# The Social Construction of Technology in Sport: A Case Study of Speedo's LZR Racer

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#### 1. Introduction

When I think of the term technology, the picture that comes to mind is often a supercomputer that takes up an entire room with the processing power to accomplish incredible tasks. However, technology can have a much wider variety of meanings. The Wikipedia page for "technology" features at least ten distinctly different definitions for the term. Depending on one's interpretation, technology can be anything from a highly advanced spaceship to something as simple as a painting.

One thing that is clear about technology is how large of a role it plays in our everyday lives. Almost every aspect of our day is heavily affected by some form of technology, whether it be just turning on a light switch when we get out of bed in the morning or the complex cell phones that we use for communication, entertainment, and a variety of other daily tasks.

On the other hand, there are parts of our lives that seem, on the surface, relatively unaffected by the use of technology. An example of this might be engaging in sports. Sports are an expression of our physical abilities seemingly absent of technological innovation. However, technology does play more of a role than we realize in athletics, increasingly so in recent years. From the shoes we wear to the advanced computer programming used to analyze statistics, technology is very present in sport.

In recent years, technology has begun to play an even larger role in sport than it has in the past. For example, the use of video review to improve officiating and improvements in equipment have gained much of the spotlight when it comes to the use of technology in sport. Along with that growing prevalence has also come scrutiny, as critics claim that technology affects the purity of athletic expression in sport. This scrutiny has created a debate over the extent to which technology should be incorporated into sport. In this thesis, I will discuss how

social attitudes towards technology in sport have caused some technologies to be banned while others are encouraged through a case study on Speedo's LZR Racer swimsuit that was banned following the 2008 Summer Olympics.

### 2. The LZR Racer

Swimming has been a staple sport in the Olympic Games ever since their inception in 1896. Since then, swimmers have worked to improve their performance in every way possible, whether it is inventing new techniques, shaving their body hair, finding the ideal swimsuit, and everything in between. In a sport where the difference between a gold and silver medal can be less than a second, every tiny advantage that one can get makes an enormous difference.

### 2.1 History of Swimsuit Technology

The technology of the swimsuit plays a very important role in a swimmer's performance. In order to understand the role of innovative swimsuit technology, you must first understand the role that the swimsuit plays in the general physics of swimming. Studies have shown that 90% of a swimmer's energy is spent overcoming hydrodynamic resistance (Vorontsov 2000). This hydrodynamic resistance can be split into three separate components: wave drag, form drag, and skin friction drag (Moria 2010). Wave drag is associated with the amount of work needed to create waves while swimming. Form drag is the resistance of motion due to the shape of the body. Skin friction drag is due to the surface area of the body that is in contact with the water. Each of these forms of drag slow a swimmer down and different strategies are used to overcome them. The swimsuit itself is typically designed to overcome the skin friction drag component as the suit covers the body and reduces the overall contact of the water with the body. By using a less absorbent material that covers a larger amount of the body, a swimsuit can greatly reduce this component of drag.

Since the first Olympic Games, the swimsuit has come a long way. In the early years of swimming, they were made from wool and covered most of the body. These early swimsuits were worn for modesty rather than performance. As a very heavy and absorbent material, wool

made swimming more difficult. Throughout the early 20<sup>th</sup> century, modesty became less important as a social value<sup>1</sup>, and swimmers began opting for swimsuits which covered an increasingly smaller surface area on the body. By reducing the amount of skin covered by the suit, the heavy and bulky wool suits would have less of an impact on slowing down the swimmer.

With more skin being exposed, swimmers began the practice of shaving their body hair. A 1988 study found that shaving away body hair can reduce blood lactate accumulation by 23%; the effect of this is comparable to a collegiate athlete training for an entire season (Sharp et al. 1988). The practice of shaving reduces drag on the body and allows a swimmer to expend less energy to travel at the same speed. Blood lactate is essentially the chemical compound that causes the body to feel fatigue. As the accumulation of this compound is slowed down with the reduction in drag as a result of shaving, the swimmer will feel less fatigued and have the ability to use more energy to swim greater distances at a faster pace without getting as tired. The design of swimsuits attempts to mimic this effect and when a swimsuit is made from the proper material, it can reduce drag even below bare human skin.

Following World War II, the invention of nylon (and later, Lycra) became the preferred material for swimsuits as it was less absorbent and more form-fitting. These materials more closely mimic human skin and opened the door to the invention of swimsuits that push the limits of technology. Speedo, the worldwide leader in swimwear, began taking significant steps to create the fastest swimsuits possible. In the early 21<sup>st</sup> century, they developed the material known as fastskin. This material closely mimics shark skin, using different textures on different parts of

<sup>&</sup>lt;sup>1</sup> This decrease in modesty is an interesting historical phenomenon that spans far beyond competitive swimming and the scope of this paper.

the body and designing them to be unique for each stroke (Thilmany 2014). In the 2000 Olympic Games in Sydney, Australia, this Fastskin FSII swimsuit was worn by 80 percent of the medalists.

