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ORIGINAL ARTICLE

From anti-doping to a 'performance policy' sport technology, being human, and doing ethics

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Abstract
This paper discusses three questions concerning the ethics of performance enhancement in sport. The first has to do with the *improvement to policy* and argues that there is a need for policy about doping to be re-constituted and to question the conceptual priority of 'anti' doping. It is argued that policy discussions about science in sport must recognise the broader context of sport technology and seek to develop a policy about 'performance', rather than 'doping'. The second argues that a quantitative enhancement to a sporting performance has no value and is, thus, unethical, unless the motivation behind using it implies something meaningful about being human. Thus, unless the use of the technology is constitutive of our humanness, then it is not a justifiable method of *altering* (rather than enhancing) performance. This rules out the legitimacy of using performance enhancement to gain an advantage over other competitors, who do not have access to similar means. Finally, the third argument claims that sport ethics has had only a limited discourse and has failed to recognise broader theoretical ideas in relation to performance modification, which might be found in the *philosophy of technology* and *bioethics*. Collectively, these positions articulate important concerns about the role of science in sport and the ethical discussions arising from them.

Keywords: *Ethics, genetics, performance, policy, enhancement, anti-doping*

Introduction

This essay explores a number of assumptions about elite sport in the context of new technologies, which are beginning to challenge its ethical foundation. Primarily, the paper is concerned with the parameters of ethical performance in sport and how this should be reflected in policy about performance enhancing technologies. As part of this deliberation, critical concepts that are often assumed to be fundamental to elite sport will be questioned by critiquing the way that ethics has been developed in sport. To some extent, the expectation is that this paper can offer some evidence and suggestion as to how sports authorities might work towards keeping sport meaningful.

There are three questions about improvement that I will discuss. The first has to do with the *improvement to policy* in relation to sport. The second concerns whether an *improvement to performance* might or might not constitute an improvement to sport. Finally, the third kind of improvement can be seen as a recommendation to *improve sport ethics*. I intend to tackle each of these separately, though collectively they reveal important insights into scientific trends in elite sport and the ethical issues arising from them. Each of these sections can be understood in the context of emerging technologies, which are being used to modify performance and are, thus, directed specifically to sport scientists. Unfortunately, it is not possible to introduce a significant amount of detail about individual cases, though more information on these specific matters can be found elsewhere (Miah, 2002; Miah & Eassom, 2002).

Improving policy

The subject of doping and drug use in sport has dominated ethical debates about science in sport over the last 30 years. Since 1999, the World Anti-Doping Agency (WADA) has been charged with 'harmonising' anti-doping policy, thus addressing previous weaknesses in the global anti-doping

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struggle. However, when analysing the manner of policy development in anti-doping, it is useful to begin a little earlier. Indeed, a significant starting point would be the emergence of the International Olympic Committee's (IOC) Medical Commission in 1967. These times were constituted by considerable unrest in the medical ethical and sporting community. The IOC Medical Commission arose partly as a result of athletes dying in the field. Perhaps the most significant of these cases was Tommie Simpson, who was visible to the world through the televisation of the Tour de France in 1967. Arguably, one might suggest that the mediatisation of this event was integral to the political force of the anti-doping movement. One might even make a similar claim about the emergence of WADA, which itself developed partly out of the 1998 Tour de France drug scandals. Throughout this time, anti-doping policy has remained the responsibility of medical professionals. To this extent, it is not surprising that the kinds of values it reflects are consistent with medical ethical norms.

In this sense, the policy and structures involved with its development rely significantly on a concern for an athlete's *health*. This is reflected in anti-doping policy, where substances are prohibited because they are considered to be medically unsound to use with healthy people. While policy makes other references to the 'spirit of sport' as an additional ethical concern, there is limited elaboration on what this means. Moreover, it seems reasonable to claim that the values pertaining to the medical profession are more directly influential to doping policy, than the values of sports ethicists. As such, one can conclude that the 'harm' concern is often a *sufficient* condition on which new technologies are prohibited, even though this might not be possibly to justify. It is an argument that has the weight of the entire medical profession behind it.

