



## Technology, Sport, and the Body

**A**fter completing this chapter you should be able to:

- define technology as it relates to sport and exercise;
- explain four different theoretical positions regarding technology;
- describe how science and technology have transformed sport over the years, especially elite sport;
- identify and provide examples of the different types of sport technologies;
- argue the pros and cons of technology in sport.

Sport and exercise science, like most areas of life, has been affected greatly by technological advances. In fact, it is difficult to imagine modern sports and the various subdisciplines of exercise science without the technologies that we currently take for granted. Can you imagine doing biomechanical analyses without computers, assessing body composition without underwater weighing, or training for Olympic-level track and field events without modern training techniques and assessment procedures? How about watching sports on television with only one or two camera angles? Indeed, the influx of sport technologies has profoundly changed the landscape of sport and exercise science, and perhaps more important, technology has, in many ways, begun to change what we think of as the athletic body.

Paradoxically, it is the omnipresence of technology that has contributed most to our inability to fully grasp the scope and depth of its influence, adding to our uncertainty as to what role various technological advancements should play in our lives. For many Americans, technology seems to be simultaneously omnipresent and invisible. It is evident in the most mundane aspects of our lives in the form of computers, cell phones, automobiles, contact lenses, and heart medication. It also exists in the grandest accomplishments of humankind, both giant and microscopic, from space shuttles to nanotechnologies.

Responses to the question “So, what do you

think about technology?” are almost without exception tinted with frustration and ambivalence. It is difficult to argue that technology has not contributed to the betterment of our lives, from medical advancements to the information superhighway. As far back as the 17th century, Francis Bacon believed that a benevolent technology would ultimately yield a better quality of life for all people. Of course, we can also make a strong case that some forms of technology pose a serious threat to human existence. Technology has given us longer lives, convenience, and efficiency, but it has also contributed to weapons of mass destruction, an ability to wipe out vast expanses of rainforests, and a culture from which it is now virtually impossible to “unplug.” In short, the meanings and values of technology depend on the context in which it is discussed and on the perspectives of those involved in the discussion. This sort of variability has made the topic of technology difficult to address. What *is* certain is that technology is everywhere in our lives.

The term **technoculture** refers to the idea that technology has been incorporated into most aspects of our lives, and to imagine ourselves outside of the technological realm is increasingly difficult. Humans living in technocultures also begin to view themselves in terms of their technological surroundings. As cultures become increasingly technologized, we tend to model ourselves after the matrix of technologies around

### Defining Technology

**Technology** is very difficult to define, and we often use the word in multiple ways. Numerous attempts to define technology have yielded such an array of descriptions that one may become resigned to the idea that technology is simply not definable. On the one hand, it is synonymous with science and rational thought, encompassing every little gadget we've ever held in wonder in our hands. It is the collective machinery that powers Western societies and the microchips that power our personal computers. Of course, technology is not just “out there” in the world. On the contrary, it is inside us

as well. Indeed, on any given day our bloodstreams carry the remnants of ibuprofen and multivitamins, and many individuals have been technologized, or made more technologized, through artificial hearts, contact lenses, and other medical procedures. In this chapter, then, technology will be used to describe any tangible, conceptual, or procedural element of modern sport and exercise science aimed at progress. This flexible definition allows us to see everything from advancements in running shoes and eyewear to different ways of thinking about the body as technological.





us and interpret ourselves in technological terms. Technologies therefore redefine not only the world but our notions of “humanness” and “self” as well. Do you ever consider how “plugged in” you are?

## Theories of Technology

Andrew Feenberg, one of the leading philosophers of technology, outlined four theoretical positions regarding technology. In essence, these positions are like lenses through which we can see the impact of technology on our lives. Depending on which lens we look through, technological advancements may appear very positive or frighteningly negative.

### Instrumentalist Theory

The **instrumentalist theory** views technology as a neutral tool, something whose ends and means are separate. So, to use the example of high-tech tennis rackets, the instrumentalist perspective would probably consider the new lightweight rackets as just another tool in the ongoing quest for improved performance. Much like other technologies, athletes are simply using whatever tools are available to gain an edge over their competitors.