#### 2.2 Developing the LZR Racer

Swimwear companies have long competed to gain contracts and sponsorships with professional athletes and teams. In order to gain these sponsorships, the companies must continue to produce the fastest possible product. Speedo has been able to maintain their place as the world's dominant swimwear company because they continue to invest and innovate in the technology that is needed to swim fast. Although the Fastskin FSII was the fastest swimsuit that Speedo had ever made, they continued pushing to create an even faster one. Prior to the 2008 Olympics in Beijing, Speedo began a partnership with NASA in order to conduct further research. Together, they used high-tech wind tunnels, computational fluid dynamics software, and studied a flume tunnel at Otago University in New Zealand to develop the fastest swimsuit in history: the LZR Racer (Hutchinson 2008).





Figure 1: An image from the patent for the LZR Racer, showing the general shape of the suit and the location of the polyurethane panels. Figure 2: An image of the completed LZR Racer worn by a swimmer.<sup>2</sup>

The swimsuit includes several panels laminated on the outer surface of a base layer of stretchable elastic fabric (Rance 2008). The design of the LZR Racer, like many other swimsuits, is very form-fitting which minimizes the amount of water that that can enter between the body and the suit. The patent for the LZR Racer highlights the use of the base layer covering the torso with strategically placed laminated panels on various parts of the body which are used to create different textures in different areas. These panels are generally across the torso and on the legs,

<sup>&</sup>lt;sup>2</sup> New LZR racer suit (helping flotation and streamlining your body). 360swim. (n.d.). Retrieved January 16, 2022, from https://360swim.com/blog/new-lzr-racer-suit

and they are not placed on the arms of the suit as swimming requires freedom of movement for the arms, so a lightweight fabric without the laminated panels is used for the arms.

The LZR Racer was made from a synthetic material known as polyurethane. Polyurethane is made of polymer resins joined by urethane links and a woven textile made of polyester, cotton, or other fabrics (Blesius 2018). There are three different types of resins that are used to make different types of fabric: polycarbonate, polyether, and polyester. Each of these resins create a fabric of different quality and serve different purposes, such as varying levels of humidity resistance and the amount of activity that they will be used for. By combining these polymers with the woven textile, it creates a material that is water resistant, light weight and flexible.

After its invention in 1937, polyurethane has been used in a variety of applications and has proven to be a very versatile polymer. It was initially used as a replacement for rubber during World War II and served the purpose of coating mustard gas resistant garments. The material then began being used as a form of insulation for several different purpose ranging from houses to beer barrels. As a clothing fabric, polyurethane is very similar to spandex and Lycra and began being used for a variety of athletic attire including biking shorts and dancewear. This material proved to be ideal for designing a fast swimsuit, as polyurethane has properties such as being waterproof which allows for a swimmer to move more swiftly through the water.

One advantage of using polyurethane in swimsuits is that it is much less permeable than most fabrics, which means that less water will be able to pass through the material. This allows air to remain between the swimmer's body and swimsuit which creates buoyancy, another advantage. Buoyancy is the ability for an object, or in this case, person, to float. Increasing buoyancy allows a swimmer to exert less effort to staying afloat in the water so that more energy can be spent moving forward. The water-proof quality of polyurethane also makes the suit much more slippery which reduces wave drag, making it easier for the swimmer to propel themselves. Additionally, the design of the suit shapes the body in a way that reduces form drag (Rance, 2008). This design shaped the underlying part of the swimmer's torso into a more streamlined position which improves agility in the water. The LZR Racer was able to make almost any person's body shaped like an elite athlete due to the compression of the suit. This results in the swimmer being more aerodynamic (or hydrodynamic, in this case), reducing form drag. The compression of the swimsuit also works to improve muscle coordination. By applying pressure to certain parts of the body, one can experience improved circulation, attenuation of muscular oscillations, decrease in muscle damage, and reduced time for recovery of muscle injuries (Yick 2018).

#### 2.3 Impact of the LZR Racer on the Sport

The LZR Racer had an immediate impact on the sport with the arrival of the 2008 Olympics in Beijing. During these games, 25 world records were broken (NBC Olympics, 2008). Of these 25, 23 were set by swimmers wearing the LZR Racer swimsuit (Betuel, 2020). This is an unprecedented mark, as swimmers' times took a jump far beyond anything that had been seen before. Throughout the history of swimming, there has always been a general trend of gradual upward growth in swimmers' speed. This is likely a result of slight improvements in swimsuit technology, improvements in research on techniques, along with other minor factors. However, the jump in 2008 was much more drastic compared to the general trend (Foster, 2012).



