaluated and established?"

Beyond the selected frameworks, there will be distinct methods used to help narrow down the research. The methods used in the paper will be document research to synthesize, historical case studies, and ethnography. The document research will allow for prior analysis of research articles about concussions to create a background of understanding for how the process is handled. This will extend from medical studies to general understanding of concussions and CTE. Synthesizing would be drawing a connection to how concussion protocols have changed over time in the NFL, giving an idea of how the protocols have adapted over time. The evidence from document research is pulled and connects into an easier to understand timeline of the concussion protocol. Synthesizing ties directly into historical case studies, showing how these different cases caused a change in the protocol. Historical case studies as shown above with Tagovailoa and Webster will be used as a basis for why changes have occurred in the league, and produce explicit examples of where the ethics become meddled. Finally, ethnography will be done through watching and analyzing interviews, specifically from concussion experts. There will be a specific analysis of Doctor Bennet Omalu and his interviews throughout the 2010's on why he challenged the NFL. These methods described above will create an understanding of how the concussion protocol is handled in the NFL and why it may be ethically unsound.

Conclusion

The technical project will help create an optimized plan for the UVA football athletic department on game days. It will create an improvement in the traffic flow patterns as well as the concession flow in the stadium. This will be finalized in a proposal that will be presented to the athletic department at the end of the Spring 2023 semester. The STS prospectus will analyze the ethics of the current concussion protocols used in the NFL and how this can affect players permanently after their time in the league. The deliverable for the STS portion will be a research

paper that focuses on the history of the concussion protocol in the NFL. Although different sides of the game day overall experience, both optimization of game day events and understanding of the ethics of injuries are essential to American football and the continuation of the sports' success.

Key Texts and Primary Resources

A text that helped me understand information about concussion protocols in the NFL is a case study that was led by Gregory Hollin. This article was published in *Frontiers in Sports and Active Living*, and mainly focuses on the discovery of CTE in Mike Webster's autopsy. His writing walks the reader through the story starting with when Dr. Omalu first begins looking at Webster's brain. As he develops the facts of the case, he talks about the legal and moral arguments that began during the process. He summarizes his argument in two cases. First, Webster is the origin story for the "contemporary concussion crisis," and secondly, Omalu raising awareness of how the NFL handles these situations is morally correct and important. Hollin cites the autobiographies of Omalu throughout the entire piece.

Another case that I found to be essential in my understanding was the case that covered Tua Tagovailoa. This is an article written by Marcel Louis-Jacques, who is an ESPN analyst that focuses mainly on American football. Tagovailoa's injury is so recent that very few articles and journals have strong written pieces about this case. Louis-Jacques details the exact events surrounding his injuries and how the situation was handled. He discusses how the NFLPA comes into the situation and the immediate demand for an update of the concussion protocol. Louis-Jacques does less of a personal review and instead pulls in a lot of stakeholders and their commentary on the situation. This article is the best description of what happened to Tagovailoa, and how the NFL immediately reacted.

A journal article from *Oxford University Press* written by Nyaz Didehbani created the best foundational basis for what concussion protocols were and how they are historically handled in the NFL. They produced a study testing 42 diverse NFL players and saw how their health held up across the years following their time in the league. This gave a general overview of the ethics of the NFL and how they handle neurological trauma. The study goes into detail about how retired NFL players lead lives that are far from optimal, and that CTE runs rampant in this specific group. The results found that NFL players that had faced concussions had more neurological damage and were more susceptible to depression and other mental illnesses.

The final case study that I found to be particularly important in my research of the concussion protocol is written by Kevin Guskiewicz. In this article there was also a study performed on the concussions of retired players, except there was an emphasis on the amount of concussions it takes to truly cause the CTE breakdown. In his results and arguments it is determined that players that have three or more concussions will be at a much higher risk of having mental illness in the future. This creates the moral argument of whether there should be an allowance of players playing beyond three concussions.

References

- Bijker, W. (2018). The Social Construction of Facts and Artifacts. *STS Infrastructures*. <https://stsinfrastructures.org/content/scot-poster-4s-1983>
- Carey, Z. (2022). UVA Football Tailgating and Its Impact on Attendance: The Good, the Bad, and the Ugly. *Streaking The Lawn*. <https://www.streakingthelawn.com/2022/9/24/23368842/uva-football-virginia-cavaliers-tailgating-dukes-mayo-syracuse-orange-scott-stadium-tony-elliott>
- CTV News. (2015). “Concussion”: The Doctor Who Went to War with the NFL. *Youtube*. <https://www.youtube.com/watch>
- Didehbani, N. (2013). Depressive Symptoms and Concussions in Aging Retired NFL Players. *Oxford University Press*. 418-424. doi: 10.1093%2Farclin%2Fact028
- Fainaru-Wada, M. Fainaru, S. (2013). League of Denial. *Crown Archetype Publishing*.
- Furness, Z. (2016). Reframing Concussions, Masculinity, and NFL Mythology in **League of Denial**. *Routledge Taylor and Francis Group*. <https://www.tandfonline.com/doi/full/10.1080/15405702.2015.1084628>
- Guskiewicz, K. (2006). Recurrent Concussion and Risk of Depression in Retired Professional Football Players. *Medicine and Science in Sports and Exercise*. doi:10.1249/mss.0b013e3180383da5
- Hollin, G. (2021). “Learning to Listen to Them and Ask the Right Questions.” Bennet Omalu, Scientific Objectives, and the Witnessing of a Concussion Crisis. *Frontiers in Sports and Active Living*. doi: 10.3389/fspor.2021.672749
- Johnson, M. (2022). NFL Concussions Reportedly Dipped Significantly in 2021. *Sportsnaut*. <https://sportsnaut.com/nfl-concussions-statistics-2021/>
- Lartey, J. (2015). Concussion: Doctor Who Fought NFL Says ‘No Equipment Can Prevent’ Such Injuries. *The Guardian*. <https://www.theguardian.com/us-news/2015/dec/28/concussion-prevention-football-safety-brain-injury-bennet-omalu-nfl-will-smith>
- Louis-Jacques, M. (2022). Following Review of the Handling of Tua Tagovailoa’s Injury, NFL, NFLPA Agree ‘the Outcome in This Case Is Not What Was Intended’.” *ESPN*. https://www.espn.com/nfl/story/_/id/34755142/following-review-handling-tua-tagovailoa-injury-nfl-nflpa-agree-outcome-case-not-was-intended
- Navarro, S. (2017). Short-term Outcomes Following Concussion in the NFL: A Study of Players Longevity, Performance, and Financial Loss. *Sage Journals*. doi: 10.1177/2325967117740847
- NFL. (2022). NFL Concussion Diagnosis and Management Protocol. *NFLPA*. <https://www.nfl.com/playerhealthandsafety/resources/fact-sheets/nfl-head-neck-and-spine-committee-s-concussion-diagnosis-and-management-protocol>

Omalu, B. (2010). Chronic Traumatic Encephalopathy (CTE) in a National Football League Player. *Journal of Forensic Nursing*. doi: 10.1227/01.neu.0000163407.92769.ed