

# Introduction

When, in 2013, Lance Armstrong confessed to having adopted a range of doping practices, there was no question that he had ingested banned substances in order to enhance his cycling performance. However, when asked whether he felt any guilt over his behaviour, Armstrong curiously replied that he did not. While several authors have explained Armstrong's lack of guilt by arguing that the Tour de France has been dominated by a doping culture for many years (see, for example, Brewer, 2002; Strulik, 2012), the existence of further examination and discussion of Armstrong's actions indicates that the simple explanation that athletes' decisions to use banned technologies are based purely on enhancing performance is insufficient for understanding the use of technology in sport.

Lance Armstrong's case also concerned the immense amount of money that he obtained through sponsorship and other commercial arrangements, with fans raising questions about the continuation of those arrangements once his doping history was known. With the professionalisation of sport, athletes face increasing pressure from sponsors not only to perform but also to use particular technologies or equipment produced by their sponsors. The use of some technologies can therefore be explained by athletes' experiencing pressure from sponsors or other commercial bodies; and, by extension, athletes' desire to win can be explained by their wish to benefit commercially.

At the same time, athletes also make deliberate decisions not to use particular technologies or not to dope because of their desire for purity, to keep their bodies and sport clean and untainted. For example, US 5000m athletics champion Lauren Fleshman publicly criticised Lance Armstrong on the grounds that he undermined fair play, which she believed defined sporting practice (see Fleshman, 2013). Fleshman's stance assumes an amateur ethos that places fair play ahead of winning, and harks back to a romanticised view of sport as historically free from overly competitive practices.

There is no doubt that the explanations of performance enhancement, commercial pressure and a desire for purity are valid in terms of athletes' own

individual motivations for using or not using particular technologies in sport. But one of the most controversial aspects of Armstrong's case was the revelation of just how widespread his doping network was, and how many individuals and technological implements, such as syringes and other equipment necessary for performing blood transfusions, were involved in facilitating his doping. This revelation demonstrated that individual motives are only one aspect of understanding the use of technology in sport, with athletes also utilising a variety of other processes and enrolling many other actors to facilitate their use of technology.

In this book, I argue that singular explanations such as quest for performance, commercialisation or quest for purity are insufficient explanations in themselves for understanding the use or non-use of technology in sport. I do not argue that these explanations are not valid, and indeed I use cases where these explanations come into play. But this book argues that these explanations do not encapsulate the myriad of processes that contribute to the use of technology in sport. Instead, I argue that in order to understand which technologies become enrolled in sport, we must examine the processes of enrolment, and seek out the various actors that affect the enrolling or non-enrolling, and acknowledge that there are multiple issues and decisions at play. This involves a shift in focus from much other work that has been done on technology in sport. It involves attending to enactment, and to process, rather than to regulations, philosophies or cultural meanings. Yet these latter aspects can also be important, since the enrolling process can include deploying the philosophies or cultural meanings held by those involved in the enrolment processes.

Indeed, enrolment processes can be highly complex, although their complexity is often obscured by the dominant narratives used by influential sporting bodies (Goldsher-Diamond, 2014). Once a technology is enrolled and its use becomes normalised, the process that produced the stability becomes concealed from view and can therefore be difficult to ascertain (Law, 1992). For example, all sports have rules that outline which technologies are permitted or not permitted to be used, but this is the extent of the information that appears in the rules and regulations. The controversies or decisions that resulted in those rules are not recorded in the same public manner and therefore become erased. Thus, in attending to how technologies come to be enrolled or not-enrolled, I also aim to bring to light the complex processes that produce particular rules or decisions.

Attending to complexity is particularly important in the light of the rapid increase in technological change that we are currently experiencing. Where, in the past, many technologies were reasonably simple and it was possible for many

laypeople to understand their workings, the complexity and number of technologies have now increased exponentially, and only experts can fully comprehend them. Within such an environment, it is necessary to develop and adopt approaches that acknowledge complexity and are designed to examine multiple strands. While philosophers such as Deleuze and Guattari (2004) have argued for the need to see the world as consisting of assemblages in order to examine the current fluid and unstable environment, they did not extend their ideas to encompass methodology. By contrast, the approach adopted in this book, Actor-Network Theory (ANT), was designed as a methodology to examine scientific practices and technological change while acknowledging the complex and multiple strands that affect change, including human and non-human actors.

