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Editorial

# Introduction to Philosophical Issues in Sport Science

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**Abstract:** The role and value of science within sport increases with ever greater professionalization and commercialization. Scientific and technological innovations are devised to increase performance, ensure greater accuracy of measurement and officiating, reduce risks of harm, enhance spectatorship and raise revenues. However, such innovations inevitably come up against epistemological and metaphysical problems related to the nature of sport and physical competition. This special issue identifies and explores key and contemporary philosophical issues in relation to the science of sport and exercise. The opening four chapters focus on the nature of scientific evidence, and causation in sport; the middle four chapters on the influence of science and technology and its relationship to sport officiating; whilst the final three chapters consider the way in which science affects the construction of sport. It brings together scholars working on philosophical problems in sport to examine issues related to the values and assumptions behind sport and exercise science, key problems that result, and provide recommendations for improving its practice.

**Keywords:** sport science; epistemology; ontology; causation; technology; evidence

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## 1. Introduction

This special issue arose because although there are individuals writing philosophically about issues in the sport and exercise sciences, there has not been a collection of articles that focus on the sports sciences itself since McNamee's [1] edited collection *Philosophy and the Sciences of Exercise, Health and Sport* published in 2005. McNamee's collection of essays provides a useful starting point for sports scientists to think about their practice and some of the assumptions behind it, and this edited collection attempts to pick up the baton a decade and a half later. Clearly, during this period, although similar philosophical issues arise, the application and context has changed. The evolution of sport, and particularly the way in which technology affects it, will always raise significant philosophical and ethical questions about both the value and concept of sport and its relationship to the sciences. As our technological capacity and scientific knowledge develops, there remains a place for philosophical thinking about if and how it should be utilized as well as the often-unintended consequences that may follow. Similarly, the importance of sport and exercise science as a means to affect and influence this evolution appears to directly correspond with the professionalization and commercialization of sport and provokes questions about what we want sport to look like and what we expect it to do. As I am writing, questions have been raised over the legitimacy and value of Kipchoge's sub two-hour marathon, and Kosgei's women's world record a day later. Both of whom were wearing highly engineered running shoes designed to conserve the runner's energy and cushion the impact, thus making it 'easier' to run. Controversy surrounds this footwear technology and whether the advantage it provides is akin to the subsequently banned 'sharkskin' swimming costumes that broke a multitude of world records within a single swimming event in 2009 [2]. Similarly, questions are asked about the way in which athletes are commodified and their bodies are dissected into ever more discrete physiological and biomechanical components in order to achieve 'marginal gains' in competition. There are also

continued questions about the accuracy of officiating in sport, with ongoing implementation of ever more elaborate devices to ensure the 'correct decision is made'. However, as can be illustrated by the recent introduction of video assistant referee (VAR) in football, technology is not infallible and does not necessarily provide the means to answer questions about reality as to what 'really happened', hence why there seems to be an equal amount of controversy over officiating decisions following its implementation. All of this demonstrates that although scientific and technological innovations are intended to make sport better by increasing performance, ensuring greater accuracy of measurement and officiating, reducing risks of harm, enhancing spectatorship and creating wealth, they inevitably come up against epistemological, metaphysical, ontological and axiological problems that cannot easily be solved.

The focus of the papers within this special issue is broad and covers a range of topics, from the way in which philosophical thinking can provide sport and exercise sciences with an underpinning rationale about the value of sport and its priorities, to the more specific conceptual problems that arise from the use of technology in sport, to the way in which science is used to defend the way sport is structured, particularly around the issue of sex segregation. The first four chapters deal with scientific evidence and the issue of causation in sport, the next four chapters with technology and officiating, and the last three chapters with scientific influences on the construction of sport.

## 2. Chapter Overview

The first four chapters consider some of the broader epistemological and metaphysical questions in sport and exercise science, particularly focusing on how sport and exercise professionals should construct their practice and acknowledge the underpinning assumptions it rests upon.

