

The history of football helmets and their improvements over time

(STS paper)

Research Paper In STS 4600

Presented to The Faculty of the

School of Engineering and Applied Science

University of Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science in Mechanical Engineering

By

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February 14, 2025

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

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Introduction:

As football continues to be played in and outside the United States, a part of the game that is continually changing is the helmet. Football helmets were once thin leather skull caps that provide minimal protection for the players wearing them. Now, they are sophisticated pieces of technology that combine materials like carbon fiber, polyurethane foams, and plastics that are put together to protect the players on the field. In addition to the changes that have been made to the helmets, there have been many changes to the rules of the game to improve player safety to reduce concussions and other types of injuries.

In 2016, the National Football League (NFL) stated they would spend 100 million to develop new technology and for medical research. (Dallas News, 2016). One of the main things driving this research is concern for player safety not only in the short term, but the long-term effects that continuous impacts to the head can have. One of the biggest long-term effects is Chronic Traumatic Encephalopathy (CTE), a neurodegenerative disease associated with repeated head trauma. “CTE doesn't appear to be related to a single head injury. It's related to repeated head injuries, often occurring in contact sports” (Mayo clinic staff). There is currently some conflicting data about the percentages of former NFL players that have CTE, but there is a consensus that almost all NFL players are at risk of CTE. This paper will discuss some of the early development of helmets and the motivations behind them, how the materials have changed over time, the cultural and economic impacts, and what the future could look like for helmets. This paper will use the Actor-Network Theory (ANT) framework to guide its research. This analysis will allow for a deep dive into the roles of everyone and everything including medical professionals, engineers designing the helmets, researchers, the players themselves in addition to the helmets themselves and governing bodies like the NFL and the NFLPA (NFL Players

association). This research paper will cover what used to drive changes in football helmets in the past and what drives it now. Actor-Network Theory will give a good look into the people, associations, and physical things that made these changes.

Supportive Background Information:

Concussions are a part of every contact sport that humans play, it is entirely unavoidable. “The Center for Disease Control estimates that 5-10% of athletes will experience a concussion in any given sports season.” (University of Michigan) Concussions can occur playing any sport, but the one that causes the most outside of combat sports, is American Football. By the very nature of the sport, concussions are bound to happen. Almost every play involves a player’s head making contact with a surface, whether it be the ground, another player’s body, or another player’s head. One thing to note is that concussions do not have a lot of data until recently, additionally the mentality towards concussions has changed over the years meaning players are more likely to be diagnosed now.

Football helmets started as leather caps that provided minimal protection, but also, the sport looked a little different. There was less head-to-head contact, but there were still head to ground contact which could have caused concussions. Eventually, there was a shift to plastic helmets in the 1940s which was in an effort to use more durable materials. This change in helmet material had an effect where the sport was thought to be safer which caused players to play more violently. Helmet to helmet hits started to become a part of the sport and with that came additional concussion risk for both the tackler and the person being tackled. Starting in the 1960s and 70s, helmets were fitted with padding on the inside to increase comfort, but also provide more protection. (Chester County Hospital, 2023). Some other things were added along the way such as the facemask and different materials. The motivation behind most of the early changes

were for durability and to protect the players. Helmets used to be more “one size fits all”, but now they are fully customizable to each player to better protect them. This customization involves the players wearing them and the researchers doing studies to find out what works best to prevent concussions. Today, helmets have unbelievable amounts of technology in them, ranging from position specific helmets, to liquid shock absorber padding on the inside, and sensors to help detect hits that could’ve caused a concussion.

