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ARTICLE

The Creation and Regulation of Sports Equipment: Implications for the Future

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From the swimsuit to the golf ball, innovators in the sports manufacturing industry have long sought to design the most developed and original sports equipment to help attain athletic excellence. However, the utilisation of this rapidly developing technology in the realm of sport has not been without controversy. Such equipment may have serious ramifications for fairness, innovation and the integrity of sport as a whole. This article considers these issues from a number of sporting perspectives: those of manufacturers, athletes (professional and disabled) and the safety of competitors in general. The article concludes by calling for more guidance on, and regulation of, novel sports equipment from both adjudicators and the various stakeholders in sport.

Keywords: sports law; sports technology; sports equipment; regulation; fairness; safety

Introduction

In 1896, Bill Hoyt used a wooden pole to attain gold in the pole vault with a jump height of 3.30 m; today, this would fall remarkably short of the height to even qualify for the Olympic Games. The current record – set by Frenchman Renaud Lavillenie in 2014 with the assistance of a fiberglass pole – stands at an impressive 6.16 m (World Athletics 2014). According to Jenkins (2005, 73), this pole, which consists of ‘up to 12 layers of glass fibre wrapped around a thin metal cylinder’, greatly increases the potential height an athlete can reach. Consequently, in seeking to understand how Lavillenie almost doubled the record set by Hoyt, we might discover a pertinent issue: to what extent did developments in sports technology contribute to Lavillenie’s awe-inspiring feat? And how might similar technological advancements impact on the future of other sports?

This article attempts to answer these questions by exploring the rapid evolution in sports technology that has incrementally enhanced the performance of athletes throughout numerous generations – and, as demonstrated by van Dulken (2010), has even resulted in the creation of new sports. The article is separated into three parts. Firstly, and with one eye on the protection afforded by a patent, it analyses the possible implications for innovation that manufacturers might encounter in creating such state-of-the-art sports equipment. Thereafter, I discuss the desirability of such progressive technology from the perspective of both the professional and the disabled athlete. Various issues are raised here, such as whether the creation of certain equipment is conducive to fairness and a level playing field in sport; whether these novel appliances might otherwise be considered as doping; and how the uncertain and emotionally-charged debate about what pieces of equipment may be deemed ethically acceptable may be hampering the integrity of sport. Finally, I consider how advances in sports technology might impact on the safety of competitors in general, and tie this in to the somewhat vain and image-focused nature that we might associate with contemporary sport. With these sentiments in mind, the article concludes by looking towards the future and calling for more guidance on the regulation of sports equipment from both adjudicators and the various stakeholders in sport.

Developing Sports Equipment: Implications for Manufacturers

In any discussion of the implications of the development and regulation of sports equipment for stakeholders, it is perhaps logical to begin with those who have created this paraphernalia: the manufacturers. In order to legally protect their inventions, they are likely to seek out the safeguards afforded by a patent, which gives the proprietor or inventor (the ‘patentee’) an exclusive right to utilise their product for a period of up to 20 years in order to help protect new and industrially applicable inventions (Cornish, Llewelyn and Aplin 2013, 186). The idea behind this intellectual property right is that it helps to prevent ‘free-riding’, by which one person could obtain an economic (and presumably also social) benefit from the work of another (Lemley 2005, 1040).

This line of reasoning is based primarily on the utilitarian-incentive theory, which supposes that manufacturers will not invest the necessary resources and effort to create high-quality products without the possibility of recouping the profits from their invention. Consequently, it is generally surmised that the failure to adequately recognise a property right in ideas would cause innovative thought to lapse, much to the detriment of consumers (World Intellectual Property Organisation n.d.). For example, in the UK case of *Genentech's Patent [1989] RPC 147, 286–7*, a considerable amount of time and money was spent on resources and highly-qualified researchers, but without a 'sufficient incentive to take the risk and to make the investment in developing new ideas' (Griffith-Jones 1997, 191), members of the public are unlikely to gain much benefit from future developments in genetic engineering technology.

It is contended here that the same argument transfers effectively to sports equipment. As Dulakakhoria and Jana (2013, 410) propound, an incentive to innovate is a 'key factor on which the growth of any industry depends; the same is true for the sports industry'. Given the various technological advances in sport over the years, it seems that legal protection *prima facie* allows such innovation to flourish. Indeed, prior to the mass commercialisation and commodification of sport since the early 1980s (James 2017, 5), most activities were played for leisure (Anderson 2010, 7), with a large portion of sports equipment being made from natural materials such as gut, rubber and twine (Froes 1997, 15). Now, perhaps through the encouragement of the use of patents, it appears that a cycle of innovation has emerged that results in lighter and more advanced equipment, as demonstrated by the replacement of animal intestine racket strings with the more modern (yet no less controversial) 'spaghetti strung' rackets in tennis (Sheridan 2006, 32–3). Thus, it seems that through this gradual 'snowball effect' of innovation, sport has been able to keep apace of technology in contemporary society.