It begins with Matthew Hickson considering the place of philosophy in the sport and exercise sciences. Hickson contends that the predominance of a materialistic and reductionist perspective in the exercise sciences is concerning because it leads to a disregard of ethical considerations, such as the rightness or wrongness of genetic engineering and its application in sport. Hickson argues that a reductionist approach that sees humans as merely a sum of a collection of parts depersonalizes what it is to be human, and consequently, what it is to be an athlete. This criticism levelled at the sport sciences is not new (e.g., [3–6]) and has traditionally centered on the instrumental attitude adopted in the sport and exercise sciences that aims to fix and control the human body in an ever-greater attempt at quantification of performance. Where Hickson develops these arguments is in his focus on the notion of causality. Sport and exercise scientists, he argues, implicitly accept a Newtonian account of causality, in that there is a predictable and mechanistic theory of cause and effect, that is founded on a belief that changes can occur—or problems fixed—if one just interferes with this linear causal process. Here, Hickson shares Gray's concern set-out in the subsequent chapter regarding the medicalization of the exercise sciences, particularly in the 'soft' science of psychology. Such a simplistic view of nature does not adequately reflect human behavior, which is far more complex than a linear causal relationship at a micro-cellular, neural or genetic level. This is a point I have made in a previous paper [5] that draws upon Peter Winch's [7] reflections; we do not ascribe causes for human behavior but rather reasons for it, and therefore it is incorrect to view human behavior in Newtonian terms. Viewing human action in terms of reasons rather than causes enables us to accept the notion of agency and free will and, importantly, moral culpability as Hickson rightly indicates. Instead of falling into the reductionist trap, Hickson advocates that the sport and exercise sciences need to adopt an Aristotelian, holistic approach to their method. This, he argues, can be done through ensuring that those working in the sport and exercise sciences recognize the limitations that such a reductionist approach entails.

John Gray continues this line of critique in the following chapter. In particular, he is critical of the medicalization of the sport and exercise sphere and the techno-rational approach that he argues has become the dominant paradigm. He describes the way in which the biomedical model—in which human problems are viewed through a biological lens that can be solved through an application of scientific knowledge and technology—has been layered over the sport and exercise professions,

and evidences this through a thorough examination of literature in the exercise sciences. As Gray notes, the situation is complex as the educational expectations and professional requirements of exercise practitioners has increased alongside its growth. It is arguably right that the professionalization of the exercise sciences now seeks a far greater reliance upon scientific evidence to underpin practice. Yet, this is at the detriment of an ontological and axiological understanding of the limits of science and the evidence it accepts. Gray argues that as a result, exercise science is reduced to, “a routine of linear action to fulfil the expectations of medical data as opposed to an immersive humanistic experience” (ref). This parallels criticism levelled at the professionalization of nursing which, similarly, became fixated on medical solutions at the detriment of a caring and human ethos which is arguably at the heart of what it is to be a nurse. As an antidote against this techno-rationalism in the exercise sciences, Gray turns to the work of Johan Huizinga and his conception of *Homo Ludens* (playful man) in maintaining that this needs to be the underpinning principle that exercise professionals should work from.

We return to the issue of causation in sport in Evan Knott’s chapter. Knott attempts to answer the question implied as a result of Hickson’s earlier criticism: what theory of causation can best be applied to sport? In many respects, a mechanistic account of causation seems intrinsic to sport, i.e. the physical properties of, and relationship between, sporting objects such as a boot striking a ball, causing it to move in a particular direction. As Mumford [8] has previously identified, we congratulate goal-scorers on the basis that there was a causal relationship between their actions and the goal being scored. And yet the issue of causation has been little considered in the sport philosophy literature. Knott notes the limitations of several theories of causation, such as agency, mechanistic/deterministic and probabilistic theories, and instead, draws upon Lewis’ counter-factual theory. Counter-factuals can indicate what we believe to be the causal relation between events in sport by their omission, e.g., ‘the Red team would have won if A had occurred’ on the basis that A is causally linked to winning. A counter-factual theory of causation holds that since A was absent, the Red team did not win. In this, Knott seems right to suggest that although a mechanistic or probabilistic causal relationship might be usefully applied to some aspects of sport, it fails in others; most particularly, in complex events which cannot fully be understood by reference to physical laws, and which also involve social rules and human action. Instead, a theory that focuses on absent causes, omissions or counter-factuals may bear fruition in a causal analysis of sporting events. Knott’s recommendations has implications for sports scientists and performance analysts in particular. One of the main criticisms to be levelled at performance analysis in sport is that it quantifies particular actions in sport, such as number of tackles made, percentage of possession held, or meters run, as if such indicators are causally linked to a particular outcome, when the reality of the situation is far more complex than this. As Knott suggests, if sport scientists and coaches use thought experiments to consider counter-factuals in their understanding of causal relationships it will arguably lead to a much richer level of performance analysis in sport.