Figure 3: This graph is from a 2012 study conducted by Leon Foster, David James, and Steve Haake which shows the jump in performance around the time of the invention of the LZR Racer. The downturn following 2009 reflects the decision to ban the swimsuit.

Due to this substantial effect of the LZR Racer on swimming performance, FINA (the world governing body for the sport of swimming) decided to enact new regulations which resulted in the banning of this swimsuit. In 2009, FINA enacted a new rule which reads, "No swimmer shall be permitted to use or wear any device or swimsuit that may aid his speed, buoyancy or endurance during a competition" (FINA). This adjustment contains language that can be extremely ambiguous; almost all swimwear does, to at least some extent, aid the swimmer. However, the intent of this rule is clear as it was accompanied by changes in the regulations for acceptable swimwear. The new regulations limit the amount of skin that can be covered by the swimsuit: for men, the swimsuit cannot extend below the knees or above the navel, and for women, the suit must remain between the knees and the shoulders. Additionally, the fabric was required to be permeable by air, to not allow an excessive increase in buoyancy. The swimsuits also cannot have fastening devices, such as zippers.

#### 3. Fédération Internationale De Natation (FINA)

The Fédération Internationale De Natation, abbreviated as FINA, is the world governing body for aquatic sports. They control the development for the sports of swimming, water polo, diving, artistic swimming, high diving, and open water swimming. FINA defines the rules for the worldwide development of these aquatic disciplines and ensure the application of fair play. It is made up of member federations from 209 countries across five continents. Along with defining and enforcing rules, FINA organizes world championships and other competitions for each of these aquatic sports and have played a major role in the Olympic Movement which has contributed heavily to the popularity and success of the Olympics.

FINA was founded in London in 1908 by eight national federations in Europe. Following this, aquatic sports began to become more popular in the Olympic Games, as women competed in aquatic events for the first time in the 1912 Games in Sweden. Throughout the 20<sup>th</sup> Century, swimming and other aquatic sports such as water polo and synchronized swimming became well-known events in the Olympic Games. FINA's movement to drive global awareness of aquatic sports was a key factor in the rise of aquatic events in the Olympics and other international competitions.

At the 1968 Olympic Games in Mexico City, the use of technology in swimming began to come into focus as electronic timing made its first appearance. This form of technology corrected human error in recording times, as times could not be recorded perfectly accurately down to the fraction of a second. Using electronic timing allowed more accurate and consistent scoring of times. While swimsuit technology was slowly evolving at this time, this form of technology was not yet highlighted as there were no major changes in performance as a result. The use of electronic timing was not criticized very widely as it was considered fair for all athletes and was objectively an improvement in accuracy, with little effect on anything else. Later debates over uses of technology in sport tend to be more highly criticized due to either having a larger effect on the pacing of the sport (for example, the use of video review in sports like soccer and basketball) or granting what some may consider to be an unfair advantage to certain athletes over others.

FINA's role in setting the rules for swimming is important because they are the governing body and organizers of major competitions in the sport. When the technology of Speedo's LZR Racer swimsuit began to significantly change the sport of swimming, according to many, FINA made the decision to change the regulations for what is acceptable swimwear. For men, they have implemented rules stating that swimsuits may not extend above the navel or below the knees (FINA, 2016). And for women, they must not cover the neck and may not extend past the shoulders or below the knees. This change in the rules made the LZR Racer, along with newer competitors' models, illegal to use.

### 4. The Different Players

The LZR Racer shook the swimming world as an unprecedented number of records were set in such a short period of time. Different groups of people were affected in different ways by this swimsuit. It is important to understand each group's perspective on the situation.

In The Social Construction of Technological Systems (1994), Wiebe Bijker, Thomas Hughes, and Trevor Pinch construct a framework for understanding how new technologies interact with the world around them. The focus of the book is on the development of the bicycle. When the bicycle was first invented, it generated a mixture of reactions from different crowds. The design of the original bicycle was significantly different from the bicycles we know today. Their structure for understanding the web of perspectives from different social groups was to create a tree that included the artifact in question, the social groups that were involved, and the problems and solutions that each social group had with the artifact. In the case of the bicycle, some of the various groups involved were sport cyclists, elderly men, tourist cyclists, and many others. Each of these groups of people identified different problems with the design of the bicycle. For example, the sport cyclists enjoyed the mobility that bicycles granted them and wanted them to become faster, while other groups were concerned with the safety of the bicycle and considered that a problem that needed to be fixed first. With lots of groups holding strong opinions over what needs to be changed about the artifact, it is important to take into consideration the perspectives that these different groups hold.

This framework is useful when evaluating the LZR Racer and FINA's decision to ban it. The social groups involved here include the swimmers, FINA, Speedo and other swimsuit manufacturers, and fans of the sport. Each of these groups has a unique perspective on the technology and what it means to the sport.

