

# Cyborgization in sport – a problem on the borderline of interfering with the athlete’s body, ethical and pedagogical challenges

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Adam Podolski <sup>ABCDE</sup>, Kinga Kania<sup>ABCD</sup>

Institute of Pedagogy, College of Social Sciences, University of Rzeszow, Rzeszow, Poland

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## Abstract

Sport is an activity that permanently extends the bounds of its functioning and this area is susceptible to the expansion of technical innovations. This kind of alliance of technology with the world of sport can be considered in several respects. It can be regarded as a technology that improves comfort of sports competition, training technology, technology that affects the attractiveness of a sports event (marketing aspect), the use of advanced technology to conduct sports competition. However, there is a special aspect – technological interference with the sportsperson’s body. The aim of this scientific essay is our view on ethical and pedagogical issues related to the phenomenon of modern technology interfering with the body of a disabled person who undertakes a professional sports activity (including combat sports).

Manfred Clynes & Nathan Kline used the term “cyborg” in a paper from 1960 delivered during a NASA conference on space exploration as a combination of “cybernetics” and “organism” – they did not limit it to a combination of synthetic and organic parts. A few years later, these authors presented the cyborg as an achievement of a specific transhuman goal: a human being freed from the mechanical constraints of his/her body. This concept also refers to sports, including disabled sports. Sports activity of disabled people is defined as a form of their participation in physical culture, the main purpose of which is to maintain and develop functional efficiency regained in the process of medical rehabilitation. However, the temptation is great – the negative phenomena of professional sport are transferred to various areas of disabled sports.

In the ancient sport, the Olympic idea was destroyed by professionalism, in modern sport doping is a danger, and the threat to professional sport of the 21st century may be technological progress and transhuman ideas. These phenomena are the minor contribution to violate ethics in sport and create multi-faceted legislative and intra-organisational risks for entities working in the field of sports promotion.

**Keywords:** combat sports • disabled sports • science of martial arts • transhuman

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**Author’s address:** Adam Podolski, College of Humanities, Institute of Pedagogy, University of Rzeszow, 24 Ks. Jałowego Street, 35-010 Rzeszow, Poland; e-mail: apodolsk@ur.edu.pl

**Cyborgization** – all a process of intentional, thus conscious, enhancement and development of human cognitive functions with the use of technical means available. It means deliberate influence on the course of a series of human life processes, also including our development and education. Cyborgization is therefore an eternal human drive at upgrading oneself to higher levels of development (which probably should be called "moving up to higher levels", using the terminology from computer games). It is thus a process that is naturally instilled in the will to speed evolution up, as evolution seems to be a process that is too slow for the modern man" [15].

**Boccia** – *noun* a Paralympic sport that is similar to boules [50].

**Professional** – *adjective* engaged in an occupation as a paid job rather than as a hobby ■ *noun* an expert player of a sport who is paid to teach other players in a club [50].

**Olympic Games, Olympics** – *plural noun* a large-scale international sports contest intended to promote international goodwill, held every four years since 1896 in different cities around the world [50].

**Paralympian** – *noun* an athlete who competes in the Paralympics [50].

**Paralympic Games, Paralympics** – *plural noun* an international sports competition for athletes with disabilities, held every four years in the same year as the Olympic Games [50].

## INTRODUCTION

The last few decades have been marked by extremely rapid technological progress. It is hard to imagine our daily life without many of the inventions of the 20th century, especially for those born in the 21st century, having experienced the living in highly industrialized regions of the world. Although technological solutions are constantly evolving, at the same time they are increasingly impactful in relation to the current legal and organizational norms. Under the influence of many technological innovations, some social phenomena are also being redefined, with sports to be no exception.

Sports is an activity that permanently expands the boundaries of its functioning, and this area is sensitive to the emergence of technical innovations. This peculiar alliance of technology with the world of sports can be considered on several levels: from a technology improving the quality of sports competition, a training technology, as well as the one that affects the attractiveness of sports events (marketing aspect), to the use of advanced technology to organize and conduct sports competitions. Przemyslaw Nosal aptly emphasizes: "(...) the world of sports does not recognize the status quo, because it does not settle for what has already been experienced and gained but focuses on breaking more records and achieving new quality. Consequently, it becomes a space of constant innovation and improvement of the behaviour of competing individuals" (the citation translated from Polish [1]).

Considering the complexity of the area of sport not only because of its technological nature, but also sociological, pedagogical, psychological, ethical, health related or legal one, at least one separate study can be devoted to each of these threads. It is because of the multifaceted nature of the problem and the editorial limitations that we approach the area of sports very generally, mainly emphasizing the issue of technological interference with an athlete's body [2].

Although being a global phenomenon in terms of professionalism as well as a universal form of physical activity, the term "sports" lacks one universally accepted definition. Therefore, a sensible frame of reference is the Olympic Charter's provisions on the second of the Fundamental Principles of Olympism: "(...) to place sport at the service of the harmonious development of humankind, with a view to promoting a peaceful society concerned with the preservation of

human dignity" [3, p. 13], and also the declared mission of the International Olympic Committee (IOC): "1. (...) the promotion of ethics and (...) ensuring that, in sport, the spirit of fair play prevails, and violence is banned" [3, p. 18].