The fourth chapter focuses on the issue of evidence and appropriate methods in sport science. Saana Jukola highlights the inherent problem of providing good quality, evidence-based nutritional advice in sport. She argues whilst individual case or laboratory studies are often dismissed as lacking credibility when compared to the ‘gold standard’ of RCTs, they can play an important role in bridging a gap between hypothesis and application. This is particularly the case in reaching judgements about the efficacy of nutritional advice for elite athletes. As she rightly notes, elite athletes, by definition, are not representative of the ‘normal’ population and therefore the results of randomized controlled trials (RCT) (if they can be carried out at all) cannot be straightforwardly applied. Instead, nutritionists must rely upon unverified assumptions, or extrapolation from small group observations, case studies and laboratory tests. Jukola therefore suggests that sports nutrition should be casuistic, in that reasoned judgements should be made for individual cases based upon evidence from multiple sources. Whereas casuistic reasoning is often criticized for being unsound in the way conclusions are reached, she notes it does have a precedence in bioethics where general principles may not apply to all cases.

In the case of bio and medical ethics, judgements need to be made based upon the needs of affected individuals as well as the wider community and other interested parties. Jukola concludes by arguing that sports nutritionists, and sport scientists more generally, need to understand the methods and assumptions that underpin scientific research and be able to defend particular approaches with a robust philosophical underpinning. Jukola's assessment has implications for the philosophical training that sport scientists should receive and provides a call for greater philosophical input into sport science educational programmes.

The next four chapters continue this investigation into the practice of sport and exercise but narrows the focus to specific technological issues. It opens with chapters framing the notion of the natural athlete and the way in which technology can limit the richness of the sporting experience, then considers the relationship between good sport officiating and notions of accuracy and justice.

Javi Lopez-Frias begins this section with a consideration of the concept of 'natural' and its relationship to anti-doping policy in sport. As he notes, the construction of the concept designates a range of ethical and cultural values about what is or is not acceptable. In this context, our concept of what is natural and how it relates to good sport, influences the decisions we make about technological and scientific innovations. Lopez-Frias argues that contemporary conceptions of the natural human influence the way in which we medicalize the body, in attempts to restore natural functions when the body breaks down, but also the way in which we design sport as a competitive environment within which we test the natural capacities of the human. He examines the way in which this concept has affected the development of anti-doping policy and suggests it is heavily influenced by the Protestant, puritan conception of human nature. This is reflected by comments from those defending anti-doping policy who insist that victory in sport should be a result of hard work and natural talents. Such an argument equates the development of natural talent through hard work and effort with moral excellence. Yet, as Lopez-Frias notes, there is little evidence to suggest that hard work and effort do attain the moral excellences that such advocates imagine. Arguably, the Protestant work ethic can result in an emphasis on the value of winning and profit-making above all else. Lopez-Frias maintains an alternative, postmodern conception of the natural human, that focuses upon the value of freedom, could result in a very different anti-doping policy to the one which is currently administered. Such a conception of human nature as one that is free to create itself, is one whereby doping could feasibly be tolerated and even cultivated. He advocates that anti-doping policy should recognize other conceptions of human nature rather than just a 'thin' one founded on Protestant puritanism, which has implications for the way in which sport science is developed and practiced.

The next paper continues this exploration between the human athlete, technology, and good sport. Pam Sailors begins by highlighting the unintended consequences of using electronic 'chips' to accurately record race times in marathons. The use of timing 'chips' in addition to starting and finishing gates can result in disputes as to who is the winner and how many races are really taking place. The issue set out by Sailors is the way in which a dependency on constant technological innovation can drive flawed conceptions of sport. To illustrate, Sailors recounts a multi-national corporation's failed attempt to draw upon all possible technological innovations break the two hour marathon (although as noted earlier, this has now been achieved) as if the record time is all that matters rather than how it is achieved or what it actually means for the notion of sporting competition itself. The problem, she argues, is that an over-arching emphasis on technology reduces sporting competitions to mere quantifiable outcomes but this bypasses much of what makes sport, sport. Sport is not just a matter of 'testing' but rather 'contesting'. The meaning and value of sport is so much richer than anemic attempts to depict a quantifiable and fixed reality that is represented by mathematical calculations and statistical analysis. In her examination of the issue, Sailors' utilizes the work of philosophers, such as Kretchmar, Reid, Loland, and Elcombe, to demonstrate how the vital ethical and axiological elements of sport are eradicated when sport is reduced to mere quantification of performance.