Yet, the invocation of such paternalism – or, what might otherwise be described as a straightforward application of the biomedical model of ethics – does not have widespread acceptance, since it is seen to conflict with an athlete's individual liberty. On this basis, athletes should be permitted to use whatever they like on their bodies, so long as it does not conflict with law (although this final caveat is, itself, problematic, since doping policy does have the weight of law behind it). Such concerns have been exacerbated by claims that anti-doping tests are a further infringement on individual freedom (Palmer, 1992). This response is often countered by the suggestion that individual liberties have less currency in sports, since they are social practices that rely on a set of agreed rules. Research has drawn attention to privileged voices who have developed modern sport, to the expense of a democratic, open dialogue about its values (Morgan, 1994). Indeed, one might identify the aristocratic origins of modern, competitive sport as some support for this.

Yet, if anti-doping relies on the harm argument, how far can it really be used? Arguments against the prohibition of doping for reasons of harm often employ an example of an accepted harmful practice, to justify why banning doping is *not* acceptable at least, not on this basis. For example, horseracing and boxing are both examples of sports that are inherently risky (Payne, 1990). As such, if the sole basis of banning doping is its potential to harm, then a similar concern might mean that we should ban boxing and horseracing. In response to this potential defence of doping, the position mistakenly assumes an *argument from precedent* by using an ethically undesirable circumstance – harm in boxing – to justify why a similarly undesirable circumstance – doping – should be allowed. For this reason, it is an invalid argument: just because we do a), we should also do b), which is the same as a). A number of further points can be explored to understand how this difference in treatment of harms is rationalised, though it reveals that harm alone is not the only reason for banning doping, even if it is a good reason to reject new, untested methods of performance enhancement. However, the justification for this paternalism is to prevent circumstances where sports become *more* harmful than they need to be.

The concern for health has been a significant part of anti-doping policy, though it is strengthened by other ethical arguments, such as the concern for fair play (Loland, 2002c). Alternatively, one might argue that anti-doping is justified because it ensures that athletes are playing the desired kind of game. On this view, doping is unethical because it undermines the constitutive elements of the sport. Yet, this kind of response is also contested, since the purpose of any given sport is disputed. For example, is the purpose of soccer to score more goals in the opposing team's goal than is scored in one's own, or is there something more to the victory, such as the manner in which it is done? In many blood sports and aesthetic sports, the way that actions are carried out is critical to what constitutes sporting excellence. Indeed, these views have been discussed extensively in the philosophy of sport literature, most notably by Best (1978) who explores the differences between purposive and non-purposive sports. Even in sports that are clearly purposive, Best argues, it is possible to describe non-purposive elements that are of value. For example, in soccer, a goal scored from a penalty in soccer is valued differently from a goal that has resulted from a highly complex set of passes and an acrobatically precise final shot. As Best describes when considering a vault in gymnastics, "The way in which the appropriate movements are performed is

not incidental but central to such a sport" (p. 104). From this perspective, one might argue that the manner in which sport take places should be without the aid of doping because using such methods is to participate in a completely different kind of activity.

In response to this argument and the concern about health more specifically, it is necessary to explore more carefully what kinds of games are of interest to Sports Federations. What version of skiing or tennis is desirable and how does this relate to doping? To answer this question, it is essential to consider its broader context. To this extent, I would like to advance the discussion by arguing that there is a need to approach anti-doping policy in a manner that recognises doping as only one section within a policy on performance enhancement. Moreover, I wish to highlight the inability (and thus, hypocrisy) of anti-doping policy to suitably protect sports from the various kinds of performance modification that might undermine the value of sporting achievements.

Thus, a concern for doping in sport is more properly a concern for a variety of methods of performance modification, though the manner in which ethics about doping has been theorised in anti-doping policies fails to recognise this broader aspect of performance. Aspiring to understand what is ethically problematic about doping requires understanding what constitutes a valuable sporting performance. Such discussions must engage with the ethical status of other kinds of performance enhancing technology.