One of the most important pieces of evidence of sports attractiveness, within the framework of the ideals of Olympism articulated above, is the formal sanctioning of sports for people with disabilities. However, the ideals of Olympism are not the only factor in this respect. Therefore, the global phenomenon of sports for people with disabilities, although bringing many positive elements in the area of public health, is susceptible to the pathologies that professional sport struggles with.

The aim of this scientific essay is our view on ethical and pedagogical issues related to the phenomenon of modern technology and its interference with the body of a disabled person undertaking a professional sports activity (including combat sports).

### Some aspects of sports for people with disabilities

Physical activity (or sports in a broader sense) for people with disabilities is defined as a form of their participation in physical culture, the main goal of which is to maintain and develop functional fitness regained in the process of therapeutic rehabilitation. However, in the case of people who opt for the need for sports competition (in a narrower sense), the goal is to strive for the best possible results [4]. Sport for people with disabilities, also known as parasport or adaptive sport, is based on sports disciplines practiced by athletes with specific disabilities and in accordance with adapted rules and the equipment appropriate to the type and degree of disability [5].

Sports competition in paradisciplines is usually based on existing sports, however modified according to the needs of people with disabilities. Major sports events of this type include Paralympic Games, Special Olympics, and the Olympic Games for the Deaf (deaf) called *Deaflympics* [6].

Summer and winter games in the indicated above types of the Paralympic movement are held every 4 years under the aegis of the international organizations relevant to a given sporting event: *International Paralympic Committee*,

*Special Olympics and International Committee of Sports for the Deaf*, as well as the national equivalent organizations. In Poland, these are the following: Polish Paralympic Committee (PKPar), Special Olympics Poland, and Polish Association of Sports for the Deaf [7].

Since 2014, the multidisciplinary *Invictus Games* competitions have been in the catalog of sports competitions for people with disabilities. Their founder was Prince Henry, and they are dedicated to soldiers, war veterans, and the wounded during missions at home and abroad. The name of the competition comes from the Latin word *invictus*, which means “invincible” [8].

Due to the specific nature of sports for people with disabilities, the functional capabilities of individuals with different types and degrees of dysfunction are taken into account when determining the rules of a competition in a given discipline. In addition, an extensive classification system established by the International Paralympic Committee, IPC, has been introduced. It determines which athletes are eligible for a Paralympic competition and the criteria for grouping athletes for a particular competition. These criteria are relatively similar to the strategy of grouping athletes by age, gender or weight category [9].

A special feature of sports for people with disabilities is the use of specialized sports equipment. Modern technologies enable the persons with significant impairments to participate in an increasing number of sports that were previously beyond the reach of their motion and often mental capabilities. There are two points worth emphasizing. First of all, the constant improvement of facilities and equipment supporting physical rehabilitation means an increase in the level of personal safety and the possibility for competitors in any of the sports formulas for people with disabilities to achieve all the time higher levels of sportsmanship. Secondly, these circumstances lead to the phenomena that discriminate against economically weaker athletes, acting as a kind of techno-doping.

### Cyborgization and sport aspect

Manfred Clynes & Nathan Kline [9] used the term “cyborg” in their paper in 1960 delivered during a NASA conference on space exploration as a combination of “cybernetics” and “organism”, though not limiting it to the combination of synthetic and organic parts. They represented

a particular approach to the technical challenges of space travel – the physical adaptation of humans to survive in an unfavourable environment, rather than changing the environment. A few years later, these authors presented *the cyborg* as an achievement of a specific transhuman goal: a human being freed from the mechanical constraints of his/her body. Currently, this concept refers to sports as well, including sports for the disabled (see also [11-13]). Over time, the term, “cyborg” has evolved and become very generic. Due to its metaphorical plasticity, it is more popular among *science fiction* writers than among scientists and the academia, who rather prefer the terms biotelemetry, teleoperator, bionics.

Cyborgization is therefore a kind of hybridization – the combination of a biological human body with at least one technological element, making a person’s physical capabilities expanded by a machine that modifies the body’s functions beyond normal human limitations. Cyborgization treatment can come in several forms depending on the function it is intended to perform: **therapeutic cyborgization** (the goal is to restore in part or in full the functionality of an organ or the entire organism; this type of hybridization does not go beyond the natural conditions of the human organism); **enhancement cyborgization** (making changes to the human organism that go beyond its natural conditions); **modifying cyborgization** (when hybridization, although extending the capabilities of the human organism beyond a certain standard, still preserves them within the capabilities of the human species).

