Wahoo SplashTrack: A Tool to Enhance Swimmer Start Performance

An Analysis of the Historical and Societal Effects of Capital and Technological Investment on Basketball Players and Society

A Thesis Prospectus
In STS 4500
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The Faculty of the
School of Engineering and Applied Science
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In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Engineering

By
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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

  The world loves sports. We love watching, playing, and consuming sports and the entire entourage of television, social media, and cult-like fandoms of professional sports teams. This growing enthusiasm has propelled sports like basketball and swimming to unprecedented levels of popularity and investment, bringing capital into areas from athlete training to specialized sports technology. In this paper, I will explore how capital and technological investments in sports have influenced both athletes and society, shaping who athletes are and where they come from.

  My technical project, a collaboration between the University of Virginia's Department of Electrical and Computer Engineering and the Virginia Cavaliers Swimming and Diving teams, reflects this growing technological and capital investment in athletics. The international success of the swimming team and its coaching staff have created pressure to perform at the highest level and continuously improve and reach faster times. Our team was tasked to develop a system to analyze key metrics in a swimmer's start from a block. These metrics can be used to improve start velocity, which is critical in competitive swimming. This partnership, supported by significant academic and capital resources, highlights the level of investment organizations make to advance athlete performance. This kind of investment isn't limited to just the swim team at UVA and is common across national universities who spend to recruit, develop, and maintain their athletes. This is mirrored at an even higher level across professional sports leagues, particularly in high revenue leagues like the NBA.

  The STS portion of my paper dives into how technological and financial investment in basketball has created a societal structure around the sport and has created levels for elite athletes across intramural, collegial, and professional leagues. My analysis will cover the historical and more broadly, the Social Construction of Technology in reference to technology and sports science have advanced in basketball, why it has been so prevalent, and what effects it has had on society and athletes. Why basketball, and not other sports that have similar levels of popularity and advancements in technology? Simply, a matter of preference as well as the existence of a very well-known structure of basketball development from youth leagues like AAU, to NCAA Divisional leagues, to major professional leagues across the world. Access to basketball is also traditionally easier in many ways than many other sports that take significant field management or specialty equipment. While requirements like a ball itself, a court, and a good pair of shoes are needed, it is significantly less than the other sports that have major professional leagues like hocket, baseball, and football. This makes a lower barrier to entry and relatively even baseline level of access that will highlight the differences in the average athlete and those at the top.

Technical Project

My technical project was born out of one of the nation's top swim and dive programs that has been powered by elite talent and guided by accomplished coaches and staff. Swimmers across different events and categories have competed at the highest level across the NCAA as well as international competitions where they have broken records and accrued accolades. This has only

encouraged the program to do more, train more, and invest even more into their swimmers, their staff, and the analytics that allow swimmers to enhance their performance. One area that hasn't been targeted in training and analytics is a swimmer's start, which can often have a drastic impact on how a swimmer performs given that mere seconds in the air are also the fastest a swimmer will be. Notably, an elite UVA swimmer, Gretchen Walsh, has a very average start in terms of reaction time and velocity off the starting block compared to other elite swimmers. This hasn't stopped her from getting to gold from her dominance when she is in the water, but an improvement in her start could mean she has even more time to take off her records.

The head coach of the swim team, Todd Desorbo, as well as Professor Ken Ono who assists athletes in mathematical analysis proposed to the ECE Department that they wanted a way to measure primarily the force a swimmer outputs coming off a starting block, and the reaction time to a starting cue as a secondary statistic since reaction time isn't necessarily a productive training metric. Our goal was to use the concepts and techniques we have learned throughout our education in the electrical and computer engineering department to create a system to accurately measure force and reaction time and present the data in a consumable and actionable way for swimmers and their coaching staff.

Our project is led by team leads for different areas of our project. They help us stay organized and on top of tasks, while giving each person a role they can focus on as well as the ability to delegate effectively when needed. Our electrical lead focuses on sensor components, circuit design, as well as soldering and electrical connections. Our mechanical lead focuses on physical components like working with start block, designing and manufacturing custom parts, as well as system integration of parts. Our microcontroller focuses on our myRIO microcontroller to develop functionality in LabView, handle input and output signals, as well as integrating with local networks. Our software lead focuses on processing data from our sensor, handling and storing metrics in cloud services, and designing a user interface for our customer. Finally, our testing lead ensures that each part of our project has a well-developed testing plan and ensures the functionality of whole system integration.

Our project conception and initiation has been planned to be from September 2nd to September 27th, design and simulation to be from September 16rd to October 14th, project implementation to be from September 23rd to November 11th, and validation and presentation to be November 11th to December 9th.

STS Project

Basketball exemplifies the kind of relationship between technology, performance, and investment that has changed society to adapt to the demand for elite athletes and their abilities. At the highest level, the NBA has seen rapid increases in total revenue as well as steady growth in the financial valuations of teams across the league (Statista). In this STS portion, I will be examining technological advancements in basketball in training, recovery, and strategy. My historical and societal investigation will delve into how technology has shaped the sport of basketball, the impact it has on its athletes, and how society has changed to meet its demands.

While sports may initially seem trivial, they reflect larger societal issues, from economic disparity to racial and social dynamics.