A number of different categories of performance-altering technology are possible to identify in elite sport. An initial attempt at this conceptualisation is offered in Miah (2002) and is summarised thus:

- Technologies that make sport possible.
- Technologies that improve Safety and Reduce Harm (Bjerklie, 1993; Gelberg, 1995; Tenner, 1996).
- Technologies that de-skill or re-skill sports (Gardner, 1989; Hummel & Foster, 1986; McIntosh, 1963; Miah, 2000c; Simon, 1991).
- Technologies that dehumanise performances (Fraleigh, 1984; Hoberman, 1992; Miah, 2000a, 2001).
- Technologies that increase participation and/or spectatorship (Brody, 2000; Gardner, 1989; Miah, 2000b; Tenner, 1996).

These varied examples provide some basis for understanding the complexity and effect of performance-altering technologies in sport. A further category might be required to account for those technologies that have an ambiguous effect on the sport or for which there are a number of unknown consequences. One such example is found in Gelberg's (1995) overview of the plastic helmet in American Football. This innovation was designed to reduce the significant risk of head injury that existed in American Football. By virtue of being more robust than previous leather shells, the plastic helmet was set to promote a new standard of safety within American Football, despite some initial teething problems in design. As Gelberg describes, by the late 1950s leather helmets were no longer used by Football players and plastic helmets became dominant. However, Gelberg explains, the result was not simply a less dangerous sport. Instead, the game became even "more brutal" (p. 302). While head injuries decreased, a significant increase occurred in the amount of other injuries that were sustained by Football players. This anomaly is also attributable to the helmet since, as Gelberg explains, players would tackle harder, resulting in more injuries to other parts of the body. Players would even learn to use the helmet as a weapon against opponents, as its robust structure allowed a significant impact upon another person's body. As Gelberg states, "If the helmet hit the player, often the force was devastating enough to cause the player to release the balls" (p. 306).

These categories demonstrate that ethical issues concerning performance enhancement are not exclusive to doping. One limitation of this conceptualisation might be the degree of overlap between the different categories. For example, the improvement of floor surfaces within sports halls can significantly reduce injury and would thus be described as a 'safety' improvement. Yet, it is also reasonable to characterise this technology as having re-skilled the activities. As such, it could be argued that the categorisation vastly simplifies any single example of technology within sport and, therefore, does not suitably characterise it.

Consequently, it is tempting to draw some further categorisation about them in an effort to find some conceptual framework that demarcates technologies from non-technologies. One suggestion is offered by Butryn (2002) who separates them into five categories: self, landscape, implement, rehabilitative and movement. One might use an example of technology, such as genetransfer, as a 'self' altering augmenting technology, or a tennis racket as an 'implement' technology. Further refinements to this conceptualisation are not possible in this paper, though it is important to emphasise that such proposals are not under consideration in anti-doping policy. Yet, Butryn's analysis demonstrates that there are a number of ways in which technology alters performance and that this goes far beyond the simplistic conceptualisation within anti-doping policy.

On the basis of this broader framework of evaluating performance-enhancing technology in sport, one of the most useful theoretical developments in anti-doping policy would be to omit the phrase 'anti-doping' from international sporting circuits and replace it with a more complex and tentative policy on *performance*. Such a policy would recognise the broader ethical issues arising from sport technology and attempt to define the parameters of what constitute legitimate means of performance enhancement. It would also be more sensitive to the different kinds of technologies emerging in elite sport and reveal more precisely what it is about performance that is valuable.

One new method of performance enhancement for which this revised conceptualisation could be useful is *hypobaric training* chambers or altitude chambers, which have begun to cause controversy in elite sport (Loland, 2002b). This technology is being used for a variety of reasons, though are predominantly controversial because elite athletes are using them to try to boost their performance. It is argued by some athletes that the chambers or tents allow them to eliminate a performance disadvantage incurred by having to compete at high-altitude, when coming from a low-altitude country. The chambers simulate a high altitude and allow an athlete to acclimatise to the environment and train at a low altitude, thus being able to 'live high and train low' without having to move geographical location (Levine & Stray-Gunderson, 1997). However, athletes are also using such chambers simply to push the body even further, in order to increase their competitive advantage.