### Determinist Theory

The **determinist theory** also states that technology is neutral, or value-free, but it has become autonomous, or self-directed. So, using the tennis racket example again, the determinist perspective would consider the new racket as a tool that, once allowed into the game, would take on a “life of its own” and prompt athletes to use it whether they wanted to or not. The very presence of the racket would mean that once one athlete decides to use the equipment, others would feel the pressure to

do so as well. Also, if the new racket gives high-velocity servers an even greater advantage, then this one technology could change the way the game of tennis is played forever.

### Substantivist Theory

Feenberg’s third theoretical position is called the **substantivist theory**, and this involves the view that technology is neither neutral nor completely within our control. This view is the most pessimistic in terms of how it would regard the new tennis racket. New rackets would be viewed as having certain values attached. For instance, while the racket designers may have simply been trying to build a better, lighter racket that allows players to hit the ball harder and faster, the consequences of this new design seem to value speed and power over finesse. The substantivist position shares the determinist view that, once unleashed, technologies have the potential to gain a direction of their own, and it will become increasingly difficult to go back to more “natural” forms of performance-enhancing techniques. In the end, technology will drive what sports we play, how we play them, and who is best suited to participate.

### Critical Theory

Finally, Feenberg advocates moving toward a more **critical theory** of technology. Critical views of technology recognize that, ultimately, technologies should be controlled by us. A critical theory sees the politics and values associated with technology. So, critical perspectives of the influx of new tennis racket technologies would call for more open debates on the politics of the technique and ask questions such as “Who will have access to this equipment?” “Who decides whether the equipment should be legal or restricted on the professional tour?” and “What will be the long-term effects of new racket technologies on the game?” It is important to note that none of these theories is completely right or wrong, but they each clearly have different implications for how we evaluate the continued technologization of sport and the body.



## Technology and the Body

For the most part, contemporary Western societies view the body as a kind of machine. Modern science has been able to build replacements for many of our parts when they break or suffer from wear. This vision of the human body is magnified in high-level sport by the close relationship between athletes and the medical community (Figure 22.1). Elite athletes in most sports are now aided by a team of physicians, exercise physiologists, biomechanists, and sport psychologists. Cyclist Lance Armstrong wrote that even *eating* became part of a scientific formula; eating was one of many variables that allowed his machinery to function at optimal capacity. However, it is important to remember that the idea of the athlete as machine is only the most recent in a succession of ways of thinking about athletic bodies.

Over the last few centuries, North American societies have seen the mind and body as separate things, with the mind being viewed as more important than the body. This disconnect between the mind and body is termed **mind–body dualism**, and some argue that the influence of mind–body dualism remains strong in many aspects of Western society. As far back as late Greek culture, the notion that the mind was the boss of the body



**Figure 22.1** The irrefutable link between modern science and elite sport has changed the way athletes approach training and competition.

emerged. Mind–body dualism was first proposed by Plato, who described the mind as the essence of human existence and the body as an obstacle to intellectual progress because of its physical, and presumably secondary, needs.

A more holistic view of the relationship between the mind and body arose during the Renaissance, when advocates of humanism promoted a new respect for human corporeality. The body was no longer an instrument that served the mind's purposes but a source of creativity that was meant to be fully lived in the present. This move toward a sense of mind–body wholeness was interrupted, however, by the rise of **Cartesian dualism**. In the mid-1600s, Rene Descartes extended Plato's radical distinction between the rational mind and the brute physicality of the body. Descartes argued that the mind represented the authentic and eternal human self, while the body functioned as an unconscious machine, separate from yet controlled by the mind.

During the scientific revolution of the 17th century, the increased understanding of human anatomy led to new comparisons between physiology and machinery, centuries before athletes' bodies were referred to in technological terms. In 1651, for instance, philosopher Thomas Hobbes stated, "For what is the heart but a spring; and the nerves but so many strings; and the joints but so many wheels, giving motion to the whole body." This reduction of humans to a set of mechanical components was tied to a larger societal belief that science and technology were the sole valid sources of knowledge and truth. It was during this period that the dominant contemporary view of the body was rooted, and the standards by which minds and bodies were deemed healthy or unhealthy became tied to their ability to function with the efficiency of machines.