In the following paper, Harry Collins' picks up some of the arguments he has previously articulated on how technology is used to make officiating decisions in sport. He rightly notes that there

is a pervading myth in sport that technology can produce perfection in decision making, i.e. that we can defer to technology to determine whether the ball was out (as in tennis), over the line (as in football), or whether the ball would have gone on to hit the stumps (as in cricket). In dispelling this myth, Collins maintains that we should frame the argument on the use of officiating technology in sport as one of justice not accuracy. Criticism of match officials is often as a result of technology undermining the authority of match officials in their role of upholders of justice and it is this that needs to be addressed, not the issue of accuracy. The solution Collins provides is to use video assistance when it is obvious that an officiating decision is at odds with other accounts (i.e., the replay). In changing the debate, he advocates a 'Right If Not WroNg' (RINOWN) principle. This avoids the problem of determining accuracy (in what 'really happened') and the subsequent paradox that a decision can be overturned through the use of technological aids even though officials and spectators alike 'saw' the same thing. Collins illustrates this paradox through the real-life example of a video-replay seeming to support the referee awarding a goal but it being over-ruled by other, more complex officiating technology that provides mathematical predictions about the ball's 'real' position in space and time. If the officials judge that a goal has been scored, and the video-replays appear to back this up, then there is no injustice in awarding it, even if there may be questions about its accuracy. Collins' paper has important epistemological and ontological implications for officiating in elite sport and enters the philosophical territory as to the notion of reality. Perpetuating the myth that technology is able to determine what 'really' happened suggests that when it comes to officiating sport, human judgement is flawed and that the correct view of reality can be obtained through technological means. As philosophers and scientists are well aware, the notion of 'reality' is far more complicated than this and Collins is right to refocus the debate in terms of justice and consistency since it both sidesteps this philosophical quagmire and returns to the essence of good sport.

Seth Bordner continues this analysis of accuracy in officiating sport in his chapter and argues that a fundamental question has been neglected in the literature: what does accuracy in officiating actually mean? As Bordner notes, accuracy is relative to the criteria that determines outcome. If we construct sport in such a way (through its rules) that humans are likely to make mistakes, then we should not be surprised if there is an increase in 'bad calls'. Humans are limited in what they are able to accurately judge and poorly constructed rules will hinder the notion of accuracy in human officiating. To illustrate, Bordner gives the example of the strike zone in baseball. There is no clearly defined boundary in the air as to what constitutes the strike zone, and the ball travels at a pace too fast for the human eye to fully track, therefore accuracy in decision making as to whether the ball was inside or outside the strike zone is going to be limited. Technology, such as Hawk-Eye, could be set up to map out a strike zone so that a ball passing through an area could be tracked and information to be provided to an official as to whether a ball passed through it—hence a more accurate decision—but the problem arises because of an unrealistic expectation as to what humans are able to do. This, Bordner argues, is a problem created by deficient sporting rules. Similarly, Bordner notes that human officials are not infallible when it comes to determining intention of action, in the case of fouls or unsporting conduct. Again, the criteria that defines how intention is judged will influence the decision of officials. Bordner argues that in wrestling with questions over officiating, sports governing bodies need to look at the rules and not merely to expect technology to solve the problems. Officials (generally) know the rules but they don't always know when to apply them: it can be difficult for a human to determine what the correct officiating call should be. As such, if we construct the rules in such a way that it is easier to know when they should be applied, the accuracy of officiating will be greater. As Bordner notes, "It is very easy for a human official to be mistaken by an inch or two . . . ; it is much harder to be mistaken by three feet." (ref?) Bordner's conjecture here seems reasonable. To illustrate, he provides the following example: consider the difference between a rule in American Football that states, 'the ball must be placed where it was grounded', and a rule that states, 'the ball must be placed on the last yard line that the ball carrier made contact with in the direction of travel'. Both rules may appear similar, but the latter provides criteria whereby it is easier for a referee to provide accuracy in their decision.

However, the criteria are also determined by the values we believe to be inherent in sport. On the basis that sport is rule based, one of the primary values will be justice, as noted in Collins' chapter, but it could also be entertainment, flow or some other aesthetic value. It is the additional values that may affect how accurate we wish officiating to be. As I have previously noted [9], one of the reasons FIFA (the International Federation of Association Football) were resistant in utilizing goal-line technology was its disruption to the flow of the game since a game's flow is an important value in the game of football. In Bordner's example, the current rules in American Football provide a farcical situation whereby the game is stopped and attempts are made, through the use of a low-tech chain marker, to accurately determine the spot where the ball should be placed. If the rule were to be changed to accord with human ability to determine its correct application then such situations would not arise. He concludes it is possible to both have accuracy of officiating and human officials but there may be a trade-off with the aesthetics (and other values) of sport which we would not wish to make.

The final three chapters of this book consider the way in which science influences the way in which sport is constructed. The first two chapters focus on the issue of sex segregation in sport and the scientific evidence that underpins it. The final chapter considers how sporting competitions could be fairly constructed so that the best team wins.