However, and importantly for our purposes in assessing the impact of such technological advancements for sports manufacturers, it might be that these advances obscure a somewhat detrimental underbelly to the creation of sports equipment. Using a simulation of a patent system titled 'The Patent Game', Torrance and Tomlinson (2009, 277) concluded that patent protection did not produce any 'statistically significant difference in rates of innovation'. One of the authors later elucidated that 'the patent system did not work to spur innovation' (Main 2009). This may have particular resonance in the realm of sports equipment due to the fact that litigation seems to be rife amongst manufacturers. Slot (2019) notes, in relation to a new microchip-embedded mouthguard currently being trialled in rugby to help monitor and treat the impact of concussion,¹ that 'there are a number of sports manufacturers keenly trying to occupy this space'. This is reinforced by Champion, Willis and Thornton (2014, 35) who astutely observe that '[a]lmost as soon as the packages hit the shelves, many companies find themselves in litigation. It seems that patent infringement suits among industry competitors have become as ubiquitous in golf as the oversized metal driver.'²

With the threat of legal action hanging over most sports manufacturers like the sword of Damocles, it may be questioned whether legal protection for such dynamic enhancements to sports equipment is simply encouraging the destruction of competitors, rather than incentivising innovation. Although this will be explored in more detail later, it is perhaps worth noting here that this state of affairs might have serious ramifications where the safety of athletes is concerned. For example, in *Riddell Inc v Schutt Sports* 724 F. Supp. 2d 963 (W.D. Wis. 2010), a US case concerning a patent for an American football helmet designed to prevent concussion, the defendant filed for bankruptcy after claiming that Riddell inundated them with claims in an attempt to force them out of the market (Hanna 2017; Sachdev 2010).

One might suspect here that Riddell were using their monopolistic patent right in an attempt to solidify a financially advantageous position in the market for football helmets, rather than genuinely attempting to advance sport with higher-quality equipment. If so, this may arguably endanger the physical health of athletes; if a company's financial greed leads them to sue other manufacturers, the ideal helmet that prevents concussion is less likely to reach the market. Moreover, the (seemingly high) possibility of litigation not only draws finances away from the research laboratory and towards the courts, but may also discourage new manufacturers from entering the market (thus constituting a barrier to entry) and therefore further reduce the chances of the 'perfect helmet' being available to athletes.

A similar phenomenon is noted by Lerner (1995, 464–6) in the context of biotechnology. Baumbauer (2005, 413) states that the 'utilitarian justification holds only so long as the benefits of the incentive effect from the monopoly [...] outweigh the costs to consumers'. Given the potential ramifications for safety, it is not at all clear that legal protection for new sports equipment passes this cost-benefit test: if an innovation improves sport for the better, why not let it be freely used by all? Indeed, Aplin and Davis (2017, 15) have suggested that there are alternative ways – such as governmental support and funding – to provide incentives to innovate aside from the monopolistic nature of patent protection. The present author agrees with these sentiments, and this perhaps leads to the crux of the argument posited in this section: given the short-term financial advantages a manufacturer is likely to receive from being the first to launch an invention into a market as lucrative as that of sport, this may be enough in itself to provide an incentive to innovate.

It is perhaps relevant to outline two conclusory points here. Firstly, in making this argument, there is a need to be cognisant of the fact that the underlying motivations of many sports manufacturers will not be easily ascertainable, so the question as to whether they are necessarily incentivised to create novel sports equipment is perhaps speculative at best. As Hettinger (1989, 51) pithily laments, 'substantial empirical evidence is needed'. Without it, this may simply be a moot point. The second point is that the debate on the relationship between manufacturers and sports equipment is only the tip of the iceberg in relation to the plethora of issues that must be discussed in regards to the creation and regulation of sporting technology. It is perhaps trite to state that such technological developments in sport are not likely to cease

any time soon. After all, the win-at-all-costs mentality often promulgated in professional sport (and generally embedded in the Olympic motto of *Citius, Altius, Fortius*) appears to suggest that athletes will always be looking for any edge (however fleeting or minimal) over their opponents. How these technological developments are to be regulated is now considered in more detail.