Scientists are presently attempting to develop replacements for almost every part of the body. It has been 100 years since the first artificial hip replacement was attempted, and since then we have seen improvements in artificial knees, hearts, and inner ears. Scientists are even developing tissue outside of the body, including knee cartilage, for "off the shelf" replacements. In the next century, we



might see injured athletes who are able to play harder and longer with the help of multiple replacement parts. The elite athlete will, perhaps, become more bionic and technological than natural!

## From Humans to Cyborgs?

Because athletes have become tied to various technologies, some argue that the 21st century is the era of the **cyborg** athlete. The term *cyborg*, short for *cybernetic organism*, was coined in 1960 by NASA scientists Manfred E. Clynes and Nathan S. Kline to describe the creation of an enhanced being capable of surviving in extraterrestrial environments. Far from the dramatic images of science fiction movies such as *The Terminator*, the first true cyborg was a simple white lab rat with a pump implanted into its body to release chemicals aimed at regulating physiological functions. This strange-looking creature, with



**Figure 22.2** Lance Armstrong is a perfect example of a cyborg athlete.

a plastic and metal apparatus plugged in via its tail, marked a clear end to the idea that animals – including humans – and machines are completely separate. Inhabitants of technocultures are all, in some way or another, cyborgs. Whether it is an elderly woman with a pacemaker, an accident victim with an artificial limb, or an athlete whose damaged tissue has been replaced with animal tendons, the boundaries between “natural” and “artificial” have become blurred and will become more blurred in the future. The negative implications for different kinds of cyborg bodies and sport technologies will be discussed later.

Some sport studies researchers have applied the cyborg idea to 21st-century sport. In fact, the cyborg is perhaps best exemplified by the modern elite athlete (Figure 22.2). Athletes today are fine-tuned in almost every way. In short, the relationship between science and the medical profession and sport has never been closer. The age of blood, sweat, and tears is slowly becoming an era of blood, sweat, and gears. Viewing athletes as cyborgs might sound frightening at first. However, it allows us to ask different kinds of questions. For example, how much technology should be allowed in sport? Do sports fans care whether their favorite sports heroes are part machine, or whether they hit more home runs because of better equipment? Who gets to decide what kinds of cyborg athletes and sporting activities will be allowed in the first place? Do athletes get any say over what technologies they can use to improve their bodies? These questions will become increasingly relevant in the era of cyborg sport.

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## Brief History of Sport Technologies

In his groundbreaking historical analysis of the changing nature of sport, *From Ritual to Record: The Nature of Modern Sport*, Allen Guttman describes how sport was once related to ritual and religious practices. Technology, by and large, was not a very important part of sport in ancient times. However, over several centuries sport became more secular, and technology played an important role

### Guttman's Seven Characteristics of Modern Sport

1. **Secularism:** As opposed to many sporting practices of the past, most modern sporting contests are not directly related to religious practices.
2. **Equality:** In theory, at least, modern sports are open to everyone, and competitors should all face similar conditions.
3. **Specialization:** With few exceptions, today's high-level athletes specialize in one event, which has its own nuanced skill sets, training methods, and technological accessories.
4. **Rationalization:** Most of the major contemporary sport practices involve sets of rules.
5. **Bureaucratization:** Contemporary sports are governed by organizations and officials that control athletes and teams and manage many other logistical aspects of sport.
6. **Quantification:** Modern sports emphasize increasingly precise performance measurements and the reduction of performance outcomes to numbers.
7. **Records:** One of the main emphases of modern sport is the quest to surpass previous performance standards.