The earliest uses of ANT involved the examination of the processes of producing scientific knowledge, with detailed ethnographic practices revealing a complex network of factors that produce science (see, for example, Latour, 1987, 1993b; Latour and Woolgar, 1979). In this book, it is the network of sport that I am interested in following in order to trace similarly the factors that lead to the enrolment or non-enrolment of technology in sport. To date, there has been no other extensive study of sport using an ANT approach.

ANT is not the only approach well designed to trace the enrolment of technologies in sport. The social construction of technology (SCOT), as developed and adopted by Pinch and Bijker (1984), has similarly been utilised for the same goal and is more commonly used for examining sport (see, for example, Goldsher-Diamond, 2014; Pinch and Henry, 1999; Rosen, 1993; Varney, 2002). In examining how technologies come to be used, SCOT's focus is on identifying the relevant social groups that contribute to the use of the technology. For example, in their analysis of the bicycle in the nineteenth century, Pinch and Bijker (1984) determined that the so-called 'ordinary' bicycle was deemed too risky and unsafe for use by women, whereas it was highly attractive to young men precisely because of that same riskiness. Thus, different social groups interpreted the ordinary bicycle differently (in an example of the concept of interpretive flexibility), which affected whether each group chose to use the bicycle.

ANT's focus differs from SCOT's through its emphasis on the technologies, and other non-humans, as actors that affect and influence enrolment processes. In SCOT, as in most sociological approaches, the focus remains purely on the human actors: in particular, on social groups. In ANT, humans and non-humans are understood as equally important, and this is reflected in the preference for the term 'actant' over 'actor' to refer to anyone or anything that affects the enrolment process. Other scholars interested in 'things' have similarly argued that

non-human artefacts can hold agency and act as significantly as people (Harvey and Knox, 2014).

Determining how ‘things’, and particularly technologies, act is particularly important in sport, where international sporting bodies are constantly in the position of having to regulate the use of technology based on the ability of the technology to affect sporting performance. Sporting bodies must determine a technology’s level of agency in order to decide how to regulate it. This was illustrated particularly well in the case of Oscar Pistorius, where it took several years for the International Association of Athletic Federations to determine whether his prosthetic legs had greater running capacity than human legs. The crucial point was whether the actions available to the prosthetic legs were greater than those available to human legs. It was decided that they did not have greater capacity, but it took a substantial amount of time to determine this was the case.

In claiming that non-humans can hold agency, ANT has attracted critics who argue that agency can only exist through deliberate intent and therefore agency can only be the domain of humans, as non-humans do not possess the consciousness to decide to act. In emphasising the ability of non-humans to act, ANT has been criticised for anthropomorphising non-humans (see, for example, Elder-Vass, 2008; Hearn, 2012). While this point will be discussed in more detail in Chapter 1, it is a point that has been recently considered by a range of researchers interested in what Fox and Alldred (2015) term ‘new materialism’.

Essentially, discussions around agency revolve around conceptions of power. Rather than viewing power as incorporating deliberate intent, ANT views power as an effect. Utilising such a definition, anyone or anything that affects action can potentially hold power. The form this action may take varies depending on the individual study, but a simple example of the way that technology in sport can affect the action comes from my own ethnographic work in the sport of gymnastics, which utilised an ANT approach. In this excerpt from an interview with a gymnast, Malcolm, he discusses how the equipment holds power through directly affecting his gymnastics performance:

**Malcolm:** The high bar is always different, bouncier or harder. And the rings, sometimes they shake more.

**Researcher:** Is that the same here? When you compete at [another club] is it different?

**Malcolm:** At [another club] the high bar is a bit bouncier than I like it, and the rings, the rings are pretty good actually. The floor’s a bit harder than here, so you can get a bit more bounce if you put more into it.

