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SPORT, SCIENCE, AND COMPLEXITY: A PEDAGOGICAL AND METHODOLOGICAL REFLECTION

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ABSTRACT. The main aim of this study is to reflect on sport, science, and complexity by sketching a genuine pedagogical perspective resulting from the analysis of a new epistemological proposal within the philosophy of science and education: the theory of complexity. This pedagogical perspective, which is based on hermeneutics, shows that pedagogy, understood in a theoretical as well as in a practical sense, is a fundamental cornerstone within the scientific field of sport and physical activity. In so doing, this study shows that pedagogical knowledge is relevant in the abovementioned scientific field. It helps sport professionals develop a reflexive and critical attitude towards the practices related to sport and physical activity. In this sense, pedagogy becomes an intrinsic component of sport science, which calls for the need of ethics within this science and for better-prepared professionals able to fight the negative aspects of contemporary sports, such as, alienation and commodification.

Keywords: pedagogy, philosophy, sport, complexity, sport sciences.

Sport Science, Interdisciplinarity and Silos

This study focuses on the epistemology of sport science(s), which is called as "kinesiology" in Anglo-American universities. Following R. Scott Kretchmar, we understand sport science to be: "the study of human movement and physical activity in virtually all its forms and manifestations" (Kretchmar 2008: 4). As Kretchmar notes, several silos have been created inside sport sciences in order to study these phenomena. Each silo has access to a part of reality and employs distinctive research methods to measure and to understand its subject matter. For example, both philosophy of sport and sport pedagogy focus on the ludic aspect of sport in order to understand it as a socially constructed activity that

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plays an important part in giving meaning to human life. However, this humanistic side of sport has been downplayed recently. As many authors, such as Patricia Vertinsky and R. Scott Kretchmar, have pointed out, sport sciences has redirected its attention, from cultural activities that matter to people, to the measurable scientific study of movement during the 21st Century.

Nevertheless, there is a recent and strong tendency that argues for recovering the humanistic side of sport science studies by developing an interdisciplinary study of human movement and physical activity. Kretchmar is one of the main proponents of this approach. He defends that silo walls have to become thinner and more permeable. Thus, the humanities have an important role to play in sport sciences and physical education departments. Sports are not practiced just for health reasons. Rather, they are also ludic activities. Science-based sport sciences tend to overemphasize the former while overlooking the latter. However, the ludic aspect has much to contribute. It cannot be downplayed since it also plays a major role in human life, not the least of which is to motivate us to engage in sport for the long run. As Johan Huizinga showed, we are *homines ludentes* (*homo ludens* is the title of Huizinga's book, published in 1950). Play is at the ground of basic human activities and institutions such as religion, law, and the state—as the Spanish philosopher Ortega y Gasset argued (2004, 705-719). In other words, human movement and physical exercise play a major role in *human flourishing*.

Researchers in sport sciences have to go beyond the mere biological, medical or biomechanical focus on sport and physical activities and, following Kretchmar, help these sciences to turn into a holistic discipline which helps us live *a healthy* and *meaningful* life (Kretchmar, 2008, 5), whose values are always promoted by education and both its regional and world wide systems. We have to mend the gap between sciences and humanities by adopting a cross-disciplinary attitude by promoting what Vertinsky calls "intellectual bilingualism" (2009: 47). This means that researchers in one discipline have to make the effort to, at least, understand what is being done in research areas related to their background. Researchers need to have familiarity with both qualitative and quantitative studies and research methods.

The philosophy of complexity that we will analyse in this study is integrative in this sense because it argues for an interdisciplinary way of doing science. In following this methodology, the members of the diverse areas (or silos, in Kretchmar's terms) within sport sciences will help each other in order to provide us with a more comprehensive understanding of physical activities and human movement so we can think of better ways of doing and promoting these activities.

The Philosophy of Complexity: An Overview

The main goal of the theory of complexity is to ground a new science on the basis of integration. Following Edgar Morin, "*complexus*" is "what is interwoven" (1994). This new way of thinking emphasizes the fact that our objects of study cannot be taken in isolation as closed systems. Rather, they have to be seen *as radically interwoven* with their environment. For instance, human beings are not isolated; they have to be studied by taking into account their social environment. In line with this idea, Ton Jörg argues that we have to "complexify" our objects of study to perceive the whole picture (2011).