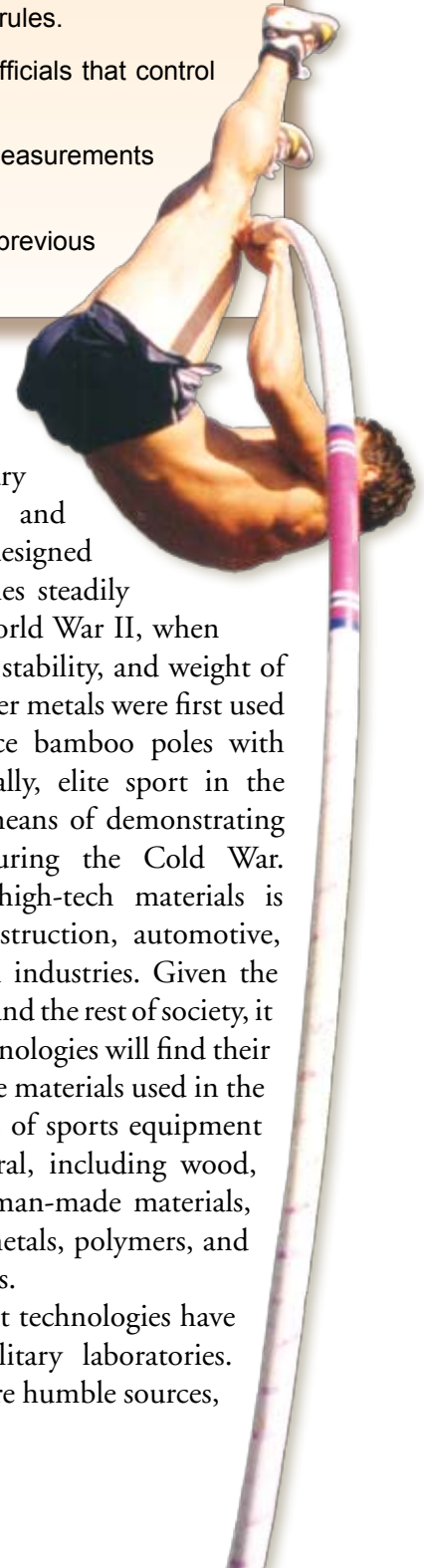
in transforming sport into the quest for records it is today (see box *Guttman's Seven Characteristics of Modern Sport*).

The modern Olympic Games have not only welcomed but also depended on various technological innovations from the outset. The Olympics would never have grown into the spectacle we see today without such things as improvements in athletic equipment, the global mass media, and the enhanced railroad and steamship technologies needed to support the growth of the modern Games in the early 20th century. More recently, one International Olympic Committee (IOC) member commented that the choice of Atlanta for the 1996 Games was extremely wise because the city represented "a touch of American Olympism melded to 21st-century technology." The influence of science and technology on high-level sport cannot be overstated, and it is no exaggeration to say that athletes owe much of their steadily increasing performance standards to technological innovations.

One interesting thing to note is that many sport technologies were not developed for sport at all. Carbon fiber poles for pole vaulting, the aerodynamic design of time-trial bikes, and many

other kinds of high-tech sports equipment have their roots in military innovations. Materials and equipment primarily designed for top-secret war machines steadily filtered into sport after World War II, when advances in the flexibility, stability, and weight of alloys and previously bulkier metals were first used by pole-vaulters to replace bamboo poles with pliable fiberglass. Eventually, elite sport in the United States became a means of demonstrating technological prowess during the Cold War. Of course, the use of high-tech materials is also common in the construction, automotive, aerospace, and biomedical industries. Given the connection between sport and the rest of society, it is inevitable that these technologies will find their way into athletes' lives. The materials used in the production of many kinds of sports equipment have switched from natural, including wood, twine, and rubber, to human-made materials, most notably reinforced metals, polymers, and synthetic hybrid substances.

Of course, not all sport technologies have emerged from secret military laboratories. Some have come from more humble sources,





whether out of necessity, entrepreneurialism, or simple creative passion. One of the most influential was the homemade rubber waffle soles that Oregon track and field coach Bill Bowerman created on his wife's waffle iron; these soles became the basis for Nike's early success in the running shoe business.

So, did athletes seek out technology to improve performance? Or did new technologies drive athletes to go swifter, higher, and stronger? This is a tough question. However, it can be argued that the increased emphasis on performance came *before* the invention and introduction of many sport technologies. For example, even though physical education theorists of the early 19th century such as J. C. F. GutsMuths attempted to measure, compare, and record running times, he was quick to admit that the pocket watches of his time were unfortunately incapable of registering smaller time units. Some have argued that it was not the stopwatch that provided the impetus for the movement from exercise-based activities to competitive sports, but rather that this new technological development became a device that symbolized the larger societal trend of striving toward quantifiable goals. So, while sport is not merely a mirror of North American society, it has certainly absorbed its spirit of increased technologization, or cyborgification.