It is important to realize that one and the same type of cyborgization may take a different perspective for two persons: modifying cyborgization for one person will turn into therapeutic type for another. There is a dilemma in defining the standards, therefore, the problem of the boundary identification between therapeutic and modifying cyborgizations arises. This situation raises specific questions: Should the standard be equated with statistical data or medical criteria? How to define reliable standards? What constitutes a condition that meets health related criteria, and what constitutes a deficiency? The criteria for differentiation will change depending on the social context and individual goals. Scientific advances are sure to have a significant impact, enabling new, previously rigorous possibilities for manipulating biological phenomena [12-14].

The bodies of athletes are not *tabulae rasae* but are subject to «cyborgization». Athletes do not enter the arena personally, on their own. Rather, they are part of larger systems created by teams of experts who control every aspect of their body's performance (including training, diet, equipment, supplements, psychological interactions, as well as drugs, dietary supplements), use hypobaric chambers and recording devices. Athletic performance is therefore the result of the interplay between the efforts of athletes and the effects of a widely understood support network along with the use of state-of-the-art technology. Athletes are not the only determinant engaged in sports performance, and the line between «natural» and «technological» abilities is becoming increasingly difficult to draw [14], see also glossary [15].

The assumption that enhancement and modifying cyborgizations will most often be used in the context of sports competition seems true. This is a hands-on prospect, so T.M. Butryn's [16] idea about calling the elite athletes as cyborgs is not surprising. In his view, sports performance is always «contaminated» by the use of sports technology, among which he distinguishes five types: individually adjusted, environmental, implementational, rehabilitative, and motion evaluative.

Individually adjusted technologies involve interventions that alter the physical or mental aspects of athletes. These technologies are the most obvious, for many representing the most disturbing form of cyborgization. According to Butryn [16], this category also covers performance-enhancing drugs for athletes, surgical procedures, prosthetic limbs, psychological support and genetic engineering. The goal of environmental technology is to shape the sports surroundings in which athletes compete. Implementational technologies include the devices and pieces of equipment that athletes use during sports as «components» of their bodies. Rehabilitative technologies are used to counteract the debilitating effects of sports training, while motion evaluative technologies are devices designed to help athletes and sports experts assess the form and performance of athletes' bodies.

### Techno-doping

In the ancient sports, the Olympic idea was destroyed by professionalism, in modern sports, there was another danger – that of doping, while the threat to professional sports of the 21st century may be technological progress and transhuman ideas.

The word «O» first appeared in one of the English dictionaries in 1889. Before that, the name «dope» was used by various tribes, then warriors referred to it meaning a drink that was a mixture of alcohol or cola seeds, which could stimulate runners or the participants in religious ceremonies [17]. Techno-doping is a relatively new concept. However, the World Anti-Doping Agency (WADA), which is the leading entity in legislative efforts to combat doping, has not formulated a definition of legal techno-doping.

Techno-doping, in the most general understanding, is the use of unauthorized, special software or design solutions that will in any way give an advantage over other participants in sports competitions and contradict with the rules that normalize the given type of competitions [18].

Precise definition of techno-doping is not easy to accomplish because it depends on many factors, such as the physical and mental capacity of an athlete, the type of dysfunction, equipment specificity, etc. The use of a variety of technological solutions, especially in relation to sports done by people with disabilities, where the use of additional specialized equipment is justified by the nature of the competition does not raise as much controversy as in the case of basic sports competition. Therefore, the use of techno-doping in para sports will differ from its use in the sports competitions for non-disabled athletes.

Therefore, the main problem is to determine what can be considered techno-doping and what not, as well as where the limits of the use of modern technologies should be set. In the absence of uniform guidelines from WADA, the decisions in this regard have been distributed among individual international sports federations, i.e., entities authorized to set rules in a given sport discipline.

In the case of people with disabilities, the cyborgization that exceeds the human capabilities should be considered as doping. If, on the other hand, the extension of these capabilities is not related to a particular sport in such a way that it increases the chances of a potential competitor to surpass the capabilities of people with identical limitations, then it should be stated that this kind of cyborgization does not violate the principles of fair sports rivalry. However, since some sports federations allow the use of modern devices during sports competition, often the high cost of acquiring them favours those who

can afford such an expense, leading to the practice when some competitors find themselves in a situation of unfair advantage over the others.

According to K. Vieweg [18], techno-doping should be defined as the issues related to enhancing the body through surgical procedures (artificial tissues, breast reduction, implants, amputations, etc.), prosthesis of missing body parts or those parts of the body that suffer from malfunction (the example of Oskar Pistorius), equipment (swimming suits, jumpsuits, ionizing shirts), training methods and tools (wind tunnels, oxygen tents, etc.). The most controversial in the mentioned set is the so-called *hawk eye*.

If enhancement and modifying cyborgizations are considered as doping in non-disabled sports, and on the other hand, but at the same time, the capabilities of humans with assistive technology exceed the standards allowed in parasport, it seems reasonable that human-cyborg competition, the Cyber Olympic Games, should be sanctioned alongside the Olympic and Paralympic Games.