The reason all of this new technology is important is because it can help prevent long term health deterioration of the players of the sport which has massive cultural importance especially in the United States. This research is important as it could potentially improve the efficiency and overall process of improving and making new helmets. Additionally, it can find which actors could play a bigger role and how the actors can improve their own individual jobs

Some of the actors included in the Actor Network are medical professionals, players, coaches, the NFL, helmet developers, the helmets themselves, and the game of football. Medical professionals play a massive role in this entire network because they are the ones that discovered CTE in the first place and they are some of the biggest advocates for protecting the players. Coaches are the ones that teach players how to play by the rules, which are made to protect the other players as much as possible. The players of course are one of the biggest factors if not the biggest because they are the ones that wear the helmet and they are the ones that are often on both the giving and receiving end of a concussion. While these players (at least in the ones in the NFL) financially profit the most off playing the sport, they are also the ones that suffer the most brain damage from repeated hits to the head. The NFL is one of the biggest actors and it has both human and non-human actors. It is the governing body for the most popular organizations in the sports, not only does it make and change the rules of the game but it provides a massive amount

of funding towards research for helmets. The helmet developers and the helmets themselves are of course actors as they are the product that surrounds this thesis topic. Finally, the sport of football is of course an actor as the helmets would not exist without it.

STS Framework:

This topic fits into the field of STS because football helmets are a piece of technology that has a direct impact on the health and wellbeing of individuals. The perspective that is being used is through doctors, players and administrators of the game. The framework for this given paper and as stated previously, is Actor-Network Theory. Because of the sheer number of actors that play a role in the development of helmets. “Concussions fell to a record low this season, down 17% from the previous campaign, amid improvements to helmet technology and after the league changed rules governing kickoffs.” (Tennery). This quote shows how fixing the concussion problem is a multifaceted job that includes not just the helmet technology itself.

One of the biggest actors in this network are the players themselves. Some of them are resistant to change in regards to trying and using new helmets. “Convincing players to wear the top-rated helmets has been a challenge considering there are multiple options available, including five that were approved for use but moved to the "not recommended" category this season.” (Tennery). While this is a challenge to the problem, the NFL could eventually implement hard set rules on which helmets are allowed, but this may upset players. It is difficult to please everyone, and at the end of the day all the different actors need to make compromises in order to reach a solution.

Research Question and Methods:

The research question that guides this paper is: What actors play roles in continued helmet development and how have technological advancements in football helmets influenced player safety and perceptions of risk in the sport? The main methods that were used in guiding the research were case studies and articles that were found online. Some of the keywords that were used in researching were Football Helmets, Concussions, Chronic Traumatic Encephalopathy, STS, Actor-Network Theory. Several sources were found using AI and online researching. The rest of the paper will cover the beginnings of football helmets and their first evolutions. It will discuss the many of the changes made to helmets and the reasons behind them. It will discuss the actors behind all the changes and the roles they all played and how they are interconnected with one another. Lastly, the discussion section will talk about the effect that these changes and technological improvements had on the players playing the game, the perception of its safety, and how the public perceives it.

Results:

Helmet technology has drastically evolved from simple leather caps to high-tech, customizable protective gear, driven by concerns over concussions and long-term neurological damage such as CTE. Actors including the NFL, medical professionals, engineers, helmet manufacturers, coaches, and players all play key roles in shaping helmet innovation and public understanding of its significance. Actor-Network Theory provides insight into how these human and non-human actors interact to influence both safety outcomes and risk perception. The next few paragraphs will detail a brief timeline of helmet history and technology, the influence of on safety and risk perception, analysis of all the Actors within the actor network, the cultural and

economic implications of helmet changes and development, and finally the limitations of this paper and areas for future research.

Evolution of Helmet Technology:

As has been stated previously, football helmets started as leather skull caps that provided for minimal protection and was more instated to prevent deaths in the game, instead of concussions. But the general idea was to prevent injuries. Soon after WWII, plastic helmets became common in the NFL and helmets were required by 1943 (Kratochwill, 2013). As face injuries were still common, the introduction of the facemask and padding became more available and as time went on and injuries were still prevalent, the amount of foam cushioning and number of bars that were on the facemask increased. (Kratochwill, 2013). By the 1980s, the football helmet had become a high-tech piece of equipment, that included multiple different materials, tight fitting foam padding, and a full facemask. The general form of the helmet has not changed too much since the 1990s, but the levels of technology has only increase. With helmets now being specifically made for certain positions, shock absorbing materials, and even some including impact sensors.