Regulating Sports Equipment: Ramifications for the Athletics Community

This section seeks to address the question of the desirability and practicality of regulating technological advances in sport through three different lenses: one relating to professional athletes, another referring to disabled athletes and a final analysis concerning the safety of athletes in general. These are now discussed in turn.

Professional Athletes

The perception of how advanced equipment in sport affects professional athletes can vary greatly. Whilst Vamplew (2007, 859–60) notes, for example, that the attempted launch of the new 'Polara' golf ball – which featured a complex dimple pattern on the surface of the ball – benefited athletes by reducing the golfer's tendency to 'slice or hook' the ball, other equipment can often have unintended and unforeseen side-effects. For instance, the replacement of aluminium baseball bats with carbon fibre bats resulted in numerous baseball players regularly mistiming the ball due to the different and 'peculiar sound' that emanated from the carbon fibre alternative (Caine, Blair and Vasquez 2012, 656). Although the athletes eventually recalibrated their expectation of the noise, it seems that it cannot always be assumed that more advanced sports equipment actually translates to improved athletic performance on the field; sometimes it can hinder performance.

Furthermore, it might even be said that such technological developments could mask or eliminate the fundamental trait that a professional sport is designed to test. Take the fitting of a motor within the frame of a bicycle, a practice that the Union Cycliste Internationale (the governing body for cycling) has referred to as 'technological fraud' (Union Cycliste Internationale 2018). This exercise – which has been identified and tested for in various recent events – allows the rider to push a button on their handlebar which increases their speed by up to 5 km/h (Barbosa et al. 2019, 79). Interestingly, numerous cyclists such as Lance Armstrong and Riccardo Ricco (who have both received lengthy bans for taking prohibited substances) have expressed their condemnation of this technological enhancement, the latter stating that he would 'prefer chemical doping to motors' (Christiansen 2018, 105–107). Former professional cyclist Eddy Merckx also suggested that it is 'worse than doping' (Brown 2016). With respect, and certainly in regards to intentional chemical doping, it is not at all clear why this is the case. Perhaps these comments are reflective of the sort of gut-instinct and arbitrary nature of the assessment many are prone to make when analysing the legitimacy of such sports equipment. This point is considered later in more detail in the context of equipment for disabled athletes.

Aside from these concerns, it is also suggested that 'equipment' here should not be limited to hard goods, and should also incorporate an assessment of sports garments. There are two notable examples in this regard. The first, and one which highlights the gradual advancement from the epoch when athletic apparel was constructed from cotton and animal hair (Blair 2007, 61–3), is the now infamous LZR Racer swimsuit. The second is an altogether more recent one: Nike's Vaporfly running shoes, a product worn by Eliud Kipchoge in October 2019 when he smashed one of sport's most prominent barriers by running the marathon in less than two hours.

Speedo's LZR Racer – developed and patented in Italy (Pursell 2015, 122) – supposedly helps to balance the athlete's core by minimising drag in the water (Stefani 2012, 14) and allegedly offers swimmers a 2% improvement in performance (Foster, James and Haake 2012, 717). Given the competitiveness of professional swimming and the extremely tight margins between success and failure in this sport, this is a very significant advantage. Parnell (2008) helpfully sketches various other advantages of the swimsuit, including 'improved posture and buoyancy... better use of oxygen' and the repellence, rather than the absorption, of water. The apparent effectiveness of the garment is highlighted by the fact that 90% of the swimming records broken during the 2008 Olympics in Beijing were done so by an athlete wearing the LZR Racer (Matheson 2008).

As a result, Moses (2009, 343) observes that the suit was subsequently banned by FINA (the governing body of professional swimming) after they restated the 'main and core principle that swimming is a sport essentially based on the physical performance of the athlete' (BBC 2009). Wild (2010, 1359) argues that the LZR Racer blurred the distinction between athletic capability and technology, an argument which echoes the viewpoint of American swimmer Bill Pilczuk, who maintained that a previous version of the Fastskin swimming suit was not conducive to a 'level playing field' (Craik 2011, 74). Conversely, others have argued that the suit was an acceptable performance-enhancing addition to swimming because '[t]he swimmer makes the suit, not the other way around' (see the comments of Bob Bowman – Michael Phelps' coach – in Wild (2010, 1365)).