## Technology and the Quest for Improved Performance

Some argue that the increasingly cyborgified character of many elite sports mirrors the larger technoculture and the high-tech revolution in all areas of society. It is also important to recognize the tension that exists between the technological landscapes of the United States and the **paradox of performance** in elite sport. The paradox of performance describes the condition where elite athletes are encouraged to improve their performances but are restricted in terms of the means by which they may do so. Race car drivers may be able to go faster by putting different tires on their cars, or by eliminating drag by altering the car body, but the rules restrict such changes.

Many professional sports now restrict technologies of all kinds, and sport is one of the only spheres in Western societies where there is an effort to prevent too many technological innovations. It would be difficult to imagine, for instance, desiring a computer that functioned less quickly and efficiently and that required more effort than the current model to complete a given task.

Interestingly, there have also been occasions when the technologies themselves have determined the suitability of an athlete for the design and specifications of a particular piece of equipment. For example, the javelin originally privileged strength over precise technical prowess. Thus, even throwers with substandard technique could perform well by using sheer force to "muscle" the javelin. Then, in the early 1980s, the implement was redesigned to be lighter and more aerodynamic, and the emphasis shifted to finesse, for the perfectly executed throw could now outdistance the technically deficient throw of greater force. The redesigned javelin had unforeseen consequences, however. Once more athletes improved stylistically, the javelin began to travel past the infield and dangerously close to spectators and athletes at the opposite end of the stadium. In 1986, the de-technologized model marked the return of power throwers to the upper echelons of the event.

## Types of Sport Technologies

Countless forms of technology can be found in sport today. Each innovation has potentially positive and beneficial outcomes, but to better understand the implications of sport technologies, a basic typology is helpful. The following six types of sport technologies are not mutually exclusive, and in some cases the same technology could fit into multiple categories. The categories consist of (1) *self-technologies*, (2) *landscape technologies*, (3) *implement technologies*, (4) *rehabilitative technologies*, (5) *movement technologies*, and (6) *database technologies*. While some of the technologies discussed here have yet to make an impact on sport, an understanding of the many types of sport technologies may be



**Figure 22.3** Athletes with prosthetic limbs can still perform and compete at a very high level.

helpful in obtaining a better perspective on the technological options that athletes will eventually have access to.

### Self-technologies

**Self-technologies** represent the most obvious, and for many people the most disturbing, form of technologization because they have the potential to fundamentally and often permanently alter an athlete's physical or psychological makeup. While banned performance-enhancing drugs are the most notorious of these technologies, self-technologies encompass other kinds of athletic innovations, some of which are also controversial. For example, surgical procedures, prosthetic/bionic limbs, sport psychological interventions, and genetic engineering would all be classified as self-technologies (Figure 22.3). While the presence of certain self-technologies in sport may seem too futuristic (e.g., bionic prostheses, genetic engineering), scientists working on a muscle-building vaccine derived from engineered genes have already recognized the implications of their work for sport. The genetic alteration of athletes, or *gene doping*, will be discussed in more detail later in the chapter.

### Landscape Technologies

The second type of sport technologies is **landscape technologies**. These forms of technology involve the sporting environment, including the way that spectators watch events. The most prominent landscape technology is the increase of modern multipurpose sport complexes, complete with their JumboTron screens, retractable domes, soaring cameras, Mondo tracks, and artificial grass. Scholar John Bale argues that modern athletes have an intimate relationship with the technological sporting landscapes. For instance, track and field athletes use new tactics because they can monitor their competitors on the JumboTrons coming down the homestretch. Some discus and javelin throwers even watch the JumboTrons to see how the wind affects their throws! One interesting note about some high-tech stadiums is that they often attempt to replicate the atmosphere of older traditional-style stadiums. For baseball fans, this lets them enjoy the latest comforts while still feeling as if they were back in the “good old days.”

### Implement Technologies

**Implement technologies** include equipment that athletes use or that they kick, hurl, or otherwise propel. Other examples include football helmets equipped with warning devices and radios; “shark suits” that allow swimmers to more efficiently slice through the water; and high-tech running shoes, golf



**Figure 22.4** Advancements in soccer ball design have been made to increase the speed, accuracy, and range of the ball, but also to improve overall visibility.