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### Technological innovations and its application in the field of swimming

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#### Abstract

The ultimate goal of any world-class swimmer is to break a record, and technology enables that accomplishment. Since the start of the Olympics in 1896, the primary focus of swimsuits was modesty rather than performance. Suits covered the majority of the body and were made of wool, which made swimming difficult as they tended to absorb water and get increasingly heavier as the race went on. While materials like silk were lighter and less absorbent, their exorbitant cost prevented them from being available to most competitors. The development of Fastskin changed all that. Fastskin is a biomimetic material that is based on the design of shark skin; Fastskin mimics the dermal denticles found on shark skin that reduces drag more effectively than the smooth surface of human skin. Olympic swimming in the 2008 Beijing Olympics, the LZR had a tremendous impact on the competition results. Nearly 94% of races won and 98% of records broken were done by competitors wearing the suit. There is a lot of science and engineering involved in the development of this super suit, from the choice of fabrics to the positioning of the seams. For three years, Speedo collaborated with scientists from NASA, universities, and sport institutes, and experimented with over 60 materials. In the end, they came up with a design possessing key improvements from their previous swimsuits that: minimizes drag, maximize support to the muscles; and does so without constraining motion.

**Keywords:** Biomechanics, swimming, technology

#### 1. Introduction

Nearly every Olympics, we hear about a new broken world record in one sport or another. While much of this can be attributed to better training, coaching, and dietary techniques, the headlines never focus on the impact that technology has on these records. Although we like to believe that new records are a result of people pushing boundaries, this is not necessarily the case given the numerous examples that sporting records moved in lock-step with technological innovation. Although many factors contribute to success in sports and technology, much attention has been drawn to innovations in sports equipment including performance enhancing machines and the evolution of competitive swimsuits. Every minute aspect in the technological aspects of swimming has made a huge impact on performance as well as the demands of each competition. The highly informative part in technology is so many world records have breaking with the help of technological advancement. Improvements in swimming technology on world and American records broken from 1969-2009. While swimming technology includes body techniques, much attention has been drawn to innovations in sport equipment including performance-enhancing machines and the evolution of competitive swimsuits

#### 2. Technology in swimming

Advances in training techniques, pool design and swimsuit technology have contributed to the increases in speed for swimmers, who also enjoy financial incentives that allow them to

remain in the sport longer than they would have two decades ago, when the Olympics were restricted to amateurs. If Phelps ties the record of seven swimming gold medals won by Mark Spitz at the 1972 Munich Olympics, he will receive a \$1 million bonus from Speedo, the swimsuit manufacturer.

As there is little technology used within swimming, much of the advancement and innovation has mainly focused on textiles. Since athletes are required to be covered, most of the focus has been on reducing the drag caused by swimsuits because there is little else to alter other than removing body hair. "When technology is used in a sport, it is important to be in control of the way it is being developed and where it might lead us," Claude Fouquet, the technical director of the French swimming federation, said in reference to swimsuit technology.

Since the start of the Olympics in 1896, the primary focus of swimsuits was modesty rather than performance. Suits covered the majority of the body and were made of wool, which made swimming difficult as they tended to absorb water and get increasingly heavier as the race went on. While materials like silk were lighter and less absorbent, their exorbitant cost prevented them from being available to most competitors. The development of materials like nylon in the 50s and Lycra in the 80s set the pace of innovative swimwear. These textiles enabled swimsuits to be form-fitting and less water absorbent made with synthetic fibers spun out of polymers. This means they are one long solid strand, rather than multiple porous cotton strands woven together.

Further change came when designers better understood hydrodynamic forces; rather than minimizing the size and spread of the suit, it was understood that advantages could be gained from manipulating the body's contact with water. Previous designers worked under the assumption that textile technology could not reduce the drag between human skin and water. The best means of increasing speed was to minimize suit size as to maximize direct skin to water contact. Critics suspect that the suit aids buoyancy in the water, in violation of performance-enhancing rules set by the international swimming federation, known as FINA. Alberto Castagnetti, the Italian national swim coach whose team wears a rival brand, has equated the Racer with "technological doping." Some say the suit can boost performance as much as 2 percent; that can mean the difference between a gold medalist and an also-ran.