### Cyathlon

*Cyathlon* is a brainchild of Robert Riener [19], a biomedical engineer at the Swiss Federal Institute of Technology in Zurich (ETHZ) and the National Center of Competence in Research (NCCR) Robotics. The creation and organization of *Cyathlon* was triggered by the use of assistive technology systems in everyday life by millions of people with physical disabilities. This variation of the competition involves people with disabilities who are set in motion by the devices, but not by muscle power. They use their ingenuity in cooperation with technological devices to achieve the best possible score in a given competition. It is by the use of robotics and Artificial Intelligence (AI) that a hybrid solution – a combination of AI, a robot and a human – has been introduced into sports [11]. That is the reason why *Cyathlon* is often referred to as the Cyborg Olympics.

While a significant part of selecting the winners in sporting events is based on the criterion of speed, strength or endurance (as in the motto of modern Olympism: *Citius, Altius, Fortius*), the only criterion of *Cyathlon* is testing the innovations used in bionic assistive technological devices for people with physical disabilities. These technologies are often difficult to assign practical functions, which becomes disappointing for potential users and often results in the consequent lack of

use or even acceptance of such devices. In addition, there are barriers in the public environment which often make it difficult or impossible to use these assistive technologies.

The ultimate goal of *Cyathlon* – to make everyday life easier for people with disabilities – is achieved by the following elements: facilitating collaboration between academia and industry, cooperative dialogue between technology developers and people with disabilities, promoting the feasibility of assistive robots for the general public. Therefore, the *Cyathlon* organizing committee includes doctors, experts in robotics, communication, those involved in arranging sports events, etc. They usually organize a sports competition, being simultaneously a demonstration of the possibilities of modern technology, which not only makes daily activities easier for people the disabled, but also creates an opportunity to practice sports.

In *Cyathlon*, athletes compete in 6 events:

- *Brain Computer Interface Race (BCI)* – in BCI races, participants (pilots - in *Cyathlon* nomenclature), suffering from severe loss of motor function and paraplegia, control (by means of brain-computer interfaces) the avatars installed in a computer game.
- *Functional Electrical Stimulation (FES) Bike Race* – a bicycle race involving pilots with spinal cord injury and their non-motorized FES bicycles realized by the use electrical stimulation (FES).
- *Powered Arm, Prosthesis Race* – a competition, in which people with powered arm(s) with special prostheses participate; the criterion for presentation consists of the ability to control the prosthesis, as well as the capabilities of the prosthesis itself while performing several activities.
- *Powered Leg Prosthesis Race* – a competition with the participation of people with an amputated lower limb from the knee down equipped by the so-called “active” prostheses; participants have to overcome an obstacle course consisting of logs, inclined planes, stairs, and stones. The fastest competitor wins.
- *Powered Exoskeleton Race* – an obstacle course composed of tasks of daily life, in which the winner is decided among the participants with paraplegia with motorized pillars (orthoses),



trying to perform the largest number of activities in the shortest time possible.

- *Powered Wheelchair Race* – a race in which wheelchair pilots compete on parallel tracks, overcoming a series of obstacles [20].

Since 2020, the catalog of Cybathlon disciplines has been expanded by new competitions, including those for athletes with visual impairments, as well as the races outside the stadium. Two medals are awarded for victory in each of these disciplines: one for the pilot or athlete using a device, and another one is granted to the device developer or supplier (the company or the laboratory) [21].

Robert Riener [19] points out that ultimately peculiar and astonishing competition is the BCI, where 15 pilots sit still for four minutes while large screens in the arena show what is going on in their heads. Each competitor tries to guide a character on the screen through an obstacle course using specific patterns of brain activity, transmitted through an electrode cap into three categories of commands: “accelerate”, “jump over spikes” or “roll under laser beams”.

The difference between *Cybathlon* and the Paralympic Games is that the latter ones promote only human achievement: athletes should use commercially available devices that work solely under muscle power. *Cybathlon* fosters technology and innovation. *Cybathlon* advocates are keen to ensure that the devices tried and tested in competition during the games will accelerate the development of technology and eventually be used by people with all kinds of disabilities around the world in their daily lives. The Paralympics formula is more in line with the traditional model of “the spirit of the sport”. The concept of competition between athletes is dominant, although Paralympians are increasingly using the most modern assistive technology permitted by the Paralympic Committee. Instead, *Cybathlon* recommends new standards, where improved technology and human creativity prevail over human muscle power. However, this does not change the core mission of *Cybathlon* as another variety of sports for people with disabilities.

### **Cyborgization in the context of transhumanism**

*Cybathlon* and techno-doping are issues that are inextricably linked to the concept of transhumanism. According to A. Sulikowski [22], the

foundation of the ideology of transhumanism lies in the postulate of liberation of individuals from the limitations determined by their biological constitution, with modern technologies being the main tool of implementation.

Based on the assumptions of the World Transhumanist Association (WTA), as well as the WTA's adopted Transhumanist Declaration (2012), two formal definitions of transhumanism can be distinguished:

- it is an intellectual and cultural movement that affirms the possibility and desirability to fundamentally improve the human condition, by developing technologies and making them widely available so that they could eliminate aging and significantly improve human intellectual, physical and mental abilities;
- an exploration of the implications, promises and potential risks of technologies that will enable us to overcome basic human limitations, as well as related ethical issues involved in the development and use of such technologies [23].