This new science of complexity born out of dissatisfaction with the way "normal" sciences operate in our society. Contemporary (sport) sciences are incapable to dealing with the complexity found in the world since they employ a linear causal thinking. This "old" way of thinking conceives of the world mechanistically by "mapping mechanistic models to reality as the core of science" (Jörg, 2011, 3). The main goal of this linear thinking is to overcome and dissolute the complexity found in reality.

This was the main goal of Descartes and the fathers of modern sciences, which tried to reduce complexity to a much simpler order composed by mechanical (causal) relationships. However, this simplifying task turned out to be negative for both (sports) sciences and society. Modern sciences were too controlling and dominative. For the task of simplifying complexity to be accomplished easier, several specialized research fields were created. For instance, as Herbert Haag shows, the study of sport was divided into seven fields: sport medicine, sport biomechanics, sport psychology, sport pedagogy, sport sociology, sport history, and sport philosophy (Haag, 1993). However, this overspecialization arbitrarily destroyed both the unity and the complexity of (sport's) reality and turned sciences blind to them.

Modern sciences created the *paradigm of simplicity*. "Created" is the right word since simplicity is a human construction. It does not exist, there are only *simplified* objects. What we perceive when we analyse and think of our world is complexity. For example, famous novelists in the nineteenth century, such as Charles Dickens and Feodor Dostoyevsky, masterly captured and described complexity. They showed that individuals play several social roles that are almost uncountable. Thus, the unity of the solipsistic individual upon which modern social and human sciences were built was blurred by emphasizing individuals' several identities and roles. In contrast to this, nineteenth century sciences' main goal was to reduce reality to a single set of mechanical relationships. For instance, Laplace regarded the universe as a perfectly deterministic mechanism (Morin 1994, 88).

The philosophy of complexity is a rebellion against determinism and simplicity. However, in line with Sigmund Loland's critique of mechanical sciences, it does not deny linear causality thinking. Rather, it provides us with a way to introduce complexity into sciences. By following Jörg, we would argue that this new science of complexity is a complementary science. In fact, recent advances in sciences such as microphysics and computational theory show us that complexity should be at the core of our scientific paradigms. This is even more relevant in the realm of social and humanistic sciences whose object of study is not easy to describe in deterministic terms. This is the reason why Edgar Morin claims that this new science is an opportunity to "humanize sciences". In fact, following his proposal, Jörg introduces the notion of "fluid determinism", which is "about the processes of causal influencing in interaction within interactive relationships, showing a fluid interplay of forces as a kind of shaping forces over time" (Jörg, 2011, 145). This new science opens up a new way to view and do science; it helps us deal with the big questions and issues in real world by providing us with new tools and an integrative approach to think the very complexity that has been denied so often.

Science thus conceived is trans-disciplinary since it liberates sciences from the conceptual blindness restricting the horizons of their discourses. The philosophy of complexity is then a rebellion against silos and bunkers, and the old way of thinking. We need to go beyond the separate disciplines by embracing this new science. To do so, we need to create a new language which is not trapped in the terms of the old science that we want to overcome. This new language is Vertinsky's "intellectual bilingualism", which is mainly based on the dialogue between the diverse sciences. This new thinking in complexity attempts to negotiate and establish a dialogue with reality instead of controlling and dominating it. Thus, it provides us with a different way to approach reality. Complexity is not regarded as something to erase, but rather as a challenge. As far as sport is concerned, sportspeople perfectly know that challenges are not to be erased but faced and overcome. In fact, sports are created by setting artificial and unnecessary obstacles for simple tasks such as reaching one point or throwing objects. Facing challenges is at the core of sports, so should be with sports-related sciences.

Sports and Physical Culture as Complex Issues

An essential feature of the studies on sport and physical culture (sport sciences) is their complex nature. As researchers in these areas, we know that this research field still lacks uniformity regarding its theorems, findings, and statements. For example, these disciplines are characterized and identified through many ways and diverse approaches: a) cross-sectional sciences; b) aggregate sciences; c) applied sciences; d) interdisciplinary, multidisciplinary or trans-disciplinary sciences; e) additive sciences.