#### 4.1 Speedo

Speedo is the world's leading swimwear brand. They have been a leader in innovation for swimwear since the company's birth in 1928. Since then, their products have been worn for more Olympic Gold Medals than any other brand in swimming (Speedo).

Speedo, the company that developed and manufactured the LZR Racer was extremely unhappy with FINA's decision to ban the suit. Speedo claimed,

As a forward thinking company that has invested millions in [research and development], we believe that technology -- properly monitored and adhering to guidelines -- does have a place in all sport. Any move which seems to take the sport back two decades -- such as a possible return to the traditional female swimsuit and male jammer -- is a retrograde step that could be detrimental to the future of swimming (ESPN, 2009).

Speedo invested an immense amount of money and resources into perfecting the LZR Racer, and the fact that it was banned just a few years later is sure to upset any company. The argument that they make is intriguing; technology holds a central role in many sports, and by banning an innovative technology that pushed the sport to new limits, FINA is setting the state of technology in swimming back several years. From the perspective of an innovative company pushing the limits of swimming, it is understandable to see why banning the suit is problematic. Speedo believes that swimsuits should be considered a factor that plays a role in the outcome of the event. While other perspectives may disagree with this, Speedo views this technology as a part of the sport, and by banning it, FINA is actually disrupting the fairness of competition, as Speedo sees it, rather than restoring it.

#### 4.2 Other Swimwear Companies

With the dominance that Speedo's LZR Racer showed in its first few months, competing swimsuit manufacturers including TYR, Arena, Nike, Mizuno, Asics, and Adidas, among others, found themselves left behind in technological prowess. Many of these companies lost major contracts with teams as they chose to opt in favor of wearing the LZR Racer in the 2008 Olympics.

The Japanese Olympic team which had a contract in place with Mizuno and two other suppliers decided to abandon this contract and allow their swimmers to wear Speedo's LZR Racer so as to remain competitive. This move to abandon existing contracts becomes extremely concerning from the perspective of competing manufacturers, as they lose market power and huge financial opportunities. While some companies allowed sponsored athletes and teams to wear other apparel when racing for their national teams, others have threatened to revoke their sponsorships. Many of these athletes who are threatened by this face a dilemma over whether to choose performance or money. Mark Schubert, head coach for the United States' swimming team said, "My advice to athletes is, 'You have a black-and-white decision -- the money or the gold medal.' And it's going to be a real test of character. There is no doubt the suit makes a difference and there is no doubt that there is one manufacturer that's put millions into research while the other manufacturers are more into fashion" (Sports Business Journal, 2008).

In response to this, many of these companies began to produce their own versions of high-tech full body swimsuits to compete with Speedo. Doing this requires large financial investments and is a difficult option for many smaller companies. Some companies were able to eventually match the quality of the LZR Racer and restored their place as a competitive swimwear brand. However, others were severely hurt by the development of the LZR Racer and were only able to become competitive again following FINA's decision to ban full body swimsuits.

Overall, competing manufacturers of swimwear benefitted from FINA's ban, and they were primarily in support of the decision. Had FINA allowed Speedo to continue to dominate the market for competitive swimwear, it would have pushed out smaller companies that were unable to compete with the immense technological advancements that the LZR Racer brought.

#### 4.3 **Professional Swimmers**

One of the major influences on FINA's decision to ban the LZR Racer was the opposition of many professional swimmers to the technology. Many swimmers were frustrated with the fact that they were only able to remain competitive at the highest level of swimming if they committed to wearing the LZR Racer.

As I mentioned previously, some swimmers were faced with the choice between remaining competitive by switching to the LZR Racer and retaining their lucrative contracts with rival companies. When many of the world's best swimmers rely on sponsorship deals for their income, forcing a swimmer to choose between money and success becomes very problematic. Earning a salary as a professional swimmer is not easy; the median income for swimmers is approximately \$40,000 (My Swim Pro, 2021) which is a long way off from what the top athletes in other sports typically earn. While some income comes in the form of salaries from national governing federations and prize money from tournaments, this money is hardly enough to cover basic expenses. Most of a swimmer's income comes in the form of sponsorship deals and endorsements. This means that if a swimmer were to abandon a contract with their swimsuit sponsorship, they would be foregoing one of their largest sources of income. In addition to this problem, many swimmers were in favor of banning the LZR Racer because they felt that it took away from the sport. The most famous and dominant swimmer of all time, Michael Phelps, vowed in 2009 to stop swimming until so-called "supersuits" were banned. He, along with many other swimmers, believed that the suits were taking away from the pure athleticism of the sport. Phelps said, "It will be fun when swimming gets back to swimming" (Bull, 2009). The reliance of swimmers on this technology made it such that the sport was becoming not only a competition based on athletic ability, but also on the technology behind the swimsuit that the athlete is wearing. As I mentioned earlier, Speedo argued that this technology was a part of the sport, and it should be a factor in a swimmer's success; however, Phelps and most other swimmers disagree. The success of a swimmer, in their eyes, should not be reliant on the technology behind their swimsuits, but on their own ability.