From the perspective of transhumanism, sports is about achieving outstanding achievements by exercising a person's natural physical abilities. According to this direction, the use of technology should be permitted when it allows people to continue to unconditionally exceed their physical limitations. In this sense, technology can have a place in sports, but only when it improves the human body's underlying abilities without jeopardizing the basic elements of sports.

The Transhumanist concept of cyborg athletes is based on a “dualistic” view of their athletic productivity. From this perspective, human performance is the result of two separate elements: natural human capabilities and artificial tools. Moreover, according to the proponents of this trend, technical devices are necessary in most sports to achieve the goal of sports competition [24].

However, in modern sports, the use of technology has been immense to the extent that it becomes complicated to distinguish between what is the achievement of human capabilities and what is the result of technology use. According to posthumanism, it seems impossible to define the boundary between technology

and human nature. The two positions thus lead to two different concepts of a cyborg athlete. At the same time, posthumanists assume that there are natural human athletic abilities, with modern sports based on a “naturalistic ontology.” This view has been hotly debated, pointing out to the fact that the natural has long been “contaminated” by artificial elements, and suggesting that natural athletic abilities should now be called “naturalized human abilities” [24].

However, it was not *Cyathlon* that made the sports community aware of the issue of technodoping and transhumanism, but the incidents involving Casey Martin and Oscar Pistorius. Modern technology made it possible for these athletes to exceed the norms determined by the biology of the norm. Both cases directly demonstrated the essence of the ideological dispute between transhumanists and bio conservatives – the legitimacy of limitations that can be transcended through scientific and technological achievements. Transhumanists stand for the widest possible access to new technologies in sports activities, so that athletes can overcome what they believe are artificially accepted norms [25, 26]. Bio conservatives, on the other hand, believe that the use of technology in sports will distort it, with the consequences of moral and factual collapse, and the fundamental values of sports based on honesty and trust might be questioned [27].

It is therefore no surprise that *Cyathlon* is considered by the media to be the first transhumanist Olympic Games. Athletes-cyborgs are communicating the future face of sports and victory over an athlete in the classical sense - a human.

Such a vision of the sports cyborgization highlights that many world records would become won by athletes with disabilities. However, it is emphasized that this kind of activity has other justifications as well. Although the media popularity of sports for people with disabilities is constantly increasing, less attention is devoted to it in broadcasts or press materials than to sports rivalry of people without disabilities. It is often noted that media coverage of athletes is inversely proportional to the “visibility” of their disabilities. Porude and Howe [27] defined this phenomenon as a symptom of the “Paralympic paradox”, claiming that the paradoxical situation of the (non)visibility of disability is due to the dual role assigned to Paralympic sports and athletes

with disabilities. On the one hand, they should meet the expectations of the “efficient” audience in terms of efficiency and sports aesthetics, in a way, promoting the disguise of disabilities. On the other hand, their task is to show the spectators the sport of people with disabilities in its many aspects.

Richard and Andrieu [28] asserts that technological hybridization is not enough for a given athlete to achieve cyborg status. As an example, the author presents the example of boccia players who use a powered wheelchair, but are not transhumanist cyborgs, even though hybridization is typical of this situation. For transhumanist cyborgization to take place, in addition to the fusion of technology with an athlete’s body, there must be technological hybridization involved in the creation of an aesthetically as well as functionally uniform human body. The figure of the transhumanist cyborg becomes their skill manifestation.

The process of cyborgization of sports for people with disabilities, the participants of the Paralympic Games in particular, is based on the vision of a transhumanist cyborg, with *Cyathlon* to be the place of experimenting by hybridization of the human body’s abilities. Thus, cyborgization, as a futuristic staging of athletes’ hybridization with technological equipment, makes an athlete’s disability less visible through transhumanistic body features, at the same time justifying the use of technology in sports.

The model of a transhumanist cyborg seems controversial and problematic, because of the exclusion of people with disabilities who lack the financial means to benefit from this type of support of their bodies. Such economic constraints make many of them ineligible for the global population of potential Paralympians. Technology, therefore, “empowers” some athletes while depriving others of the same opportunities.

Cyborgization of athletes implies the emergence of a certain prestige hierarchy of para-athletes. Many sportsmen with disabilities are those who lack the financial support to use modern technology and whose disabilities are most visible. In contrast, the elite are the athletes whose bodies have been equipped with the latest technological devices with a state-of-the-art status of innovation. This description of reality is a clear example of stigmatization of athletes with disabilities. What is more, those athletes who equate

the transhumanist cyborg are promoted by the media as the most recognizable figures in contemporary disability sports.

### Other consequences of cyborgization and the dilemmas of rational perspective

On the one hand, the expansion of new technologies contributes to the multifaceted progress in sports, including the safety of competitors, and affects the effectiveness and attractiveness of the sports spectacle, the successful promotion of new disciplines. However, on the other hand, what meets the criterion of a useful and modern innovation, especially in the initial phase, may at some point become the cause of numerous risks.