My research focuses on the community around basketball: the athletes, coaches, trainers, and families supporting players through their journeys. While basketball does have the baseline level of access that is more readily available than many other comparable sports, it is important to evaluate the impacts that race, income, and culture have on the athlete population and examine its importance and effects on outcomes. This means taking a further look into what path elite athletes take to their success: what familial support they had to pursue basketball, what tools/resource they had at their disposal through their school or league, and how their finances have helped/hurt their road to the top. Examining the resources and support systems that athletes encounter will allow for a comprehensive look at how technology either serves as a leveling tool or as a barrier to entry in sports. This has relevance in not just sports, but in other types of outcomes whether that be in education, salaries, or job positions. The downside of examining those at the top is that it does leave out those who aren't considered at the top of the game either professionally or collegially. Those who never make it to the next league or the next step in the journey of basketball will be hard to account for. My research will have to take into consideration how survivor bias will play into the athlete population, and what conclusions we might be able to draw from those that are missing.

At its heart, my research is a people driven historical and societal investigation, meaning the methods and resources employed will be based primarily around the data of athletes as well as their own personal accounts of what they believe to be major impacts on their journey. Particularly around a sport that has as much popularity and media presence as basketball, it will be difficult to separate professional from collegial, and collegial from intramural in terms of cultural significance. Raw data formats from NBA, or NCAA on the player base will be helpful in examining the demographics of the athletic population in comparison to the national population. An important distinction that must be made in researching around basketball in NBA and NCAA will be between media and tabloid interpretation versus firsthand account and statistics. Raw interview transcripts will need to be derived from media and journalists' coverage whose biases will need to be researched, whether their motives are to entertain, inform, or cater to an audience or fanbase. This mix between raw demographic data and personal account is needed for this historical and societal investigation to get a holistic view on how technology has changed and the effects on individual athletes and the population. Data will give context to individual beliefs and will give way to better understanding the role of technological and capital investment in basketball and, to a greater extent, sports in general.

The primary frameworks I will be use in this STS project will be from a historical and SCOT (Societal Construction of Technology) perspective. A historical framework is important to understand how basketball has progressed in its rules, techniques, popularity, and cultural significance. This will cover how the sport was invented, the role that the first players and teams had in its growth, and the context it had on overall societal development. As we cover how basketball has been shaped into the modern era and its professional and amateur structures, then we can examine how technology has been developed for the sport of basketball through the

cultural and financial incentives that have powered basketball in popularity. The key elements in the SCOT framework are the problem, the social group it impacts, and a technological solution (Douglass). In the context of my STS Topic, the problem is more so the demand for top athletic talent that can generate more revenue. The social groups it impacts are athletes and their support systems, the shareholders of major sports leagues, and consumers. The technological solution has been all the ways technology and capital have been used to improve athletic performance through training, recovery, and strategy. My study and the data I use, almost exclusively studies of those at the top in professional and collegial basketball, imposes a survivorship bias that leaves out those that haven't made it into a spotlight position that gains coverage in media and stat sheets. These frameworks will try to give those players who don't explicitly have the voice or representation the wider context of how society invests in the development of basketball athletes.

The key primary sources that I will be using to frame the STS project are two papers that discuss the role of race, income, and background have on elite basketball players and the odds of making it to the NBA. The first key text is an article written for the International Review for the Sociology of Sport that investigates the popular culture concept of rags to riches stories of professional basketball players (Dubrow and Adams). It compiles data from a sample sub-population of NBA players and investigates local, regional, and national coverage of those individuals to gain a race, social, and familiar structure of their background. It then discusses the outcomes and what data says about the misconception of rags to riches. The second text is a 1999 publication in the Marquette Sports Law Review that covers the story of African American athletes and their history in athletics and Basketball (Smith). While it is a dated source that doesn't coincide with the modern era of NBA rapid growth in technology and revenue, it does discuss important history of African Americans and their roles in sports. The other two sources are raw data formats on the NCAA and NBA that has data on athlete populations. The NCAA dataset has demographic data on gender, race, and ethnicity broken down to every sport, division, subdivision, as well as their coaching staff (NCAA). The NBA dataset is a compilation of multiple information sources has data on player statistics, salary, race, country of origin, and other metrics that are important when analyzing the NBA (Wen). These two sets of raw data provide important insights into racial demographics over time which can be used in conjunction with personal accounts to create a wider context.

Next Steps

The timeline for my STS thesis is shown below which includes Prospectus finalization to the thesis completion in the Spring of 2025. My Prospectus and my Technical Project will be completed on December 6th, 2024. This will make the next step in my thesis process to be conducting further research into the societal and historical context of technology and capital investment in basketball. This will include trying to better understand the whole picture of basketball and the impact of technology in youth, collegiate, and professional leagues. Background research will start December 6th, and is planned to be complete by February 1st, 2025, but is flexible into the Spring semester. The STS paper is planned to be completed by

March 1st, 2025, and will allow another month for the entire Thesis to be completed by April 1st, 2025.

Prospectus Finalization -	December 6th, 2024
Technical Project -	December 6th, 2024
Background Research -	December 6th, 2024 – February 1st, 2025
STS Project -	February 1st, 2025 – March 1st, 2025
Thesis Completion -	April 1st, 2025

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