This new method of performance modification is not easily categorised as a method of doping – and it is currently not on the list of doping methods. It is conceptually different from other methods of doping, since it does not involve any invasive technology. Neither does it involve the ingestion of substances or have the negative social connotations that drug use has. Indeed, it does not sound particularly different from a plethora of 'implement' (Butryn, 2002) technologies that are readily accepted as an integral part of the training process, though this is only a partial explanation for why it is not considered to be unethical. In the context of the earlier discussions on anti-doping policy, altitude chambers are not unethical, since they do not harm. However, the World Anti-Doping Agency has recently announced its intention to investigate the effects of these chambers more thoroughly (Shipley, 2004). On the basis of my earlier claims, if such studies indicate that altitude chambers are harmful, then this will surely be used as a sufficient reason to prohibit them. Moreover, one might offer some further specificity to this category, by stating that, for the technology to be unacceptable, the harm must result from the application of some medical intervention, which is not widely endorsed by the medical profession. To this extent, it is still unclear whether hypobaric chambers would be considered unethical, though it is probable that they will be described as an unacceptable use of a medical intervention.

As is perhaps apparent by now, I would argue that this conclusion is inadequate. Rather, Sports Federations should consider the broader contribution to sport offered by altitude chambers and other performance enhancing technologies. Thus, it might require addressing the importance of eliminating the disadvantage some athletes suffer from, by residing at a low altitude. To this extent, permitting altitude chambers would be consistent with Loland's (2002) concern for eliminating 'non-relevant inequalities' – the altitude of the country where one trains is not a relevant inequality in the sports competition, though acceptance might exacerbate a further irrelevant inequality since it is available only to those countries that can afford such technology. Yet, the most significant characteristic of this example is that it demonstrates the difficulty with segregating different kinds of technologies when considering how a policy on performance enhancement should be formulated. Thus, even if one were to conclude that altitude chambers are unacceptable, the approach should be based on an ethical framework that addresses doping as just one form of technology. Such a framework could also be utilised when considering, perhaps, new tennis racquets or even new performance techniques.

In sum, policy on performance-altering technology must develop a conceptualisation of performance-altering technology in sport. The priority of this initial process of policy formation would be to inquire into the value of performance in sport and derive a definition of what constitutes sporting excellence.

Improving performance

The use of science and technology in sport gives rise to questions about what counts as a valuable kind of performance in sport. It is commonly regarded that improving one's physical capacity, breaking world records and so on, is an enhancement to performance; running faster in a competition is better than running slower. On this theory of sporting excellence, enhancement in performance entails achieving a quantifiable difference in performance achieved by legitimate means. Yet, I wish to argue that changes in quantifiable measures of performance *do not* constitute an improvement or enhancement in performance. In short, running faster is not running better. This view corresponds to Loland's (2002a, 2002b) attempt to derive different moral views on sport and

his rejection of his 'thin theory' of sport. Thus, Loland concludes that genetic modification would not add any value to sport, since it would only alter mere quantitative aspects of performance and not place any athlete in a strategically better position. Very little can be said about the credibility of the athlete as a result of genetic modification or other methods of doping, which contrasts with training methods to enhance performance, since these means reveal a commitment and effort on the part of the athlete to achieve the gains. Loland argues that it is these characteristics of sporting performance that matter and that they reflect a preferable 'thick theory' by describing the 'norms, values and internal goods that…are linked to more general human virtues' (html).

Loland's partial rejection of using altitude chambers in sport is explained through this 'thick theory' of sport performance. Yet, I would suggest that Loland's analysis takes the technology out of context. To suggest that a performance enhancement of 5% for all competitors would have no benefit to the sport – save for the 'thin' benefit that everyone will be performing at a higher level –misrepresents what takes place when athletes enhance their performances with technology. For example, greater levels of strength, speed, and agility make possible new kinds of techniques. Again, this reflects the earlier claims about 're-skilling', which takes place when a new innovation is introduced to a sport. Moreover, Loland's separation of the 'expert' or medical professional from the athlete or practice community of sport is misleading. To imagine that the athlete's coach or physician simply says 'you must do this' and that the athlete simply follows without question is, at best, a rejection of bad practice in sport. It is not a rejection of the role experts play in creating an athlete's elite performance, which is, generally, the result of a range of people's efforts, time, and investment.