Impact on Player Safety and Risk Perception:

One of the biggest factors in all the helmet technology is seeing if the improvements create actual results on the field in reducing concussions and head injuries. Per the NFL, concussions reached the lowest level since they started tracking them in 2015. (Brain Injury Association of America, 2024). This statistic and improvement has a positive impact on the sport and the players because it will be viewed as safer for parents of young children and can extend players longevity due to reduced injury risk. A risk that may have a factor in player safety is more knowledge about the long-term effects of multiple concussions has changed the way that

the game is played. An example of one of these changes is the modified kickoff rules that were introduced in 2024 as well as the introduction of the Guardian Cap which became mandatory in the NFL preseason. These changes were made in an effort to reduce head injuries which proved to have a positive effect by the slowing the kick offs which led to a 43% decrease in concussion rate from the 2021-2023 seasons. (National Football League, 2024). The Guardian Cap also helped in causing the fewest preseason concussions since 2015. (National Football League, 2024). “Other important factors in this season’s reduction include the largest safety improvement in helmets worn on field since 2021, enforcement of safety rules and broader efforts to continue fostering a culture of safety.” (National Football League, 2024). This quote ties up the actor network quite well. It ties in how in order for the safety of players to improve or at least maintain itself, helmets need to improve and medical teams need to work together to detect and treat concussions, and finally the NFL needs to change and enforce rules to help improve player safety.

Players:

The players are the actor that are most affected by all the other actors as they are the ones that are risking concussions every time they step on the field. However, they are the ones that can either be beneficiaries or resistors of change. Some of the resistance can be seen from former NFL player Antonio Brown, that refused to wear a helmet that the NFL approved of and resulted in him being ineligible to play for the Raiders that year. The resistance is believed to be from the fact that older helmets were lighter than some of the newer more protective ones. Further resistance can be seen from Quarterback Tua Tagovailoa, who refused to wear a Guardian Cap stating it was a “personal choice”. Even if players benefit from all the technology that is afforded

to them from the NFL, helmet manufacturers, doctors, and researchers, part of their safety in the sport is left to their own choices.

While players can resist change, they can also be beneficiaries. In an interview with former University of Virginia (UVA) football player Caleb Stoltz, spoke to the changes he saw from elementary and middle school to high school and college. In the interview he spoke to how helmets had foam padding when he was younger but by the time he was in high school they had air cushions which are meant to reduce impact force on the player. He also spoke to using a Speedflex Pro helmet which was a custom fit helmet intended to fit more snugly which has the intended result of reducing concussion risk.

In addition to wearing a helmet, the players are the actors that are supposed to abide by the rules set by the NFL, NCAA or whichever association they are playing for. They each have rules in place that are meant to prevent concussions. Stoltz mentioned this in the interview as well that the way the game is played now has changed, “the ways you collide with someone now are different”. He discussed how more is known about CTE and concussions and players are no longer hitting defenseless players, or using the crown of the helmet to spear other players. These rule changes results in improved player safety and the perception that the sport of football is focused on protecting the players.

Medical Professionals:

Medical professionals are the actors that play a crucial role in researching CTE and concussions as well as treating the players that suffer from concussions in the short term. The role of the doctors researching CTE play a very important role for future helmet designs as they can hopefully discover more precise causes of CTE or develop ways to diagnose it while the person is still living. These discoveries can help them advocate for changes in NFL policies and

rules. This research can also be relayed to helmet manufacturers and researchers to help incorporate their findings to improve the next generation of technology.

The other main role that medical professionals play in this network is recommendations for recovery and future precautions to players that have recently suffered concussions. As medical professionals, they have knowledge as to what is best to help the athletes recover from a concussion as well as what they can do in order to prevent more concussions. Additionally, they can make the players aware of the risks associated with getting multiple concussions and can make recommendations as to what is the safest option for players as to when they can return to play and how quickly they can return to full contact.