**Researcher:** So you know what to expect? If you got sent to the US or something, I guess you'd be thinking, 'I wonder what I'll get here?'

**Malcolm:** Yeah, because you get used to the floor you train on every day. If you have a soft floor at home and go to a hard floor somewhere else, you end up going 'Oh no!' And some floors are really bad, they're soft on the top and hard underneath and you end up tearing your achilles and stuff.

This excerpt from Malcolm's interview reveals how he has learnt how to 'be affected' (Latour, 2004, p. 210) by the apparatus, and therefore the apparatus holds the power to affect his gymnastics performance. His comment about the bounciness of the high bar makes it clear that he realises a certain amount of manipulation of the equipment is required to produce optimum results, but that the type of equipment directly affects what he must do. He is aware that his gymnastic routine will occur only if he manages to work as an *assemblage* with the equipment and describes how he 'puts more into' the floor to make a harder floor work more effectively.

The notion of the 'assemblage' is central to ANT. Essentially, ANT encapsulates the notion that 'the whole is greater than the sum of its parts' through arguing that combining humans and/or non-humans can create assemblages that have vastly different qualities and capacities from singular parts. This is easily understood in the case of sport, where athletes can be understood as possessing particular and often impressive qualities owing to the athlete-assemblage, consisting of a human plus a variety of technologies and training that transform the human into something surpassing normal human ability. For example, neither a human nor a pole is capable of independently jumping five metres into the air, but once a human with training uses a pole, they are transformed into an athlete-assemblage called a pole-vaulter, who can accomplish this task.

Viewing athletes as assemblages of humans and technologies creates a significant shift in thinking for the sports policy-maker. For example, at times, policies in sport attempt to ban or limit the use of particular technologies, seeing them as entirely separate from individuals. As previously discussed, seeing the two as separate was shown to be problematic in the case of Oscar Pistorius, whose legs are so interconnected with his ability to run at all that he epitomises Donna Haraway's (2004) notion of the cyborg, with no discernible differentiation between human and technology. It is also problematic with regard to doping, where vast sums of money are spent in attempting to determine whether an athlete has ingested banned substances. Doping policy-makers could instead, if they adopted the ANT notion of the athlete as assemblage, simply have an upper

limit of the amount of whatever substance they are testing for and disregard whether it arrived in the body by natural or artificial means. This has occurred at times. For example, in order to test for the presence of the banned artificial substance Erythropoietin (EPO), some sports organisations used the method of testing hematocrit levels in order to ensure that no athletes went beyond the limit of 50 per cent. Their reasoning for choosing a level of 50 per cent was related to the health issue of blood thickening that occurs beyond this level (Böning, Maassen and Pries, 2011). This testing method ensured that athletes were safe and healthy, but was unable to determine whether athletes reached hematocrit levels below 50 per cent by human or artificial means. This policy assumed that athletes were assemblages made up of a range of hormones and chemicals. In the language of policy-makers, such a stance ensured safety and produced a level playing field. However, this method has now been replaced by a definitive test for the use of artificial EPO, along with a range of other mechanisms as detailed in Chapter 4, which consider the human as needing to remain separate from any technological interventions.

The concept of the 'assemblage' also reflects the use of the word 'network' within ANT. To remain with the example of the pole-vaulter, implying that a pole-vaulter is simply an assemblage of a human plus training and a pole is oversimplifying the network that produced the performance. If we were particularly intent on determining how the pole-vaulter achieves this outcome, we would need to identify the myriad of other components that contribute to the pole-vaulter's success. We would expect that the pole-vaulter would use an expert coach and other sports science experts, along with possibly specialised shoes and maybe particular mats for training. The pole-vaulter would also need funding, and competition experience. The pole-vaulter's ability to jump high is thus made up of the assemblage of all these aspects, and it is this assemblage that ANT refers to as 'the network'.