Moving the emphasis of the sport away from athleticism alone and incorporating the technology into the design creates a debate over what should and shouldn't be a factor in competition. Some athletes have compared this reliance on technology to perform well to using performance enhancing drugs, using a term called "technological doping" (Klayman, 2008). By using a swimsuit that enhances performance to the degree that the LZR Racer does, the races became unfair to anyone who was not using the more technologically advanced swimsuit. While all swimmers did have access in some way to the LZR Racer, many had to sacrifice their sponsorship deals and beliefs in the purity of sport by changing to Speedo's supersuit.

#### 4.4 FINA

The most important player in this controversy, in my opinion, is FINA, the organization responsible for setting and enforcing the rules for competitive swimming. Although swimsuit technology has been evolving rapidly throughout the history of competitive swimming, FINA

had never regulated swimsuits prior to this controversy. The LZR Racer led to FINA's first regulations regarding the design and material used in competitive swimsuits.

Initially, FINA was opposed to banning the suit, taking Speedo's side in the belief that the technology was the next stage in the sport's evolution. FINA expected that Speedo's competitors in swimsuit manufacturing would soon develop their own full-body swimsuits that rivaled the LZR Racer, and that Speedo would not maintain the hold it had gained over the swimming world due to the statistics from the 2008 Olympics, in which 23 new world records were set while wearing the LZR Racer.

An interesting aspect of FINA's perspective that is important to consider is that FINA had a history of having their own sponsorship with Speedo. In 2004, FINA and Speedo agreed to a contract in which Speedo gained exclusive marketing, promotional, and advertising recognition in FINA competitions. This partnership gives FINA's initial decision to not ban the LZR Racer a new perspective, as there may be economic motivations for FINA to take Speedo's side in this debate. By banning a product that gave Speedo such a strong position in the market for competitive swimwear, FINA would be risking their partnership with Speedo which could have adverse effects on their own position as leaders in the swimming world.

On the other hand, Speedo had grabbed such a strong hold on the competitive swimming community due to athletes' need to wear their product as opposed to other companies'. This grasp that Speedo had gained over the sport could have potentially threatened FINA's power as the international governing body in the sport of swimming. FINA's decision to ban the LZR Racer restored balance to the economic environment surrounding swimming. Swimmers no longer needed to abandon existing sponsorship deals to switch to Speedo's product, and smaller competing brands did not have to invest immense resources into matching the technological power of the LZR Racer.

FINA ultimately decided to ban the swimsuit. There is no single explicit reason why they made this decision, rather it was likely a combination of the problems created by the LZR Racer. The rift that the suit caused in the market for competitive swimwear in which Speedo gained an incredible amount of market power is one contributing factor; when athletes begin to abandon existing sponsorships just to remain competitive, there is certainly room for concern. Another important factor was the outspoken opposition to the technology from high profile swimmers like Michael Phelps. If the world of swimming were to lose its most recognizable face, this would certainly lead to a decrease in popularity of the sport and contradict one of FINA's missions which is to drive global awareness and encourage people in sport, especially aquatic sports (FINA). By banning the suit, FINA angered Speedo, but appeased the majority of players in the world of swimming including swimmers, coaches, fans, and the majority of competitors in the swimwear market.

#### 4.5 Non-Professional Swimming

The LZR Racer certainly had a drastic impact on the world of competitive swimming at the highest level, but it played a much smaller role in lower levels of the sport. To be a high-level swimmer takes much more than just wearing a swimsuit; the LZR Racer offers a distinct advantage to swimmers at the highest level, where shaving fractions of a second off times is extremely valuable (Dickerman, 2008). However, at lower levels of swimming, the LZR Racer is not going to turn you into a world class swimmer, so its relevance at any level below the highest is relatively small. On the other hand, there were some Division I NCAA swimming teams that did make an effort to utilize the LZR Racer. Georgia Tech's men's swimming team had to make budget cuts in various aspects of their season to afford the \$550 swimsuits for their athletes (Outsports, 2009). They decided to save on hotel rooms by bunking three swimmers to a room and make other significant budget cuts to afford the new swimsuits. The reliance on the LZR Racer to compete at a high level extended to NCAA Division I but was not as prevalent at levels below this.