NFL and NFLPA:

The NFL and the NFLPA are arguably the biggest or at least most influential actor in the network besides the players. The NFL is responsible for many of the rule changes in football that are made in an effort to reduce concussions. They are also responsible for the enforcement of those rules through use of replay technology and the referees on the field. These rules can also have the effect of decreasing viewership, which can have a negative impact on the NFL. The NFL has the job of tying in viewership while also keeping the players on the field safe.

The NFL also ties in with the medical professionals that are meant to be able to identify when players are displaying symptoms of a concussion, but also funding research in the hopes of finding out more information about the risk factors of things like CTE and what are the best procedures for concussion protocols.

The NFL then finally has a responsibility to protect its players and keep them well informed of the dangers that the sport presents. In the past, the NFL has been involved with

lawsuits of keeping information from the players about the dangers of concussions and some of the long-term effects that they can have. While the NFL is a business and it needs the players in order to continue to make money, they have an ethical responsibility to keep the players informed on the potential risks as they are discovered.

Helmet Manufacturers:

Helmet manufacturers have the role of researching, developing, testing, and mass-producing helmets that both keep the players safe, while at the same time has something that will be accepted and used by the players. Some of the recent developments by these helmet companies include creating position specific helmets that meet the needs of players. This is in an effort to produce helmets that are better suited for certain positions that receive certain types of impacts more commonly than others.

The Helmet Itself:

The football helmet is one of the most obvious actors in this network. As a non-human actor, only human actors can change it, but many of the actions that each of the other members in the network make are in an effort to improve or change this actor. This actor is what physical protects each of the players on the field every game, practice, or scrimmage, but is also what all the researchers and manufacturers work on constantly to improve. The helmet also is a direct representative of the game itself. It is something that is immediately identifiable and is only really associated with the sport. With that in mind, designers keep the general structure and form of the helmet relatively the same in order to keep some form of uniformity over the years.

The Game of Football and It's Fans:

American football is viewed by many as an essential part of American culture. But even The NFL draws millions of viewers every fall Sunday to watch their favorite team battle it out on the gridiron. While people love to cheer for their home team, something that needs to be considered is if football becomes too safe, will it lose its entertainment value that viewers need. Will it be deemed boring if the NFL eliminates big hits or the plays that get shown on weekend highlight reels. This viewership is essential for the NFL to remain profitable so it is important that while the game can be made safer, that a balance is struck to keep the sport still entertaining while making it as safe as possible.

Limitations and Future Research:

Some of the limitations of this research paper include an overreliance on secondary sources and online articles. While these articles provide meaningful information, they lack the information that could come from firsthand accounts of doctors, players, coaches, and engineers involved with playing and developing this technology. The one interview conducted provided for interesting insight to what it is like for a player that has experienced these changes, especially in recent times. The final limiting factor on this research is lack of long-term information on newer helmet technologies and designs. While a lot of the helmets that have been put on the market show promising results thus far, there is not enough evidence to conclusively determine the impact they have.

Some areas that could be researched further would be interviews with players that have played football in college as well as professionally. In the future, it would also be valuable to track the position specific helmets to understand in which areas their performance lacks. Finally,

researching material scientists that are involved with developing helmets and seeing which emerging materials could reshape the production and design of helmets.

Conclusion:

Technological advancements in football helmets have substantially improved player safety and reshaped how both the public and participants perceive the risks of the sport. By applying Actor-Network Theory, this paper illustrates how a diverse network of actors including engineers, players, the NFL, and the helmets themselves has driven helmet innovation and reform. While significant progress has been made, further collaboration is necessary to ensure effective protection for all players, especially as the sport continues to evolve and expand. The findings highlight the importance of continued investment in this life-saving technology and the shared responsibility of all involved.

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