Against the background of the most generally outlined arguments, it seems complicated to formulate *de lege ferenda* postulates that could provide a model solution for the application of modern technology in sports. Currently available solutions for sports competitions imply a lot of challenges on the overlap of several aspects, including legislation, production of modern technologies, expectations of users, as well as the entities organizing sports competitions both on the local and global levels. Working out optimal solutions should require consideration of many factors, and only some of them have been discussed in this study. The elaboration of an optimal model will be hampered primarily by the dynamics of cyborgization and techno-doping in sports.

Shifting the focus of the discussion to the issue of cyborgization and techno-doping must not obscure either the humanistic, ethical, educational, or health-related aspects in particular, all being related to the enhancement of the ability of disabled people to survive with the help of using state-of-the-art technologies.

We strongly believe that a good example of such a broad approach to the problem is the issue of athletes' use of devices that, in addition to supporting the effectiveness of their actions, simultaneously record the reality around, i.e., the use of google glasses. The question concerns the right to privacy of those covered within the range of the recorder. Many indicators of an athlete and his/her activities are recorded, the data is stored and then transmitted. In the case of *Cyathlon*, the information is used for scientific purposes (to improve the quality and functional options of assistive devices). However, the stored data can

be intercepted by unauthorized parties because there is no guarantee that the devices recording and transmitting sensitive athlete's data to the training staff will be properly protected from third-party access. It is therefore possible that the training staff will receive data modified by the perpetrators interested in malicious interference. The consequences could be many: the athlete might be given inappropriate supplements; the change in the tactics concept that eventually may prove mistaken; the use of such data to manipulate book-maker bets, etc. Another negative long-term effect may be the deterioration of an athlete's health.

## CONCLUSIONS

The knowledge about the enhancement of the performance of a human body through various forms of cyborgization of athletes will increasingly be used in military training. Sports in its broadest sense is a unique area for testing the adaptive limits at the intersection of the biological and mental properties of humans with hard-to-define cognitive capabilities of homo sapiens and the technology of the future. Admittedly, perfectionism, implying both the maximization of an effort (*Citius, Altius, Fortius*) and its optimization (participation in team games, individual rivalry, in most combat sports, etc.) is an indispensable element of sports success. However, the man transcends the hard-to-grasp limits of their own abilities only during a real struggle for survival – in the sense of “defence of a fair cause, i.e., remaining in harmony with the universal human values” (this criterion fills the continuum on both micro and macro scale: the essential defence and survival of the human species [29-31]).

It seems reasonable to conclude, that in order to continue the study of the phenomenon of cyborgization in sports from the perspective of the necessary applications in various areas of broadly understood survival (preparation for self-defence, selfless assistance to others, obtaining qualifications for service in defence, intervention, rescue squads, etc.), it would be necessary to consider the methodological basis of innovative agonology. The key method of this new applied science is the complementary approach, with complementarity to be applied in diagnosis, promotion, prevention and therapy, as well as the fight against any disease, including pandemics.



A unique tool for evaluating outcomes at each of the stages mentioned above is the mixed assessment based on both praxeological and ethical criteria (efficiency of action and compliance with moral norms, respecting the dignity of every human as a supreme value) [32-34]. The educational (preventive) and therapeutic applications of innovative agonology are extensive. Apart from the numerous sports that meet these praxeological (expected effectiveness) and ethical criteria, these options include: diagnosing human susceptibility to bodily injury during a fall and special prevention programs dedicated to various groups at increased risk of such events; avoiding collision with an object in motion [35]; art therapy [36], martial arts bibliotherapy [37], music prophylactic and therapy with martial arts [38], fun forms of martial arts, including the simple and attractive means of diagnosing and reducing aggressiveness [39, 40]; honourable self-defence [41].

This methodological proposal is complemented by the recommendations of numerous non-apparatus, quasi-apparatus and simulation tests used to define positive health and survival abilities, accepted by students who used them while participating in some pilot programs [42-48], and also science of martial arts [49].

From the perspective of sports though, it is impossible to avoid questions that are difficult to be given an immediate answer. These might be as follows: Is there a risk that the refinement of the human body to improve its functional capabilities will become a major factor in the degradation of the idea and mission of modern Olympism? Or will the Olympic and Paralympic Games, in just a few years, be transformed into a great festival of cutting-edge technology to support the motor capabilities of the human body, and the show of athleticism will be recorded only in the history annals?