Moreover, sport sciences and sport studies – this term is used to identify the research field of humanities applied to sport (cf. Coakley, Dunning, 2007) – have a plural nature. These sciences and studies employ many methodologies that can be philosophical, anthropological, hermeneutical, analytic, rationalistic, socio-critical, political-institutional, system-theoretical, subjectively based on single constructs. In line with the complexity found in sport science studies, Haag explores the plural nature of sports sciences by analysing the topics studied by them from four different perspectives: a) established theory fields; b) new theory fields; c) sport orientation themes, and d) general orientation topics.

Given the mentioned plural nature and complexity of sport sciences, the definitions and contents provided by authors within such a discipline are meaningless; they merely reflect inherited cultural-anthropological meanings and philosophical prejudices belonging to their respective research field. For example, as Loland shows, those involved in the mechanic study of sport hold either the "stronger claim" (that states that the theory or methodology of mechanics is the only true knowledge of sports) or the "weaker claim" (that, following Karl Popper's philosophy of science, defends that analytic mechanics does not necessarily lead to absolutely true knowledge, but it represents the best knowledge available) (Loland 1993, 263-264).

This lack of general uniformity is not unique in contemporary sport sciences. Using Charles Percy Snow terms, (sport) sciences knowledge has been split into "two cultures": the sciences and the humanities. Snow wrote a book in 1959 titled *The two cultures and the scientific revolution*, whose main thesis was that the breakdown of communication between the *two cultures* of modern science was a major hindrance to solving the world's problems. Such a lack of communication is still alive in contemporary sciences. Nothing has changed since the publication of Snow's book. Sport sciences are a perfect illustration of this. In fact, the gap between humanities and sciences is increasing more and more and becoming deeper and deeper due to the following factors:

1) The biologisation, medicalization, and technification of sport sciences' contents and its problems due to the supremacy of biological and medical sciences and the prevailing of technified didactics and training system for physical education teachers and coaches.

2) The downplaying of the humanities of sport, which implies a relevant lack in the training of sport sciences students (who will be the future professionals of sport and physical activity) and denies the possibility of building a holistic methodology able to explain and understand sports and physical culture through an appropriate and not dichotomical methodology, which means, a methodology that combines qualitative and quantitative elements and focuses on the general meanings of sport and physical culture and their real value and importance to human life.

Both the downplaying of humanities in sport sciences and the prevailing of a biomedical and technical paradigm give rise to the following two theoretical mistakes: reductionism and reductivism. The former tends to reduce the study of sport and physical activity (sport sciences) to one methodological approach (the analytic one) and to one science. Thus, complex things are simplified to causal interactions, so the study of the many diverse aspects of sport as a phenomenon is conceived of as mere subfields of a higher discipline. For instance, sociologists conceive of sport as mere sub-sphere of society. A relevant case of reductivism in sport sciences is exemplified by those theories that explain success in sports by only appealing to genetic factors.

As reductionism and reductivism are employed as theoretical tools to simplify the hypercomplexity of both objects "sport" and "physical activity", they generate negative consequences in practice; they give rise to simplifying attitudes and *habitus* when approaching sport related problems. These attitudes and theoretical habits tend to simplify sports sciences' multifaceted nature and to employ just one language to explain (and to solve) its problems. Thus, studies in epistemology of sport sciences are an essential battlefield for contemporary sport sciences. Every researcher or professional in sport sciences should be forced to reflect at least once in his or her career on this debate.

Regrettably from a pedagogical point of view, by living under the paradigm of simplicity, sport sciences professionals are frequently mere technicians or specialists; they have a practical attitude towards problems regarding sport, but they lack a critical and reflexive approach to these very problems. Thus, they are not able to cope with them in a critical way; they are trained to follow certain guidelines or a given mainstream but they do not reflect upon what they do. This mainstream, as Loland shows, is embodied by analytic thinking and mechanic sciences. This is a good thing for the progress of the discipline to a certain extent, but we should find a balance between the progress of lineal-mechanic thinking and critical-hermeneutical thinking. Following Haag, we have to emphasize that the seven diverse fields that compose sport sciences are a part of a continuum at the very end of which pedagogy of sport and philosophy of sport are located.