In their consecutive chapters, Bianchi and Cooper consider the high-profile controversy that arises from separating sport along binary sex categories and the notion of fair and unfair advantage in sport. Bianchi focuses on the apparent physiological advantages that transgender women hold over their cisgender competitors and what this means for the notion of fair sport. She draws upon the 'skill thesis' which is used to defend sex segregation in sport, in that that sports should be divided according to levels of skill in order to maintain fair competition. If there is clear evidence of a difference of skill (Bianchi provides a broad conception of this) between cismales and cisfemales, it is legitimate for sport to be separated on grounds of sex. Yet this binary solution creates a problem for athletes that do not fall into these two categories. The problem as both Bianchi and Cooper note, is the situation is further complicated because in sport, testosterone is utilized as a proxy for determining sex and therefore it is not just trans athletes that get caught in the debate, but intersex athletes too. Ultimately, it raises the sensitive question of what it is to be a woman. Bianchi sets out two approaches to resolving this: to either discard the skill thesis and allow transwomen to compete in the female sport category, or to maintain the skill thesis and mitigate unfair genetic advantages that some (trans and intersex) women have. She advocates the second approach and parallels it to providing a handicap in golf. Bianchi has previously suggested that this handicap should be applied according to testosterone levels (as a proxy for sex) but in this paper, she concedes that this may be unsatisfactory since it is unclear whether testosterone is the correct determinant for performance. She accepts that it also raises some practical issues regarding testing for its effectiveness. As a result, Bianchi follows a path previously advocated by Tännsjö [10] and concludes that sports should be categorized along other relevant factors that are sport dependent, such as height, or muscle-mass. This would retain the skill thesis in sport but enable it to be more inclusive and sensitive to recent political and cultural changes without the need for determining binary sex classifications.

Whilst Bianchi considers the issue of sex categorization in sport more broadly, Cooper looks at the way in which sporting authorities have attempted to defend their policies on eligibility. This argument holds that testosterone levels are a primary determinant of sporting performance and since there are clear differences between the testosterone levels of men and women, it is reasonable for it be used as a proxy for determining sex categories in sport. Yet Cooper claims that there is a clear conflict between the International Association of Athletics Federations' (IAAF) Testosterone Regulations and human rights. Most notably, if the sporting authorities define what it is to be a woman by virtue of testosterone levels, and subject those not deemed eligible to medical intervention, it raises important ethical and legal questions on human rights grounds. Cooper concludes that the fact that such intervention is based upon little to no scientific evidence on the performance effects of testosterone and a lack of transparency over the way in which decision on this have been made, further concerns can be raised.



The final chapter is an exploration of the structure of fair sporting competitions. Here, Rory Smead applies social choice theory to sporting tournaments in order to ensure that the best team wins. However, as Smead notes, the concept of ‘best’ can fall foul of Condorcet’s paradox whereby there is no clear means for establishing which this might be; as in the case of a ‘round-robin’ league where each team beats another and everyone ends on equal points. Smead notes that the use of leagues as a means of determining sporting superiority generally assumes that relationships between teams are transitive; that A is better than B, B is better than C, and therefore A is better than C. However, this is not necessarily the case if we categorize teams or players according to individual strengths and weaknesses, as demonstrated by the game of ‘rock-paper-scissors’, and as such, teams’ relationships to others can be intransitive. Smead claims that one way of overcoming this paradox is by applying Arrow’s impossibility theorem to sports tournaments and by advocating championship pluralism. This approach accepts that there is no single way of measuring the best team and as such, a pluralism of organizational structures should be provided to capture all aspects of athletic excellence in order to structure sport competition as fairly as possible.

### 3. Conclusions

As set out at the beginning, what this collection of papers seeks to do is to demonstrate the important relationship between the sport and exercise sciences and the notion of good sport itself. Those working with sport and exercise—whether at the harder end of the sciences in physiology, biomechanics, medicine, engineering, performance analysis and nutrition, or the softer sciences related to psychology, coaching, governance or athlete support roles—need to consider their practices and what their role brings to the development and attainment of good sport. This collection starts to bring together some key discussions in this area whilst recognizing there is still more to be said in relation to the underpinning methods and assumptions within sport and exercise science, that philosophers of science, such as Karl Popper, Thomas Kuhn and Paul Feyerabend amongst others have previously commented upon. There is ongoing development in contemporary debates in the philosophy of science, around conceptions of causation, prediction, truth and knowledge that could be usefully applied to the sport and exercise context that have sadly not been able to be included in this collection. But what this collection does hopefully indicate, is that those working within sport need to be able to evaluate and understand the inherent philosophical questions on the nature of sport, what part it should play in our wider lives and how sport and exercise science can assist in these aims. As this collection shows, the relationship between science and sport is a significant one that deserves our attention.

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