A similar debate has been played out in regards to Nike's Vaporfly shoes, a product which allegedly offers a 4% improvement to an athlete's performance, and which has been roundly denounced for 'distorting the record books' after 31 of the 36 top-three finishes in major marathons in 2019 were claimed by athletes wearing this new footwear (BBC 2020). Ingle (2020) also notes that Nike have angered rival manufacturers by taking out 'several patents on the angle of the carbon plate', a point which appears to echo the concerns highlighted above regarding the monopolistic nature of legal protection for such equipment. Notably, World Athletics have recently put an 'indefinite moratorium'

on future developments in shoe technology after conceding that there is 'sufficient evidence to raise concerns that the integrity of the sport might be threatened' by such developments (Ingle 2020). A similar point is raised by Lazaroff (1999, 162) who compellingly concludes that if a certain technological advancement leads to equipment becoming 'so sophisticated that one cannot adequately distinguish the relative skill levels of the participants in their performance, the very nature of sport is irrevocably altered'.

It is important to note, however, that Lazaroff does not explicitly state that sport would be 'irrevocably altered' in any *negative* sense. Indeed, sport is surely not just about the type of equipment that one wears; to excel as a champion, one must also have the correct mind-set, the necessary dedication and work ethic, and, in some instances, tactical nous. But, even if we accept this to be the case, it might still be questioned who is actually reaping the benefits of this equipment. It is quite often the case that new sporting technology is far too expensive for the average consumer to purchase. Nike's Vaporfly shoes, for example, may prove somewhat elusive for many amateur athletes at the relatively hefty price of £240 (Burgess 2020), and this may lead to an ever-increasing gap between professional and amateur athletes and poorer and richer athletes. For instance, and to take an even more extreme example, the AlterG anti-gravity treadmill used by numerous Olympic athletes has a market value of \$75,000 apiece (Bacalao-Fleury 2011, 207). It seems likely that only the (elite) athletes in the most affluent of countries will be able to afford such technology.

This risk of inequity is further compounded by the various sponsorship limitations that exist on certain pieces of equipment. Many professional athletes are prevented from using the Vaporfly shoes due to such reasons, and this resulted in one eager runner 'stitching another logo over the Nike swoosh so that he could run in the shoe in competition' (Ostlere 2020). To give another example, British swimmers had to seek permission to use Fastskin swimsuits because the 'British Olympic Association had signed a sponsorship deal with Adidas, which at the time did not make Fastskin suits' (Zettler 2009, 382). Even more startlingly, one of the Japanese coaches from that nation's Olympic swimming team remarked: 'If swimmers don't wear the LZR Racer, they won't be able to compete in [the] Beijing Olympics' (Bardin 2012). When considered alongside the fact that only six machines – all owned by Speedo (Morrison 2012) – are able to produce the compression fabric for the new patented Fastskin-3 swimsuit, it is clear that the legal protection afforded to many of these cutting-edge products may carry a significant threat of anti-competitive conduct that could have a negative impact on the integrity of sporting competition for all. Indeed, if only certain elite-level athletes with sponsorship agreements are allowed to wear or use specific performance-enhancing equipment, and other sports persons are essentially prevented from doing so due to the high costs of such novel equipment, this could lead to more predictable and less entertaining sporting outcomes. In other words, certain forms of sports technology may endanger competitive uncertainty by granting a unilateral advantage to particular athletes, thereby removing a large slice of the attractiveness of sport to the paying public. This, in turn, might result in lost revenue for numerous sporting bodies due to spectator disengagement. Perhaps only then will the stakeholders in sport begin to discuss this issue seriously.

Fairness

Nevertheless, one should be cautious not to exaggerate this perceived gap between professional and amateur athletes created by rapid developments in sports technology. It is arguable that allowing technological advances in sport – even they are only available to a limited few – might allow manufacturers to discover cheaper methods of creating a similar version of such equipment that could trickle down for use by those without deep pockets. As Craik (2011, 75) notes, Fastskin swimsuits were eventually adopted by amateur swimmers, and even used later for leisure swimwear. Moreover, lower-level and high school baseball teams in the USA were not required to adhere to Major League Baseball rules stipulating that bats be made solely of wood, and were allowed to use bats made from other materials to help improve durability and keep costs low (Caine, Blair and Vasquez 2012, 656). Thus, in the long run, technological advances may actually help to facilitate engagement in amateur sport (which brings with it the concomitant benefit of an active and healthy lifestyle), so it is not entirely undisputable that such developments offer an unfair advantage solely to certain professional athletes.