It may seem that listing these components in this way is simply repeating the components that make up elite sporting success, as identified in studies such as that by De Bosscher et al. (2006), who produced a model of factors that determine elite sporting success. The ANT approach differs from these kinds of studies in assuming that networks are individualised, rather than universal, and highly unstable. This assumption stems from the ANT view of the world as existing as a network of assemblages that changes over time. For example, at the moment I am involved in a project examining the experiences of older elite gymnasts. One of the findings from this project is that, as gymnasts reach adulthood, their coaching and training requirements change considerably from when

they were younger. Some gymnasts question whether they even need a coach as an adult, given that they have already acquired the necessary knowledge to train themselves. In this study, it is apparent that the assemblage of fifteen-year-old gymnast + hands-on coaching + heavy training can produce the same level of success as a twenty-five-year-old gymnast + occasional coaching + light training. Therefore, I argue that examining the exact networks that make up elite sporting success can be valuable in understanding the myriad of processes that may contribute to success, but it does not acknowledge that they are also always changing. While the above example referred to the change in age of the gymnast that resulted in a different network being effective, change is also important when discussing technology because of the constant production of new technologies and improvements to current technologies. As Harvey and Knox (2014) note, viewing non-humans as parts of assemblages involves acknowledging that the range of actants involved is bound to cause instability, and that therefore constant care is required to obtain stability. Attending to how stability is achieved, or not achieved, is at the core of the ANT approach (Law, 1992).

In attempting to capture the range of processes that produce stability, a criticism that has been levelled at ANT is that the concept of the network is problematic owing to its nature as 'never-ending' (see, for example, Lee and Stenner, 1999; Strathern, 1996). For example, to return to the pole-vaulter, if we were truly examining every aspect of the pole-vaulter's network, then we would also need to examine the network of each pole-vaulting coach, each sport scientist and each technological implement, which would lead to yet more strands, leading to more networks that would indeed be impossible ever to examine properly in a single researcher's lifetime. ANT's response to this critique is a pragmatic one. ANT theorists acknowledge that no research account can ever be complete and so do not suggest that researchers should continue to examine a network indefinitely (Law, 1992). Instead, Latour (2005) suggests that researchers should simply stop examining the network either where the participants in the study determine that the network ends, or when the requirements of their particular article, book or thesis are met. For example, in my own ANT study of gymnastics in New Zealand, I stopped examining the network at the point where the participants in my study were adamant that I was no longer examining gymnastics, such as when I came across competitive aerobics. In this scenario, one type of aerobics was deemed to be 'gymnastics' as participants explained that it was regulated by the International Gymnastics Federation, but another type of aerobics was not, as it was instead regulated by an international dance federation that was not associated with gymnastics.

## A note about method

ANT is somewhat unusual in that it is both a method and a theory. Theoretically, ANT makes use of a number of concepts, such as enrolment, translation, mediators, intermediaries and others, which will be introduced throughout this book. Methodologically, ANT espouses an ethnographic approach that is closer in nature to ethnomethodology both in emphasising a high level of detail and in attending to processes. ANT assumes that data is wide-ranging and ‘messy’ (Law, 2004), and argues that ethnography is best placed to encompass the mess that a researcher is likely to find upon entering the field. In order to trace the mess, Latour (2005) describes the methodology of ANT as ‘following the network’, where the researcher does not have a clear path planned at the outset but follows particular strands as they are revealed. Farnsworth and Autrin (2005) describe the ANT following process as being akin to the work of the detective, where the researcher follows up on clues dropped by participants and occurrences in order to determine the workings of the particular situation of their interest.