## REFERENCES

- Nosal P. *Technologia i życie społeczne. Analiza relacji na przykładzie współczesnego świata sportu*. [PhD dissertation]. Poznań: Adam Mickiewicz University Poznań; 2012 [in Polish]
- Bojkowski Ł. *Ingerencja technologiczna w aktywność fizyczną i rywalizację sportową*. *Pol Prz Nauk Zdr* 2017; 1(50): 132-134 [in Polish]
- International Olympic Committee. *Olympic Charter* (in force as from 8 August 2021). Lausanne: International Olympic Committee; 2021 [cited 2022 Apr 29]. Available from: URL:[https://stillmed.olympics.com/media/Document%20Library/OlympicOrg/General/EN-Olympic-Charter.pdf?\\_ga=2.112590788.1792333463.1674694271-901521676.1674694271](https://stillmed.olympics.com/media/Document%20Library/OlympicOrg/General/EN-Olympic-Charter.pdf?_ga=2.112590788.1792333463.1674694271-901521676.1674694271)
- Tasiemski T. *Satysfakcja z życia i aktywność sportowa osób po urazach rdzenia kręgowego. Badania porównawcze polsko-brytyjskie*. Poznań: Akademia Wychowania Fizycznego; 2007: 42 [in Polish]
- Koper M, Tasiemski T. *Miejsce sportu w procesie rehabilitacji osób niepełnosprawnych fizycznie*. *Niepełnosprawność* 2013; 3(8): 122-127 [in Polish]
- <https://www.deaflympics.com/> (accessed 2020 Oct 01)
- [petycjhttps://bip.msit.gov.pl/download/2/9784/odpowiedz\\_na\\_petycje\\_-\\_pismo\\_z\\_18\\_czerwca\\_2019\\_r.pdf](https://bip.msit.gov.pl/download/2/9784/odpowiedz_na_petycje_-_pismo_z_18_czerwca_2019_r.pdf) (accessed 2020 Oct 01)
- <https://invictusgamesfoundation.org/> (accessed 2020 Oct 01)
- <https://www.paralympic.org/classification> (accessed 2020 Oct 01)
- Clynes ME, Kline NS. *Cyborgs and Space*. *Astronautics* 1960; 5(9): 26-27; 74-76
- Licklider JCR. *Man-Computer Symbiosis*. *IRE Transactions on Human Factors in Electronics* 1960; HFE-1: 4-11
- Wittes B, Chong J. *Our Cyborg Future: Law and Policy Implications*. Washington: Brookings Institution; 2014 [cited 2022 Apr 29]. Available from: URL:<https://www.brookings.edu/research/our-cyborg-future-law-and-policy-implications/>
- Frias FMJL. *Walking into the cyborg gym. Two conceptions of the cyborg athlete*. *Teknocultura* 2018; 15(1): 105-117
- Meyer B, Asbrock F. *Disabled or Cyborg? How Bionics Affect Stereotypes Toward People With Physical Disabilities*. *Front Psychol* 2018; 9: 2251
- Kijowski M, Przybyła M. *Cyborgization yesterday, today and tomorrow: Selected perspectives and educational contexts*. In: Solarczyk-Ambrozik E, editor. *Lifelong learning for lab our market needs*. Poznań: Adama Mickiewicz University Poznań; 2016: 165-175
- Butryn TM. *Cyborg horizons: Sport and the ethics of self-technologization*. In: Miah A, Eassom SB, editors. *Sport technology: history, philosophy and policy*. Oxford: Elsevier Science; 2002: 111-134
- <http://www.doping-prevention.sp.tum.de/pl/doping-in-general/history-of-doping.html> (accessed 2019 Oct 29)
- Vieweg K. *Techno – doping – legal issues concerning a nebulous and controversial phenomenon*. In: Yeun KY. *Seul: New Prospects of Sports Law*; 2013: 256-257
- Riener R. *The Cybathlon promotes the development of assistive technology for people with physical disabilities*. *J Neuroeng Rehabil* 2016; 13: 49
- [https://ethz.ch/content/dam/ethz/special-interest/conference-websites-dam/cybathlon-dam/documents/CYBATHLON\\_Races\\_and\\_Rules.pdf](https://ethz.ch/content/dam/ethz/special-interest/conference-websites-dam/cybathlon-dam/documents/CYBATHLON_Races_and_Rules.pdf) (accessed 2019 Oct 29)
- Reardon S. *Welcome to the Cyborg Olympics*. *Nature Magazine*; 2016 [cited 2019 Oct 27]. Available from: URL:<https://www.nature.com/news/welcome-to-the-cyborg-olympics-1.20353>
- Sulikowski A. *Transhumanizm i perspektywy jego oddziaływań na prawoznawstwo. Wybrane problemy*. *Wrocławsko-Lwowskie Zesz Praw* 2014; 5: 89-110 [in Polish]
- World Transhumanist Association. *The Transhumanist FAQ – A General What is transhumanism*. [cited 2020 Oct 01]. Available from: URL:<https://humanityplus.org/philosophy/transhumanist-faq/>
- Magdalinski T. *Sport, Technology and the Body: The Nature of Performance*. New York: Routledge; 2009: 204-209
- Vanlandewijck YC, Thompson R. *The Paralympic Athlete: Handbook of Sports Medicine and Science*. Lausanne: International Olympic Committee; 2010
- <https://pomorska.pl/kibic-skarzy-adriana-zielinskiego-chce-przeprosin-zdjecia/ar/12327936> (accessed 2019 Oct 29) [in Polish]
- Purdue DEJ, Howe PD. *See the Sport, Not the Disability: Exploring the Paralympic Paradox*. *Qual Res Sport Exerc Health* 2012; 4(2): 189-205