I do not accept that nothing is gained by permitting such technologies, though there is a further response to be advanced. Loland's analysis does not take into account a further point to which he alludes: *understanding what our use of technology says about our humanness.* While I support Loland's thick theory in principle (and suspect we agree on the need for a broader approach to performance technologies in sport), I challenge the conclusions it presents for some of the technological examples he considers. In particular, I suggest that genetic modification and altitude chambers can add some value to sport – even for the thick theorist – precisely because they re-describe and challenge accepted views of what it means to be human. To embrace genetic modification entails making a statement about what is valuable about being human, which might be little more than acknowledging that humans are a kind of being that seeks to transcend the limitations of biology. Thus, in relation to genetic modification or other methods of human enhancement in sport, the important point is that the justification of using genetic modification is not to enhance performance or to gain an advantage. Rather, it is to approach a way of being human that is more reflective of our authentic selves (Miah, 2004). It is this basis that should be the criterion against which performance modification is evaluated, rather than limiting the discussion to some normative ethical view of sport or some notion of fair play (although, my proposal does not negate the fair play argument).

Improving ethics

My final improvement to conceptualising performance-altering technologies in sport concerns the way that ethics is theorised. Currently, ethical arguments about performance enhancement and technology in sport draw heavily upon literature in sport philosophy and philosophical inquiry more broadly. However, there has been only a limited overlap between discourses in philosophy of technology or medical ethics (including bioethics). This has inhibited the kinds of discussions taking place in relation to performance enhancement in sport.

Literature in philosophy of technology has spent considerable time problematising technology and developing different ways of approaching how we make sense of technology in society (Cardwell, 1994). For example, Hood (1983) explains how Aristotle's view on technology implies that, "technology is a human arrangement of technics – tools, machines, instruments, materials, sciences, and personnel – to make possible and serve the attainment of human ends" (p. 347). This view makes sense of technology as a means-end activity; technology is not an end in itself, but a means to the realisation of some other, valued end. In this capacity, technology is understood as lacking in moral content and, therefore, suggests that technology does not raise moral issues. However, Hood develops this idea, arguing how,

> use is not an end in itself, its final purpose is the same as that of all human action – namely the maintenance of human life and its perfection in which man attains *eudaemonia*, his supreme happiness…. To achieve human perfection man needs to cultivate not just technology, that habits and know-how which make up productive cognition, but a life that transcends mere making (Hood, 1983, p. 351).

This view assists in explaining the historical context of technology in sport, given the way in which technology is employed as a means towards a particular end: *performance*. Re-addressing this literature can assist in making sense of technology in sport and identifying more fundamental problems with performance modification. For example, in the context of this discourse, it might be more appropriate to conclude that the technologisation of sport (again, not just for the prohibited examples of technology) has led to a situation that is wholly undesirable – perhaps because it is integral to the aspiration for technological progress, transcendence, and limitless enhancement. It might require questioning the fundamental values of sport, such as the importance of competition, winning, and physicality. Indeed, this last point is particularly important in the context of the present paper, since such aspirations seem to capture the spirit of Olympic values, made explicit by the Olympic motto, 'citius, altius, fortius'. However, without this broader understanding of technology – without being able to contextualise sport technology – it is not possible to make sense of how sports relate to technology.

It is also surprising that literature in bioethics and medical ethics has failed to become integral to discussions about the ethics of science and technology in sport. Even within anti-doping policy, ideas from this discipline are only referred to indirectly through the application of medical ethical principles related to medical technologies in sport. For example, the preoccupation with 'harm' is reflective of the important medical ethical principle of 'beneficience', where physicians are obliged to limit their interventions to those that will be to the benefit of a person's health (Beauchamp & Childress, 1994). Alternatively, it is frequent to question the distinction between therapy and enhancement in sport performance. Indeed, the World Anti-doping Agency has revised its anti-doping code to determine the ethical difference between such effects. However, very little research looking at this distinction has included reference to a significant amount of material in bioethics that problematises this distinction.