Moreover, even if we were to ignore the fact that 'unfairness' is a rather loose and woolly term in itself, we should also be cognisant of the other side of the fairness argument: that new technological sports equipment may actually provide *more* fairness from the perspective of determining the correct result of a competition. For instance, developmental advances (in this case, a sensor and touchpad) helped to correctly identify who won the silver and bronze medals in the 100-metre backstroke at 2004 Olympic Games in Athens after the second and third-placed competitors finished within one-hundredth of a second of each other; it was unclear to the human eye who finished first. Similar technology also now exists in football (Nlandu 2012; Svantesson 2014), cricket (Borooah 2016) and tennis (Collins and Evans 2008).

Perhaps the most recent – and controversial – example of such a technology is the advent of Video-Assisted Refereeing (VAR) in football. Simon (2019, 20) correctly adduces that the introduction of this system should be viewed in light of the backdrop of the 'march towards greater fairness in football by means of the use of new technologies'. This provides an interesting contrast with the aforementioned LZR Racer and Vaporfly shoes: these latter products may be less ethically defensible than technological equipment that aims to achieve the 'right' result, simply because they are not widely available on an equitable basis. In short, when we feel that equity is being compromised, the criticism regarding the lack of regulation of novel sports equipment heightens dramatically. Granted, Crespo (2019, 24) is correct in highlighting that 'there is not the economic capacity for everyone to benefit from' VAR. But the point here is that everyone in

a particular footballing contest will be playing by the same rules and procedures, whether that be governed by VAR or not. In contrast, the Vaporfly shoes and LZR Racer swimsuits are only available to a select few competitors, who may be competing against other athletes who do not have the luxury of such equipment (whether that be due to financial or sponsorship reasons). This probably helps to explain why the relatively recent introduction of electronic starting blocks in athletics – as detailed by Goldman (2014) – has come under much less scrutiny than the Vaporfly shoes. Both may change some aspects of how the sport is played, but it is only the latter that fails to benefit everyone in a particular contest equally.

In fact, sporting equipment that aims to achieve the ‘right’ result generally faces more opposition from a practical point of view than from an ethical one. The many objections to VAR we often hear in the media generally point out the many practical problems it possesses, such as the lengthy delays it produces and its potential to extinguish the passionate celebrations of fans after a goal. Other practical issues may relate to the need for greater precision in such sports equipment in the future. For instance, Nafziger (2004, 26) highlights the case of *Neykova v International Rowing Federation (FISA) & International Olympic Committee CAS Ad Hoc Division (O.G. Sydney 2000) 2000/12*. This case concerned a women’s scull race at the 2000 Sydney Olympics, where video technology did not have the necessary precision to identify the twelve-one-thousandths of a second between the two boats.

Disabled Athletes

With these comments on the link between technology and fairness in mind, Goggin and Newell (2000, 75) observe that the ‘existence of a special event for people identified as having disability is a painful reminder of inequity and injustice’. Indeed, it should thus be noted that such technological developments in sport do not just benefit professional athletes; the equipment may also operate to assist disabled athletes too. Various commentators have highlighted this fact. Jewell (2008) notes that the ‘development of new materials and cutting-edge designs as well as major advances in engineering and surgical techniques have given disabled athletes unprecedented opportunities to actively participate in sport’. Elsewhere, Howe (2011, 875) suggests that ‘technology is literally pushing the Paralympic movement’, whilst Charles (1998, 379) maintains that ‘technology and kinesiology are symbiotically linked. They have a mutually beneficial relationship’. One notable example of this phenomenon is the impact of technology on the rise of ‘wheelchair sports’, a pastime that has slowly grown in popularity and participation as various new advancements in wheelchair technology have been made.³ Nevertheless, whilst it is arguably correct to note that the Paralympic movement is a ‘vital means of integrating individuals with disabilities into the world of sports’ (Wild 2010, 1371), it is contended that there are two immediate concerns regarding the advances in technology to support disabled athletes.

The first is that the creation of equipment for those with disabilities is often marred by the somewhat ignorant and patronising comments on the Paralympic Games evident in the media. Goggin and Newell (2000, 78) note, for example, that many stories regarding disabled competitors ‘draw on stock stereotypes of “brave, elite athletes”, “special people”, “remarkable achievers”’. Other scholars – notably Misener et al. (2013) – have referred to the reinforcement of disability stereotypes perpetuated by the Paralympics. Consequently, it is asserted that the debate on the legitimacy of assistive technologies for disabled athletes should be seen in light of this underlying backdrop. The second point of interest is that the ‘technocentric ideology’ that Charles (1998, 379) identifies in disabled sport might be leading to what Howe (2011) terms the celebration of ‘cyborgification’ in the Paralympic Games. This has arguably led to a situation in disabled sport whereby the ‘closer a body is to a cyborg, the more capital it holds’ (Howe 2011, 878). Here the concern is that the rapid development of more complex technologies for disabled competitors might instead be labelled in a more corrosive and negative manner as ‘technological doping’ – or, as it has otherwise been termed by Wolbring and Tynedal (2013), ‘technodoping’. On this basis, the logic is that we risk the Paralympics descending into a competition that tests who has access to the best technology rather than who has the most natural talent. This concern might be further amplified by the often prohibitive costs of such equipment (Mahajan et al. 2019, 92).