In line with ANT’s theoretical position, which emphasises non-humans as actants, the ANT ethnography also pays attention to the role that non-humans play within the field of study. This can be difficult, given that things do not speak (Penley, Ross and Haraway, 1990) and so cannot be interviewed, but Latour (2005) suggests that this can be accomplished in a number of ways. First, he states that the creation or innovation of new innovations or knowledge within a laboratory can be examined, as they were by him in *Laboratory Life* (Latour and Woolgar, 1979) and *Pandora’s Hope* (Latour, 1999b). Second, they can be studied at a distance: for example, historically. Throughout this book there is some element of historical analysis, as the history of some sports and technologies are traced in order to demonstrate the socio-technical nature of sport. Third, Latour argues that they can be studied when they break down or become controversial. This final option is the approach primarily adopted in this book, which examines cases where technologies have caused controversy in a range of scenarios and contexts.

While ideally it would be most effective if all the cases discussed in this book used the ethnographic method of ‘following the network’, as espoused by Latour, there is unfortunately very little ethnographic work in sport that uses an ANT approach. My own ethnographic work on gymnastics, which used an ANT approach, is drawn upon for two cases: the use of sports scientists by gymnasts and the implementation of a video replay system at the Artistic Gymnastics World Championships. These two cases use ANT’s ethnographic method directly, as I obtained my data through ‘following the network’ of elite gymnastics in New Zealand.



Other cases are chosen because they illustrate a particular theoretical point and because, like this book, their focus is on how technologies came to be enrolled or not enrolled within particular sports environments. These include Patrick Trabal's study of the attempted implementation of new kayak technology in France, Elizabeth Pike's examination of rowers' use of sports doctors and Limin Liang's analysis of the role of new production technology in the broadcasting of the 2008 Olympic Games. The remainder of the cases use a combination of historical analysis and Latour's (2005) entry point of the controversy, where I follow the history and debate around the use of that particular technology through previous research, policy documents, media releases, newspaper reports and personal communications.

The method of following the network has been advocated by ANT theorists as being significant for bridging the gap between the 'micro' and the 'macro'. There are several ANT studies that demonstrate the way that ANT allows the connections between these two levels to be made apparent (see, for example, Callon, 1986; Latour, 1988, 1995, 1996; Law, 1992). Critics have suggested that ANT's ethnographic methods mean that ANT studies are too strongly focused on the micro and ignore social structures (Elder-Vass, 2008), but ANT theorists explain that the point of the following process is to identify and examine the connections between wider societal aspects and micro-level occurrences. For example, in my ANT study of gymnastics, previous studies had determined that there were a range of macro-level bodies, such as the International Gymnastics Federation and the New Zealand Olympic Committee, which determined selection for the New Zealand national team (see, for example, D'Amico, 2000); however, I found that selection was also affected by other aspects of a gymnast's network, such as the views of the parents and coaches, or finance to pay for elite training. Thus, my ANT analysis determined that, although the New Zealand Olympic Committee has the final say in the make-up of gymnastics teams, there were other processes (which would normally be termed micro-level) that influenced the final selection, demonstrating the significant links between the micro and macro levels of action.

Kellner (2002) calls for the use of approaches, such as ANT, that incorporate both the micro and macro, or local and global, within the globalisation literature. Indeed, most of the globalisation-of-sport literature is understandably focused on the global, and while connections with the local are noted, they remain primarily at the national or regional level and not at the level of individual action. By contrast, ANT's following process allows connections to be made from global occurrences to the micro level of individual interaction. The book is structured in order to highlight the movement in scale that is possible with ANT.

## The structure of the book

Following this chapter, I begin with a discussion of the ANT understanding of technology. The most significant point is the view of technology as a heterogeneous assemblage rather than a singular, complete object. It is made up of a variety of components, plus it works within a particular actor-network. The understanding of technology as made up of multiple strands and as sitting within multiple strands is significant for examining how and why technologies are used in sport. Later chapters of the book include several examples of technologies being only partially implemented or utilised as a result of sporting bodies focusing on enrolling one strand of the technology and not realising at the outset the multiple connections that must be in place in order for the technology to be fully utilised. Chapter 1 also recognises that technologies can work as stabilising devices to ensure a particular outcome, and argues that technologies have agency.