Pedagogy of Complexity and Sport

If we take a look at the history of physical education from the nineteenth century European national physical education school to this day, we would notice that the develop of sport science has hardly been unitary as well as characterized by inconsistency and fragmentation. Physical education originated many different

epistemological traditions which are nowadays impossible to bring back again to a consistent and logical coherent paradigm, which illustrates that we live within the paradigm of the two cultures sketched by Snow. Accordingly, the model of an interdisciplinary physical education or physical culture seems to be utopic. In fact, the European Union has recently officially fixed the main research areas and the disciplinary sectors of sciences without mentioning the field of sport sciences. This reflects a major trend in Europe, whose university education systems tend to erase the discipline of *sport sciences* as an independent research area (as it is happening in Italy).

Due to the prevailing and strength of this paradigm, which tends to downplay the value and contribution of the humanities in understanding and developing contemporary sport, we have tried to find a turning point for sport pedagogy by drawing on the philosophy of complexity. In so doing, we have argued for the development of a new pedagogy based on the main tenets of such philosophical proposal, which were analysed in the previous sections.

Along with Morin, the reform of our old way of thinking is a key anthropological and historical problem. We need a new way of thinking to reconnect what has been disjointed and compartmentalized by the modern way of doing science; we need a radical thinking, a multidimensional thinking, which implies, according to Morin, "a mental revolution of considerably greater proportions than the Copernican revolution". One of the main practical consequences of this new thinking will be that the studies in humanities will be placed in the centre of our educative plans. This does not mean that analytic studies will be thought of as negative or useless. Rather, they have to be complemented by other disciplines in a more integrative and multidisciplinary way of doing science.

Sport sciences should regard sport as a "set of things (issues and problems) in context" by investigating it as a complex objects. These sciences should promote an educational research which is inspired by the philosophy of education grounded on the philosophy of complexity (Haggis, 2008). In so doing, they should regard differences, varieties, particularities and features of sport as a scientific object in order to understand what lies beneath it, establish a sense of its generative principles, search for its deep structure, and avoid making the mistake of doing a reductionist/reductivist analysis of it. Such a research model attempts to create knowledge "that can be used in relation to practices in specific contexts." (Haggis, 2008, 153). However, as we have shown in this paper, the dominant epistemological, and ontological, positions and points of view of sport sciences make this educational approach to sport practices (and the problems they imply) difficult to be carried out.

Sport is always a complex web of interactions which implies problems that must be studied in light of their practical importance to sport professionals, athletes, the people interested in sport, educators, and teachers. What gives meaning to sport and makes it a human practice is its being an educational practice which embodies values that can be promoted by social and educational agencies, and institutions. Sport professionals and all the people who teach, or are engaged in, sport should be helped to critically reflect upon what they do (Isidori, 2008). As Donald Schön shows in his two famous books: *The Reflective Practitioner* and *Educating the Reflective Practitioner,* a professional is not only the individual who is able to make things and use her or his knowledge and skills in a right way. Rather, a professional should also be able to justify the reasons why he or she makes certain decisions instead of others.

This reason-giving task is grounded in the critical reflection on his or her very activity. For Schön, only a balance between theory and practice can help technicians to develop into reflective practitioners, that is to say, into truly creative professionals who use critical thinking and avoid being mere technicians. Unfortunately, Schön's model of reflective practitioner, which is inspired by John Dewey's pragmatism, has been rarely applied in Europe in the field sport sciences. The correct balance between theory and practise is the key problem for the epistemology of our research field.

To conclude this pedagogical reflection, we can employ here the following metaphor. Knowledge is an orchestra and scientists are the musicians. Knowledge regarding sport is very complex because it deals with all human beings' dimensions. Thus, a problem within sport sciences cannot be reduced to one scientific approach or methodology. We are the musicians of sport and we must learn to play better our instruments in order to teach our athletes and students, "future musicians", to better play (and this is not only a metaphor) theirs. We have to teach our students that the "how", the "what", the "why", and the purpose of sport are always unified and never must be considered in isolation because they are always a part of a *continuum*. This is the pedagogical challenge that we have to face and study further by employing new epistemological proposals such as Morin's philosophy of complexity. For us, this is the only way to make sense of this great human practice that we call "sport".

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