Bijker, Pinch, and Hughes believed in the importance of understanding the various social groups involved in a controversial piece of technology. The case of the bicycle was resolved by creating a new design for tires that improved the stability of bicycles which was acceptable to those who were worried about the dangers of the bicycle; this new design also made the bicycles faster which made sports cyclists happy as well. In this case, the solution was to find a new design that solved both problems. In the case of the swimsuit, there is no solution that resolves all of the concerns of each party, so finding a resolution that was acceptable to all was not entirely possible. Speedo believed that banning these suits sets the sport back several years and that their technology is revolutionary for the sport. On the other hand, many athletes believe that the technology has had too large of an impact on the sport, and it takes the focus off the athlete and places it on the technology. FINA's decision to ban the suit is a resolution to the conflict, but it did leave Speedo unhappy. Despite this, Speedo remains the leader in the competitive swimwear industry.

## 5. Fairness in Sport

One of the biggest concerns surrounding the LZR Racer revolves around the idea that the swimsuit gave swimmers who wore it an unfair advantage. However, the idea of fairness in sport is extremely complicated. It is difficult to define what it means to be fair in sport because the whole purpose of competition is to find different ways to gain an advantage over your opponent. This can be accomplished in a variety of ways, some of which are deemed legal, like spending more time practicing, while others are deemed illegal, like using performance enhancing drugs. What makes one method fair versus another is not often as clear as it seems.

#### 5.1 **Politics in Sport**

Sport is an industry that is filled with politics and these politics lead governing bodies to make certain decisions. The collision of sports with economics results in a commercialization of the industry. Lincoln Allison's book *The Global Politics of Sport* (2005) investigates a wide range of examples of politics being present in sports and how they affect the sport.

Powerful organizations, such as FINA, FIFA, the IOC, etc. hold immense power over the entire industries for their respective sports. The fact that relatively small, private organizations can hold the power to make rule changes, business decisions, and enact other policies that have an enormous effect on the entire sport carries significant challenges. Throughout the past few decades, sports have been heavily commercialized and commodified so that they are major industries with huge economic potential. When one organization holds control of the entire sport, the economic decisions of that governing body will affect everyone within the sport. In the case of the LZR Racer, FINA's decision to ban the suit affected a variety of social groups, which I addressed in section 4.

Langdon Winner, in *Do Artifacts Have Politics* (1980), believes that any piece of technology has some political association, whether it be explicit or implicit. Winner uses the example of bridges over streets in Long Island, New York. These overpasses have a much lower clearance than most other overpasses across the country. On the surface, this seems like nothing more than a peculiarity, and people do not often give features like this much thought. However, Winner claims, the design of these bridges was deliberate. Robert Moses, the architect behind much of New York City's infrastructure during the mid-1900s, decided to design the overpasses in this way so as to discourage public transportation and other large vehicles from entering the area. The thought process was that public transportation was generally used by classes of lower economic status, and Moses wanted to limit access to the upper-class neighborhoods.

This example is a form of technology that was deliberately designed in a certain way for political purposes. Winner offers another example of a technology that was not designed for any political goal but had economic and political ramifications as a result. The mechanical tomato harvester allowed for vast improvements in the farming industry and was designed for that purpose. However, following this invention, the number of tomato growers declined from approximately four thousand to about six hundred. The expensive harvester did serve its purpose to improve the efficiency of harvesting tomatoes, but this came at a cost for those who were unable to afford one.

We can use Winner's framework for understanding the role of politics in technology to interpret the case of the LZR Racer. While the LZR Racer was developed for the purpose of improving swimming performance, there were consequences on various groups in the world of swimming. Speedo's revolutionary swimsuit gave them a firm grasp on the competitive swimwear market and created a new environment for swimming in which the sport became more reliant on technology than in the past. The LZR Racer had immense political ramifications on the world of swimming that extend far beyond the intended purpose of the suit to improve swimming performance. These political ramifications led to a controversy in which FINA decided to create new regulations, banning the swimsuit.

#### 5.2 Fairness vs. Equality

The idea of fairness in sport can often be confused with equality. Sports are inherently unequal in that if everyone were to engage in the same training and use the same equipment, then there would be very little purpose to the sport at all; competition is the main idea of sports, and there are always going to be winners and losers. However, fairness does call for every individual to have some degree of equality in opportunity. Sigmund Loland discusses fairness in his 2002 book *Fair Play in Sport*. Loland offers the definition of fairness with three main points:

The competitors are given equal opportunity to perform by eliminating or compensating for significant inequalities that the competitors cannot influence in any significant way and for which they cannot be held responsible;

Athletic performance is interpreted as based on talent and individual effort, and performances adhere to a basic norm of not exposing others or oneself to unnecessary harm;

Unequal treatment in the distribution of advantage is in reasonable accordance with actual inequality in athletic performance, and unequal treatment in terms of eliminating or compensating for advantage gained through rule violations is in reasonable accordance with the actual inequality that has arisen due to the violation (105).