A critical analysis of the synergies between bioethics and sport ethics has yet to be fully explored. However, their use of shared concepts can inform a number of positions concerning performance enhancing technologies, particularly where authors have identified the need to derive a more coherent understanding of being human to determine the acceptable limits of performance (Loland, 2000; Schneider & Butcher, 2000). Indeed, sport is frequently cited in bioethical discussions, particularly about human genetic modification (Boyd, 2000; Chadwick, 1987; Elliott, 1998; Glover, 1984; Ledley, 1994; Parens, 1998; Welie, 1999; Wilkie, 1993).

Conclusion

This article has argued that the approach to performance enhancing technologies in sports should be far broader than is currently considered within anti-doping policy. Indeed, I have argued that the current approach exhibits considerable limitations, which, because of their incoherent ethical foundation, do not lend themselves to a successful or accepted policy. I have attempted to identify a number of taken-for-granted assumptions about what constitutes improvement in relation to policy, ethics, and performance. I suggest that one of the enduring problems with ethical arguments about science and technology in sport has to do with the limited breadth of discussions, which is only exaggerated in policy-making on these issues. Indeed, Houlihan (1999) recognises that, at no point since its inception, has the policy discourse surrounding anti-doping re-questioned the basic values of sport (and athletes) that it is trying to protect. While there are relatively few applied ethical issues that have clear conclusions for all ethicists and philosophers, sport appears to have made its conclusions about performance enhancement without first coming to terms with the complexity of the issue. By reformulating performance enhancement in sport and the ethical discussions arising from it, there is a better prospect for achieving a coherent theory of sporting values.

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References

Beauchamp, T. L., & Childress, J. F. (1994). *Principles of biomedical ethics* (4th ed.). New York and Oxford: Oxford University Press.

Best, D. (1978). *Philosophy and human movement*. London: George Allen and Unwin.

Bjerklie, D. (1993). High-tech olympians. *Technology Review*, *96*, 22–30.

Boyd, K. M. (2000). Disease, illness, sickness, health, healing and wholeness: exploring some elusive concepts. *Journal of Medical Ethics: Medical Humanities*, *26*(1), 9–17.

Brody, H. (2000). An overview of racket technology. In S. A. Haake, & A. O. Coe (Eds.), *Tennis, science, technology* (pp. 43–48). London: Blackwell Science.

Butryn, T. (2002). Cyborg horizons: Sport and the ethics of self-technologization. In A. Miah, & S. B. Eassom (Eds.), *Sport technology: History, philosophy and policy* (pp. 111–133). Oxford: Elsevier Science.

Cardwell, D. (1994). *The Fontana history of technology*. London: Fontana Press.

Chadwick, R. F., ed. (1987). *Ethics, reproduction and genetic control*. London: Routledge.

Elliott, C. (1998). What's wrong with enhancement technologies? CHIPS Public Lecture. Available from: http://www.gene.ucl.ac.uk/bioethics/writings/Elliott.html Accessed May 2004.

Fraleigh, W. (1984). *Right actions in sport: Ethics for contestants*. Champaign, IL: Human Kinetics.

Gardner, R. (1989). On performance-enhancing substances and the unfair advantage argument. *Journal of the Philosophy of Sport*, *XVI*, 59–73.

Gelberg, J. N. (1995). The lethal weapon: How the plastic football helmet transformed the game of football, 1939–1994. *Bulletin of Science, Technology and Society*, *15*(5–6), 302–309.

Glover, J. (1984). *What sort of people should there be?*. Harmondsworth: Penguin.

Hoberman, J. M. (1992). *Mortal engines: The science of performance and the dehumanization of sport*. New York: The Free Press.

Hood, W. F. (1983). The Aristotelian versus the Heideggerian approach to the problem of technology. In C. Mitcham, & R. Mackey (Eds.), *Philosophy and technology: Readings in the philosophical problems of technology* (pp. 349–363). New York: The Free Press.

Houlihan, B. (1999). *Dying to win: Doping in sport and the development of anti-doping policy*. Strasburg: Council of Europe Publishing.