Chapter 2 begins with the assumption that technology is constituent for sport, with all sports utilising a range of technologies, such as bats and balls, in order for the sports to exist. Within this context, the technologies used within sports are frequently improved or enhanced, either by individual athletes or by international sporting federations. This chapter essentially questions the role of an enhancement's functionality in the enrolment process. Through case studies on kayaks and swimsuits, the multiple strands of an athlete or sport's network are found to heavily complicate what might seem at the outset to be a simple case of using an enhanced form of technology.

While Chapter 2 remains within the network of sport through examining enhancements of technologies already used in sport, Chapter 3 moves outwards to examine technologies that are not traditionally part of sporting practice but which have been introduced into the actor-network in sport. The first case, GPS units in Australian-rules football, introduces the notion that technologies frequently produce unexpected outcomes, and shows how following technologies can reveal the power relations between different parts of the network. This case is particularly focused on the National League, with the network of a team sport being understood as very different from an individual sport. The second case examines the use and regulation of technologically constructed hypoxic environments (TCHEs), commonly known as altitude chambers. This case reveals the connections between global understandings of sport and race, and how understandings are incorporated into the network of a technology and influence its use.

Chapter 4 continues to acknowledge global connections through examining doping. This chapter chronicles a variety of groups that have attempted to

maintain control of doping, including the International Olympic Committee (IOC), the World Anti-Doping Agency (WADA) and the East German government. In all cases, I unpack the extensive actor-networks that each organisation has put in place in order to regulate and attempt to minimise or eradicate doping. This chapter draws attention to the role of inscriptions within power relations and demonstrates how Latour's (2005) concept of the oligopticon is valuable for understanding the way that institutions retain power through a networked arrangement of humans and non-humans that is quite different from the institutional arrangements described by Foucault (1977).

In Chapter 5 the book moves to examine a somewhat peripheral yet very important part of competitive sporting practice: the use of sports science and sports medicine. This chapter investigates the processes used by athletes and coaches to integrate sport scientists into the sporting context. While it would be easy to assume that enrolment would easily take place owing to athletes, coaches and scientists all having the common goal of improving performance, the two cases in this study demonstrate that the integration process is more complex and encompasses a range of perspectives and understandings, as well as specific actants, that contribute to enrolment or non-enrolment.

Chapter 6 moves to the competition arena and the workings of officiating technologies. This chapter considers the actor-network of various sports that have enrolled technological devices for assisting with umpiring or judging. The cases of cricket, tennis and artistic gymnastics are drawn upon to examine how the actor-network of each sport is affected by the new technology. The focus in this chapter is on following the actor-network beyond the initial implementation. Each sport is followed beyond the point at which the governing bodies introduce the new technology, to examine how the new assemblage affects other, often unexpected, parts of the actor-network.

Chapter 7 considers one of the most important relationships within sport: the sport media connection. However, this chapter is different from much of the other literature written on the topic as it focuses not on media representations but on the processes by which these representations are produced. It considers how humans and technologies work together to produce what we view to be a seamless television broadcast. In this chapter, the global nature of sporting coverage is considered through Collier and Ong's (2005) concept of a global assemblage, an ANT concept created to examine the creation of stable global forms.

Chapter 8 concludes by reflecting on sport as a socio-technical actor-network. I emphasise the way that the concept of the actor-network moves beyond singular explanations such as functionality for understanding how technologies come

to be integrated into sport. I also reiterate how ANT considers technologies to hold agency, and consequently as being able to cause unexpected occurrences in other parts of the actor-network, a point which is particularly important for sports bodies when considering adopting new technologies. This chapter also refers to the cases and examples in the book to respond to some of the critiques of ANT.

As sport evolves to include an ever-increasing number of technologies as part of its actor-network, it is important that those studying sport adopt approaches that encompass multiplicity and provide ways to grapple with the potentially far-reaching effects that technology can produce. In this book, I show how ANT is well up to this challenge through examining a range of cases and examples that have caused controversy within sport. In line with ANT methodology, controversies provide an effective point of entry to allow the examination of the myriad of actors that assemble to produce sport.