Conversely, other commentators have declared that such technology is only ‘restorative in nature’ (Dyer et al. 2010, 593–5). The essence of this argument is, as Edwards (2008, 121) opines, that equipment for disabled athletes helps to ‘level out [the] inequalities’ that these competitors received in the ‘poor deal they got from the natural and social lotteries’. This suggests that technological advancements may actually help to enhance the autonomy of disabled athletes by creating new opportunities (thereby broadening the scope of their choices) and supporting them to reach and maintain their peak performance. From a libertarian perspective then, it is arguable that such advancements do result in superior sporting equipment for those with disabilities, and it may be that the concerns regarding ‘technodoping’ simply constitute an overstated moral panic propagated by only the most ardent of technophobes. Indeed, as Savulescu, Foddy and Clayton (2004, 667) explain, ‘sport discriminates against the genetically unfit. Sport is the province of the genetic elite (or freak)’. This is reinforced by Anderson (2010, 163) who highlights that the success of the Finnish skier Eero Mäntyranta in the 1960s was, to a large extent, attributable to the fact that he had a ‘natural genetic mutation that meant his blood delivered 40–50% more oxygen to the muscles than the average’. The point here is that sport already seems to confer unfair advantages to some competitors, so by implementing various innovative pieces of equipment to aid disabled people to compete alongside able-bodied athletes, we may simply be allowing disabled competitors to keep up with these so-called ‘freaks’. Nevertheless, despite this deceptively simple retort, the manner in which various adjudicators have addressed this issue has been nothing short of problematic.

The key case study in illustrating this point is that of Oscar Pistorius, a double amputee sprinter known colloquially as the ‘fastest man on no legs’, due to his use of the carbon-fibre prosthetic limbs entitled ‘Cheetahs’ (van Hilvoorde and Landeweerd 2008). After the IAAF consulted Rule 144.2(e)⁴ and banned Pistorius from competing against able-bodied athletes due to the apparent advantage he gained from his prosthetics,⁵ the runner challenged the decision before the Court of Arbitration for Sport (*Pistorius v International Association of Athletics Federations CAS 2008/A/1480*). The court overturned the ban after conducting numerous scientific tests to determine the advantages and disadvantages of the use of these ‘Cheetahs’. Herein lies the potential problem: the highly individualised and fact-sensitive nature of the test arguably allows for (and perhaps, from a cynical point of view, even *encourages*) arbitrary and ad-hoc judicial decisions. Alas, as Wild (2010, 1351) explains, ‘the manner in which this test is executed poses serious problems for athletes and athletic governing organisations’. The astonishing disparity of test results in the Pistorius saga – as evidenced in Bidlack (2009, 615–7) – perhaps indicates that the decision as to whether a disabled athlete is offered an unfair advantage by a piece of sporting equipment may be dictated more by gut instinct and personal feeling than by any concrete and substantial scientific data (a point which was also highlighted earlier in relation to the motor-fitting example). As Bidlack (2009, 620) predicts, ‘the only conclusion that can be drawn is that even more testing will come.’

Given this unenviable state of affairs, it might be pondered whether this lack of decisiveness may dissuade sports manufacturers from innovating to produce new equipment for disabled athletes. In this regard, it is suggested that legal protection for such equipment may indeed facilitate better technology for those with disabilities, but since the current scientific-based testing is so prone to disparate and uncertain results, inventors might not consider it wise to take the risk to pursue further technological advances for the benefit of disabled sportspersons. This argument is lent further credence by the fact that the *Pistorius* decision is limited solely to Oscar Pistorius, meaning that other athletes who use the same (or similar) versions of such prostheses must produce a new set of test results.⁶ For example, the German long jumper Markus Rehm could not rely on *Pistorius* to prove that his carbon-fibre prosthetic leg did not give him an unfair advantage (Baker 2015, 95). A similar balancing test of the advantages and disadvantages of a golf cart to a disabled athlete was also required in the earlier US case of *PGA Tour v Martin 532 US 661 (2001)*. As a result, it seems that there is considerable potential for continued litigation in this area of law, and this is likely to lead to increased costs for manufacturers (particularly when considered alongside the lengthy and costly application process for patents to protect such products). This problematic situation is further intensified by Bidlack’s (2009, 622) observation that the use of prosthetics may sometimes be banned if they endanger the safety of participants by bringing ‘foreign objects [...] into the field of play’. The impact that such new technologically advanced equipment might have on the safety of athletes is now examined in more detail.