Hummel, R. L., & Foster, G. S. (1986). A sporting chance: Relationships between technological change & concepts of fair play in fishing. *Journal of Leisure Research*, *18*(1), 40–52.

Ledley, F. D. (1994). Distinguishing genetics and eugenics on the basis of fairness. *Journal of Medical Ethics*, *20*, 157–164.

Levine, B. D., & Stray-Gunderson, J. (1997). 'Living high-training low': Effect of moderate-altitude exposure simulated with nitrogen tents. *Journal of Applied Physiology*, *83*(1), 102–112.

Loland, S. (2000). The logic of progress and the art of moderation in competitive sports. In T. Tännsjö, & C. Tamburrini (Eds.), *Values in sport: Elitism, nationalism, gender equality, and the scientific manufacture of winners* (pp. 39–56). London: E & FN Spon.

Loland, S. (2002a). Sport technologies-A moral view. In A. Miah, & S. B. Eassom (Eds.), *Sport technology: History, philosophy, and policy* (pp. 157–171). Oxford: Elsevier Science.

Loland, S. (2002b). Technology in sport: Three ideal-typical views and their implications. *European Journal of Sport Science*, *2*(1). Available from: http://idrottsforum.org/articles/loland/loland_2.html. Accessed June 2004.

Loland, S. (2002c). *Fair play in sport: A moral norm system*. London & New York: Routledge.

McIntosh, P. C. (1963). *Sport in society*. London: C.A. Watts and Co, Ltd.

Miah, A. (2000a). The engineered athlete: Human rights in the genetic revolution. Culture, Sport. *Society*, *3*(3), 25–40.

Miah, A. (2000b). "New balls please": Tennis, technology, and the changing game. In S. A. Haake, & A. O. Coe (Eds.), *Tennis, science, and technology* (pp. 285–292). London: Blackwell Science.

Miah, A. (2000c). Climbing upwards of climbing backwards? The technological metamorphoses of climbing and mountaineering. In N. Messenger, W. Patterson, & D. Brook (Eds.), *The science of climbing and mountaineering.* [CD-ROM Chapter 27]. London: Human Kinetics.

Miah, A. (2001). Genetic technologies and sport: The new ethical issue. *Journal of Philosophy of Sport*, *XXVIII*, 32–52.

Miah, A. (2002). *Philosophical and ethical questions concerning technology in sport: The case of genetic modification. Sport science*. Bedford: De Montfort University.

Miah, A. (2004). *Genetically modified athletes: Biomedical ethics, gene doping and sport*. London and New York: Routledge.

Miah, A., & Eassom, S. B., Eds. (2002). *Sport technology: History, philosophy & policy. Research in philosophy & technology*. Oxford: Elsevier Science.

Morgan, W. J. (1994). *Leftist theories of sport: a critique and reconstruction*. Urbana: University of Illinois Press.

Palmer, C. A. (1992). Drugs vs. privacy: The new game in sports. *Marquette Sports Law Journal*, *2*(2), 175–209.

Payne, S. D. (1990). *Medicine, sport and the law*. Oxford: Blackwell Scientific Publications.

Parens, E., Ed. (1998). *Enhancing human traits: Ethical and social implications. Hastings center studies in ethics*. Washington, D. C.: Georgetown University Press.

Schneider, A. J., & Butcher, R. B. (2000). A philosophical overview of the arguments on banning doping in sport. In T. Tännsjö, & C. Tamburrini (Eds.), *Values in sport: Elitism, nationalism, gender equality, and the scientific manufacture of winners* (pp. 185–199). London: E & FN Spon.

Shipley, A. (2004). *Speedskaters live the high life in oxygen-thin rooms*. *The Washington Post*. Washington, D.C.: D01.

Simon, R. L. (1991). *Fair play: Sport, values, and society*. Boulder, CO: Westview Press.

Tenner, E. (1996). *Why things bite back: Predicting the problems of progress*. London: Fourth Estate.

Welie, J. V. M. (1999). "Do you have a healthy smile?". *Medicine Health Care and Philosophy*, *2*(2), 169–180.

Wilkie, P. (1993). *Perilous knowledge: The human genome project and its implications*. London: Faber & Faber.