28. Richard R, Andrieu B. The Cybathlon experience: beyond transhumanism to capability hybridization. *J Philos Sport* 2019; 49-62
29. Kalina RM. Agonology – the prospect of an effective defence of peace and unrestricted freedom of scientists. *Arch Budo* 2016; 12: 1-13
30. Kalina RM. Innovative agonology as a synonym for prophylactic and therapeutic agonology – the final impulse. *Arch Budo* 2016; 12: 329-344
31. Kalina R. Language and methods of innovative agonology as a guide in interdisciplinary research on interpersonal relationships and people with the environment – from micro to macro scale. *Ach Budo*; 2020: 271-280
32. Kalina R, Barczyński B. Mixed assessment of agonology as the primary means of defence against intellectual violence and to extend mental health and social health. *Proceedings of the AHFE 2017 International Conference on Human Factors in Sports, Injury Prevention and Outdoor Recreation*; 2017 Jul 17-21; Los Angeles, USA. Orlando: Springer; 2017
33. Kalina RM, Barczyński BJ. Mixed assessments as mental and pedagogic basis of innovative self-defence. *Arch Budo* 2017; 13: 187-194
34. Kałużny R, Klimczak J. Declared by medical students actions towards of people in emergency situations – mixed assessments as a basis for analysis of simulation studies. *Arch Budo* 2017; 13: 323-333
35. Michnik R, Wodarski P, Bieniek A et al. Effectiveness of avoiding collision with an object in motion – virtual reality technology in diagnostic and training from perspective of prophylactic of body injuries. *Arch Budo* 2017; 13: 203-210
36. Yermakova TS, Podolski A. Pedagogical approach to the development of art therapy – a review. *Arch Budo* 2019; 15: 171-179
37. Klimczak J, Krzemieniecki LA, Mosler D. Martial arts bibliotherapy – the possibility of compensating the negative effects of the continuous education for aggression by electronic media and the aggressive interpersonal relationship of children and adults. *Arch Budo* 2015; 11: 395-401
38. Litwiniuk A, Waszkiewicz E, Bąk R. Prophylactic and therapeutic effects of combining music with martial arts: a systematic review of literature. *Arch Budo* 2021; 17: 400-410
39. Klimczak M, Klimczak J. Application of multi-dimensional simulation research tools in the diagnosis of aggressiveness among the youth – review of innovative methods. *Arch Budo Sci Martial Art Extreme Sport* 2018; 14: 205-213
40. Klimczak J, Kalina RM. Placebo effect – the perspective of diagnosis and therapy of aggressiveness by using fun forms of martial arts during innovative agonology cognitive-behavioural sessions (case study). *Arch Budo* 2019; 15: 57-66
41. Harasymowicz J, Kalina RM. Honourable self-defence – the theoretical and methodological basis of training. *Płock: Wydawnictwo Novum*; 2006
42. Kalina RM, Jagiełło W. Non-apparatus, Quasi-apparatus and Simulations Tests in Diagnosis Positive Health and Survival Abilities. In: Ahram T, editor. *Advances in Human Factors in Sports, Injury Prevention and Outdoor Recreation. AHFE 2017. Advances in Intelligent Systems and Computing*. Cham: Springer; 2018; 603: 121-128
43. Bąk R, Barczyński BJ, Krzemieniecki LA. Reliability of the Mental and Social Health (M&SH) Questionnaire – test-retest adult men and women. *Arch Budo* 2019; 15: 321-327
44. Klimczak J. Reliability of the KK'017 questionnaire – test-retest female students of tourism and recreation *Arch Budo Sci Martial Art Extreme Sport* 2019; 15: 113-118
45. Mroczkowski A. Using foam sticks in sports competitions as a complementary element of aikido training and a form of collision avoidance skill development. *Arch Budo Sci Martial Art Extreme Sport* 2019; 15: 85-91
46. Klimczak J, Kalina A. Projection of a specific class of human activity on a micro to macro scale as a presumption for a simple approach to measurements of mental and social health. *Arch Budo* 2020; 16: 325-332
47. Gašienica Walczak B, Kalina RM. Validation of the new version of “the susceptibility test to the body injuries during the fall” (STBIDF-M). *Arch Budo* 2021; 17: 371-400
48. Klimczak J, Oleksy M, Gašienica Walczak B. Reliability and objectivity of the susceptibility test of the body injuries during a fall of physiotherapy students. *Phys Educ Students* 2022; 26(1): 4-10
49. Barczyński BJ, Kalina RM. Science of martial arts – Example of the dilemma in classifying new interdisciplinary sciences in the global systems of the science evaluation and the social consequences of courageous decisions. *Proc Manuf* 2015; 3: 1203-1210
50. *Dictionary of Sport and Exercise Science. Over 5,000 Terms Clearly Defined*. London: A & B Black; 2006

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