Is It All About Keeping Athletes Safe?

It should be stated at the outset that the safety of competitors appears to be intrinsically linked to the development of sports equipment. Hutzler (2012, 77) notes, for example, the safety concerns of using patented wheelchairs during the 1975 Boston Marathon, and it has been contended that the wellbeing of athletes was jeopardised by the introduction of synthetic balls in basketball that appeared to cause lacerations to the fingertips of the players (Caine, Blair and Vasquez 2012, 657). Likewise, the stronger and lighter baseball bats referred to earlier allowed players to strike the ball much harder, potentially putting other players – particularly the pitcher, who stands immediately in front of the batter – at a higher risk of being injured (Caine, Blair and Vasquez 2012, 656). However, whilst this reaffirms the aforementioned point that not *all* technological advances actually result in more desirable sporting equipment, more often than not, the equipment is used to *improve* the safety of athletes.

Perhaps the most interesting example of this, and one which arguably challenges previous doubts regarding the likelihood of the ‘perfect helmet’ coming to fruition, is the launch of the ‘StemGuard’ cricket helmet, designed to ‘reduce the impact of high-speed deliveries at the neck area’ (Cassidy and Potts 2015). This helmet was patented by Masuri after the tragic 2014 death of Australian cricketer Phillip Hughes, who died after a cricket ball hit him on the back of the head (BBC 2014). Furthermore, new and inventive technologies such as stimulus-activated polymers, which are receptive to heat and light (Meng and Hu 2010), could provide even safer equipment for sports in the future. Indeed, particularly in relation to amateur sportspersons and members of the public involved in leisure sports, such material could be useful for improving the visibility of cyclists or runners when the weather is poor. This raises an interesting, yet seriously underexplored, inter-related point: technological advances in sport may not just result in more desirable equipment for sportspersons, but also for the public in general. As Caine, Blair and Vasquez (2012, 657) remark, there is a ‘current trend for sports materials and technologies to be migrated into healthcare applications, such as prosthetics, compression garments and wearable sensors’. Consequently, on a utilitarian model, it might be said that the rapid rise in the number of innovative pieces of sports equipment seems to provide the greatest happiness for the greatest number by also helping to improve the welfare of the public as a whole.

However, whilst Caine, Blair and Vasquez (2012, 658) also comment that ‘safety and personal protection is, and will continue to be, a major catalyst for the integration of new materials in sports’, some concerns must be voiced about the interplay between aesthetics and sports, which threatens to weaken the impact that technological advances may have on the safety of athletes. A 2013 study found, for instance, that the principal reason for sportsmen refusing to wear a

patented ankle support device was because they were ‘aesthetically unappealing’ (Cusimano et al. 2013, 27). A similar point was also made by Marikar (2019) in the context of golf, when she suggested that the wearing of more trendy and fashionable clothes in the sport could help to boost its appeal to a younger audience.

This suggests that, if the benefit of technological advancements in the sporting arena is to be maximised, such advancements must adhere to the unwritten fact that sport has become the ‘centre stage in the pantheon of fashion’ (Craik 2011, 73). As Quinn (2002, 186) notes, the notion of style and ‘sex appeal’ is now rife in professional sport. This could help to explain why Pistorius had to fight so hard to justify his Cheetah blades; perhaps due to ‘technophobic stigmatisation’ (Swartz and Watermeyer 2008, 188), the ‘unsettling’ and ‘unnatural-looking’ hook⁷ arguably did not look aesthetically appealing enough to be used in the Olympics. This is possibly because, as one renowned commentator has caustically argued, it did not depict the ‘perfect body’ (Longman 2007). Shogun (1998, 272) makes a similar point, suggesting that when athletes with a disability ‘use technologies to adjust the participation in “normal” physical activity, the use of these technologies constructs this person as unnatural in contrast to a natural, nondisabled participant, even though both nondisabled participants and those with disabilities utilize technologies to participate’. Consequently, whilst safety is still – and should continue to be – the key concern of any new piece of sports equipment, manufacturers should be advised to consider this secondary aesthetic implication during future invention processes in order to ensure they maximise their profits and the usability of their equipment.