In short, Loland believes that an athlete's performance should be based on their own individual talent and effort while removing inequalities that are out of the athlete's control. Applying this

framework to the case of the LZR Racer, I believe that Loland would support FINA's decision to ban the suit because the swimsuit added a significant advantage for the wearer. This goes against Loland's idea that fairness implies that performance should be based on talent and effort, so the LZR Racer can be seen as unfair in this context. This, however, leads to a problem as technology has become a focal point across a wide variety of sports. Loland does acknowledge the role that technology plays, and argues that where technology is necessary, it should be standardized for all competitors.

Racing sports make for an interesting application of Loland's framework because they are generally individual events rather than a team effort. One example of a sport that inherently requires the use of lots of technology is NASCAR. In this sport, there is much debate over whether the outcome of the race is more dependent on the driver's ability or the quality of the car. Former NASCAR champion Brad Keselowski claims that evaluating success can be equated to a report card, "you look at it almost like a GPA, and the guy with the highest GPA wins." (Gluck, 2013). Keselowski believes that each driver's success is a sum of several factors that go into winning, including the driver's skill, the engine, the setup of the car before the race, and many others. Auto racing is unique because the car is a necessary part of the event. When contrasted with a sport like swimming which does not require any technology, it becomes difficult to compare them. However, NASCAR has regulated their cars in a very interesting way. Looking back several decades, each car manufacturer designed their cars differently, and the differences gave different drivers advantages at certain tracks. In recent years, NASCAR has made it so that all cars must follow much more strict regulations, and now the cars are almost identical across all makes.

Comparing the regulation of technology in NASCAR to swimming is relevant because of the differing roles that the technology plays in each sport. NASCAR is an example of a sport where performance is determined by a sum of several factors that include both the individual talent of the driver and the technology in the cars that are being driven, while swimming is a sport where, historically, technology has not played a role in an individual's performance, rather the swimmer's athletic ability has been the focus of competition. I believe that if a sport like NASCAR, where technology plays such a large role, can regulate the use of that technology to promote fairness, then a sport like swimming, where technology inherently does not play as large of a role, should also have regulations in place to ensure that unequal technology does not create an unfair environment.

Sigmund Loland acknowledges the role that technology plays in sport but believes that it should be regulated so that certain athletes do not gain an advantage due to having superior technology. This raises the question that if the LZR Racer was accessible to all swimmers, would it be considered unfair? At a cost of \$550, the suit was certainly expensive as far as swimsuits typically go but was still affordable for most national federations to supply their swimmers with. I would argue that the suit was equally accessible for swimmers at the top level, and that this mitigates the unfairness that resulted from the LZR Racer; however, FINA's decision to ban the suit was based on more than just fairness. Returning to Langdon Winner's argument that all technology is inherently political, we can understand the complex environment that resulted from the LZR Racer. The LZR Racer was heavily opposed by most professional swimmers, many of whom were forced into deciding between success and existing sponsorship deals with other swimwear companies. Furthermore, the swimsuit had become a major factor in determining an

athlete's success, an idea which many were opposed to. FINA's decision to ban the LZR Racer was based on much more than whether the suit was determined to be fair or not.

#### 5.3 Which Factors Should Determine Success

Thomas Murray expands upon Loland's analysis of fairness. He believes, "fairness requires diminishing the impact of these factors we believe should not affect the outcome. We still need to decide which factors should count" (Murray 2009). In the case of NASCAR, the question of to what extent the design and technology of the car should count towards the outcome is much more ambiguous than in the case of swimming. However, even in NASCAR, where the technology itself plays an extremely central role in the sport, the cars are standardized and heavily regulated. In swimming, technology plays a much smaller role, as the sport does not require technology to the same degree. While the swimsuit certainly plays a role in a swimmer's performance, we return to Murray's question of whether swimsuits should count in affecting the outcome. While different people will have different perspectives on this question, I would argue that the swimsuit should have less of an effect on the outcome of a swimming race than a car's effect on a NASCAR race. This question of fairness surrounding the use of technology in racing sports is heavily dependent on the role that you want that technology to play in the outcome of the event.

Rayvon Fouché, a professor of American Studies at Purdue University, has done extensive research on what he calls the technoscientific revolution in sports. He claims, "The goal of sport is to get the largest legal advantage you can. It's not about fairness; it's about inequalities" (Chamberlain, 2012). In sports, athletes are always looking to find an advantage however they can. There is often a blurred line between where this quest for an advantage is legal and where it becomes considered cheating. Fouché claims that technology plays a central role in this search for advantages, and therefore, must be central in determining what is considered an acceptable use for this technology (Fouché, 2017). Cheating is often socially constructed by what we believe it to be.