The development of Fast skin inspired further modification to the concept of full-body suits; Speedo developed a new type of body suit (aptly called the LZR) in collaboration with NASA that was specifically engineered to reduce drag and increase performance through the use of computational fluid dynamics. These fluid dynamic studies led to the creation of a new ultrasonic bonding technique, as it was identified that stitching increased drag by up to 6 percent. Furthermore, the suit offered compression in specific areas such as the abdomen, which reduced the need for athletes to expend energy on maintaining proper form; this compression also had the effect of trapping air in the suit, which increased the buoyancy of the swimmer.

High-technology swimwear are scientifically advanced materials used for swimwear in competitive water sports such as swimming and triathlon. Materials of this type are normally spandex and nylon composite fabrics with features to reduce drag against the water. The fabrics include features that increase the swimmer's glide through water and reduce the absorption of water by the suit as opposed to regular swimsuits.

Swimmers are always striving for the best form, but the complicated physics of flowing water has usually meant research lags far behind the latest techniques. Now, new technology is starting to catch up with the needs of swimmers and their coaches, and may help to improve training regimens for the next generation. During the Beijing 2008 Olympic Games, swimmers broke twenty-five world records and sixty-six Olympic records, leaving only a single previous Olympic record surviving. While some of that success is clearly due to amazing athletic talent, the goal of this paper is to identify and measure the role that technological innovation has had in speeding up the elite swimmer, and therefore the rate of swimming record breaks. The Perfect Material In the past: Hairless skin better than suit Human skin: Too porous, turbulence too high Shark skin: Scales spaced very closely together Hydrophobicity, turbulence control → Drag resistance "slice the water. "The Perfect Shape Extreme tight fit: Streamline Body shape – reduce (bad) Vibrations.

More sophisticated pool design has also helped to dissipate wave action. The pool in Beijing is three meters deep, compared with two meters for many racing pools. The added depth is designed to lessen resistance. For major international competitions, like the Olympics, the pool is 10 lanes wide, instead of 8. The two empty outside lanes serve as buffers, keeping the waves from ricocheting, dispersing them instead to a gutter system that is flush with the surface of the water. The plastic buoys that serve as lane dividers are designed to direct water downward instead of outward. The nonskid starting blocks are meant to facilitate a propulsive takeoff, similar to track and field, which can shave valuable ticks off the clock.

### 3. How does a tech suit make you swim faster

A range of technologies to help cut down on drag and also improve oxygen efficiency. To begin with, tech suits are made from a water repellent material, often referred to as hydrophobic. This material doesn't absorb water, which would otherwise weigh the swimmer down. Tech suits also use compression to give a closer fit. This is crucial for swimmers because a slimmer profile helps to streamline them and cut down on drag. Compression also helps to improve circulation, which can boost performance. Many tech suits also lack seams, which makes them smooth and reduces drag even further. biomimetic design emulates the hydrodynamic efficiency of the dermal denticles of a shark's skin and "super-stretch" characteristics of the fabric improve shape retention and increase muscle compression to reduce vibration and retain muscle shape to reduce fatigue and power loss. It is the most technically advanced swimwear ever made It has been proven that tech suits make you faster. They have broken records, they've been developed in labs by professionals and they have had huge budgets poured into their creation. Scientific research into the effect of tech suits on drag and speed in the water has also returned positive results they reduce friction and drag in the water, increasing the efficiency of the swimmer's forward motion. The tight fits allow for easy movement and are said to reduce muscle vibration, thus reducing drag. This also reduces the possibility that a high forwards dive will remove a divers swimwear as swimming technology continues to improve, swimming records should keep falling. The bulk of that phenomenon is due to factors outside of our model, showing that technology plays a demonstrably small role, at least as measured here. Whereas an average of 30 records fall every year each technological innovation can only be held accountable for 1/3of one record

break per year

The advancement of swimming goggles over time has vastly improved the overall performance and participation of swimming. It has enabled an increased distance and time for people to swim, and has improved the level of participation in the sports for people of all ages.

#### **4. Conclusions**

The use of technology in sports is growing rapidly. The new methods and advancement in technology have created a huge impact on the performance of athletes, especially in the field of swimming. The modern trends in swimming suit, swimming pools and goggles help a lot in securing medals and also to break world records. If a sport or game has legislation to protect it, it will benefit from technology. Technology ensures fairness in sport and games. Design. Sport is big business, and there is a lot of money invested into the design and development of sports equipment and clothing to help athletes improve their performance. Technology aids an athlete to improve their performance, but without directly changing the athlete's body.

With the progress of technology being an inevitable influence on Olympic sports, it's critical to prevent technology from edging out human effort as the key focus of the games in order to maintain the integrity of the competition.

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