Conclusion: Looking Towards the Future

It is also during this invention process that manufacturers are likely to require more guidance on what equipment is – and is not – deemed acceptable in the sporting context. A failure to adequately distinguish between these two rudimentary positions might lead to two possible ramifications. Firstly, it might discourage efficient innovation as, without some idea as to what inventions will be valid in the future, manufacturers may not consider it worthwhile to expend both their time and precious financial resources on technological advances for the benefit of competitors. This could have obvious negative ramifications for the safety of athletes. The second possible consequence is that the tempestuous and emotionally-charged debate about the ethical and moral implications of certain athletes gaining an unfair advantage from ‘technodoping’ is likely to continue. This could also operate to the detriment of many athletes, particularly if they are ruled out of competition for an extended period of time. Oscar Pistorius, for example, failed to qualify for the 2008 South African Olympic Team due to the delayed and uncertain nature of the scientific testing in his case (Bidlack 2009, 613). As such, it is likely that, in order to resolve these issues, future guidance may be required from both the Court of Arbitration for Sport and sports governing bodies to ensure that the correct balance is struck between tradition and innovation in sport.

The International Table Tennis Federation’s (ITTF) regulation of table tennis equipment in the 1980s provides an illuminating example. Due to concerns around spectator engagement and the imbalance of matches, the ITTF sought to regulate the size, colour and material (notably, the glue) of table tennis paddles in an attempt to maintain sporting equity (Gelberg 1998, 40). A similar, and more recent, example of a call for regulation in regards to sports equipment is proffered by Burns and Tam (2019). They suggest that, given both the need to retain the ‘spirit of the universality of athletics’ and the complexity of the design of Nike’s Vaporfly trainers, the shoe’s midsole thickness should be regulated. In this regard, it is suggested that there is much to be commended in Pendlebury and Semens’ (2011, 20) analysis that sports governing bodies must conduct a regulatory assessment of their equipment to ‘ensure that sports maintain their unpredictability, their integrity and continue to be safe’.

Whilst it should be noted that many governing bodies are doing a commendable job in this process, with some implementing a ‘proactive approval policy’ for new technological sports equipment (see Dyer (2015, 3), who notes the current policy of the national governing body for golf in the US), others have failed remarkably. As Parnell (2008) reports in relation to professional swimming, ‘all FINA sees is the glamour and world records. They see themselves as entrepreneurs, not as the custodians of the sport’. In rare instances, the problems engendered by inadequate regulation may even be exacerbated in some sports due to the lack of a governing body at all. For instance, the absence of a specific governing body for sailing resulted in various disagreements over hull design at the America’s Cup (Nafziger 2004, 14). However, it is clear that if both adjudicators and sporting governing bodies at least attempt to provide some form of guidance to further assist manufacturers in creating more state-of-the-art sporting equipment, we may finally see the day where we can confidently conclude that technological advancements are able to provide professional, amateur and disabled athletes with the opportunity to reach their full athletic potential in a safer (and, one would imagine, more aesthetically pleasing) manner.

Notes

¹ Notably, a similar type of safety-related mouthguard also appears to have made its way to Australia, with various AFL and NRL clubs using a mouthguard equipped with motion sensors to collect data on impacts to the brain. See Le Grand 2019.

² See further, at p.40: ‘Warrior will win some and lose some, but it most assuredly has informed their competitors that it will zealously protect its research, intellectual property, and patent rights in the demimonde of lacrosse equipment manufacturers.’

- ³ See, for example, Phillip Gonzales' 1992 application for a 'Wheelchair Occupant Motion Stabilizer for Exercise Machines' (European Patent Office 1994).
- ⁴ See the IAAF Competition Rulebook available at <https://www.iaaf.org/about-iaaf/documents/rules-regulations> accessed 11 December 2019.
- ⁵ As former IAAF President Lamine Diack warned: 'We cannot permit technical aids that give one athlete an unfair advantage over another.' See Wild (2010, 1349).
- ⁶ *Pistorius*, para 56: '...the Panel's decision in this appeal has absolutely no application to any other athlete, or other type of prosthetic limb. Each case must be considered by the IAAF on its own merits.'
- ⁷ It is notable that Pistorius didn't help really help himself in this regard by appearing in a Nike advert where he described himself, somewhat unceremoniously, as a 'thing'; see Marcellini et al. (2011, 7).

Competing Interests

The author has no competing interests to declare.

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