One example of an act that is widely accepted as a form of cheating is the use of performance enhancing drugs. However, David van Mill (2015) argues that it is not so simple. He expresses two reasons why people often claim that performance enhancing drugs should be illegal: fairness and safety. People often claim that using drugs in this way is unfair to the competition because it gives an athlete an advantage over their opponents. However, van Mill argues that athletes do a wide variety of activities in order to gain advantages over their opponents. Athletes utilize coaches, psychologists, dietitians, high-altitude training, and many other strategies to improve their performance. Using performance enhancing drugs could just be another category here. The fact that some athletes engage in an activity to improve their performance does not necessarily make the activity unfair. The other typical argument that van Mill identifies against performance enhancing drugs is that they are unsafe. However, van Mill argues that, in many sports, the danger from just playing the sport is at least as harmful as the danger of using drugs to improve your performance. The NFL has had to pay millions of dollars to athletes as a result of brain injuries they acquired while playing in the league. It is difficult to argue safety as a reason to ban something when the sport itself is extremely dangerous already. Van Mill is not arguing in favor of legalizing these performance enhancing drugs in sports, but simply pointing out the complexity of this question. This example is an illustration of how fairness in sport is not as straightforward as it may seem on the surface.

Cheating in sport is especially relevant in individual sports. The benefit from small improvements in performance leads to significantly larger benefits in individual sports than in

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team sports. Mark Duggan and Steven Levitt (2002) investigate corruption in Japanese sumo wrestling. Sumo wrestling, as the national sport of Japan, has a 2,000+ year tradition heavily focused on honor, ritual, and history. Finding corruption within a sport that is this centered around tradition would imply that all sports are subject to corruption and cheating. The structure of the sumo wrestling tournaments leads to a very large benefit to cheating in certain situations. Each wrestler plays a total of 15 matches, and the incentives for winning 8 of those 15 are extremely high. This means that if a wrestler is 7-7 entering their final match, they have far more to gain from winning than an opponent who is 8-6. Therefore, we see a large incentive to engage in corruption. Duggan and Levitt find that the data supports the hypothesis that corruption exists surrounding important matches. This further supports the idea that athletes are willing to go to extreme lengths to gain small advantages over their competitors. The existence of the LZR Racer, a swimsuit which gives a swimmer a significant boost, ensures that athletes will all attempt to use this to their advantage. While there is a difference between corruption and using technology, the fact is that when athletes attempt to gain advantages over their competitors, fairness will always come into question.

One of the major concerns that arose during the controversy over Speedo's LZR Racer was brought up by Speedo in their argument against banning the LZR Racer in that the use of technology is a part of the sport. This ties into Murray's discussion over what should and should not be included in determining success in sport. Swimmers like Michael Phelps tend to believe that success in swimming should be determined by individual athletic ability, and not by the quality of the swimsuit that they are wearing, as Phelps claimed that he was looking forward to "when swimming gets back to swimming" (Bull, 2009) indicating that he believed the role that swimsuits were playing in the sport was too large. Determining what factors should and should not play a role in an athlete's success is central to deciding what is fair versus unfair. This question is one that is up to each individual's interpretation of the sport and technology, so there exists no simple answer. I have attempted to highlight the arguments for either side of the argument but deciding what extent that technology should affect outcomes in sports is going to vary in every case and will ultimately come down to a matter of opinion. That said, I believe that FINA made the correct decision in separating the technology of the swimsuit from the athleticism of the swimmer because of the social, political, and economic effects that the LZR Racer had on the world of swimming.

#### 6. Conclusion

Technology has always played a role in sport but as it continues to advance, the degrees which technology has been implemented in sport has changed significantly. The LZR Racer vastly changed the sport of swimming as performance improved at an unprecedented rate. This immense impact on the sport caused the technology to come under heavy scrutiny until FINA created new regulations that banned full-body swimsuits. Despite their decision to ban the LZR Racer, FINA declared that records set by swimmers wearing the suit will stand.

The case study of Speedo's LZR Racer highlights how different social groups take varying perspectives on the controversy, and how these different perspectives fit into the overall world of swimming. It can be easy to fall into your beliefs based on your own individual perspective on the issue, but it is important to understand how your perspective fits into the overall political environment. Both Speedo's perspective and professional swimmer's perspectives on the LZR Racer are perfectly reasonable, but they each are just one player in a complex web of social groups all experiencing the same phenomenon from different perspectives.

Other sports have also seen various implementations of technology have a large impact on the sport. In soccer, the use of video assistant referee (VAR) has created a divide among fans. VAR allows officials to review and correct officiating decisions. While this offers a clear benefit in making the correct call during controversial plays, its use has created lengthy stoppages in play that interrupt the flow of the game. The same has been seen in other sports as well, including basketball. The balance between maintaining the purity of the sport and making use of technological advancements opens room for debate over what role technology should play in sport. Debates will continue to spur over the use of technology in sport as technology advances and becomes implemented in a wide variety of applications. In this thesis, I have attempted to create a framework for understanding the social environment that results from the implementation of new technologies in sport and understanding the factors that should be considered when deeming a technology acceptable or unacceptable.

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