Why Do We Train the Way We Train? A Historical-Epistemological Framework of Sport Training

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Sport performance | Motor competence | Praxiology | Training design | Football | Team sports

Headline

There is a need to update scientific assumptions in sport to promote the critical thinking of scientists, coaches, and practitioners and improve their methodological decisions (Pol et al., 2020). Every approach to sport training is based, explicitly or implicitly, on particular conceptions of human beings. However, these conceptions did not originate within the field of sport but were inherited from scientific, philosophical, and technological paradigms developed long before their incorporation into training practice (Kiely, 2018). This idea was anticipated by Pierre Parlebas (1985), who suggested that sport evolves under the influence of the major transformations shaping humanity. Under this premise, we train the way we train not only for methodological reasons, but because our practices reflect historically situated ways of thinking about and acting in the world.

This technical note develops a concise historical - epistemological framework to explore how successive paradigms (mechanistic thinking, the energy revolution, the computational metaphor, dynamical systems, and big data & artificial intelligence) have shaped the organisation of training and coaching. Following the Structured Training approach proposed by Francisco Seirul·lo (2003), sport performance can be understood as the emergent interaction of different interrelated structures of the human athlete (Gómez et al., 2019; Pons Alcalá et al., 2020; Tarragó et al., 2019). From this perspective, training methodologies and training tasks can be considered expressions of paradigms that have shaped the prioritisation of these structures over time. Rather than a linear progression, these paradigms are better understood as overlapping explanatory layers that coexist and generate tensions within training theory.

Beyond describing the historical evolution of sport training, the proposed framework provides coaches with a practical lens through which to analyse training methodologies and training tasks. By identifying the structures of performance emphasised by different paradigms, practitioners can critically evaluate their own training decisions, improve the coherence of their programmes, and better align task design with the specific demands of their sport.

Aim

The aim of this work is to analyse how key paradigms continue to influence sport coaching, training design, and performance evaluation, in order to propose implications for practice.

Method

This study adopted a conceptual approach based on historical-epistemological analysis. Updating the assumptions originating from previous work by Pierre Parlebas (1985), a narrative and comparative examination of major paradigms shaping sport training was conducted in relation to broader cultural and technological transformations. The analysis focused on identifying how different paradigms have historically prioritised specific human structures, taking structured training as a reference (Gómez et al., 2019; Pons Alcalá et al., 2020; Seirul·lo, 2003; Tarragó et al., 2019).

Discussion

From the Body-Machine to Biomechanical-based Training

One of the earliest explanatory frameworks to shape sport training was the mechanistic worldview inherited from Cartesian rationalism. The separation between mind and body, together with the conception of the organism as a machine susceptible to analysis through its constituent parts, established a metaphor of profound influence.

Although formulated in the seventeenth century, this conception found practical expression in sport much later. The Swedish gymnastics system of Pehr Henrik Ling in the nineteenth century may be interpreted as a pedagogical materialization of this worldview: a body organised, corrected, aligned, and optimized according to mechanical principles. A first important insight emerges here: training models often appropriate paradigms developed centuries earlier in other fields.

This legacy persists today in approaches centred on ideal technique, analytical decomposition of movement, applied biomechanics, and corrective forms of training. Much contemporary practice still operates, under the shadow of Descartes' Error (Damasio, 1994), reproducing dualisms that separate movement, cognition, and emotion. From this perspective, the body-as-machine was not merely a philosophical metaphor; it became an organising principle of sport practice.

From the Steam Engine & "Strains" to Energetic-conditional Training

The Industrial Revolution introduced another decisive metaphor: the machine capable of transforming matter into energy and energy into movement. More than a century later, this rationality deeply penetrated sport training, giving rise to new logic for understanding productive systems based on energetic pathways and physiological response.

Classical periodization (Matveev, 1972) and contemporary block models (Issurin, 2010; Verkhoshansky, 1986) can be interpreted through this paradigm. In this sense, training was structured around components of load (intensity, volume, duration, density, frequency), designed to impose a specific "strain" upon the organism. Interestingly, when Hans Selye (1950) introduced his General Adaptation Syndrome, he borrowed the term "stress" from engineering, though he later admitted he should have used "strain" to describe the organism's internal deformation under pressure. Under this lens,

the body strengthens its conditional structure to withstand the tension imposed by the training load.

This paradigm generated enormous advances and remains central in many sports. Yet it also showed certain controversies (Kiely, 2018) and consolidated a reductionist tendency: assuming that improving energetic and conditional structures in isolation necessarily improves performance. Particularly in team sports, that equivalence is highly debatable.

From the Computer to the Computational Mind

A third important turning point occurred with the cognitive revolution of the mid-20th century. The advent of computers gave way to a new dominant metaphor: the mind as an information processing system based on memory. A clear example was the multi-store memory model, which divided memory into sensory input, short-term memory, long-term memory, and response execution (output) (Atkinson & Shiffrin, 1968).

This logic was gradually incorporated into sports, where models of motor learning and control were developed (Marteniuk, 1976; Schmidt & Lee, 1999; Singer, 1980), considering three phases as sequential operations: perception, decision, and execution. Cognitive approaches to sport training, based on higher psychological processes, declarative knowledge, and mental representations, can be understood as direct heirs of this paradigm, linked to cognitive and mental structures.

Its influence remains evident in many approaches to decision-making in training, often under laboratory or decontextualized conditions. At the same time, it has been criticized for sometimes maintaining an excessively internalist view of behavior, and for failing to account for the continuous, emergent relationship between the individual and their environment (Araújo et al., 2025). Once again, a broad scientific revolution ultimately shaped a particular way of training.

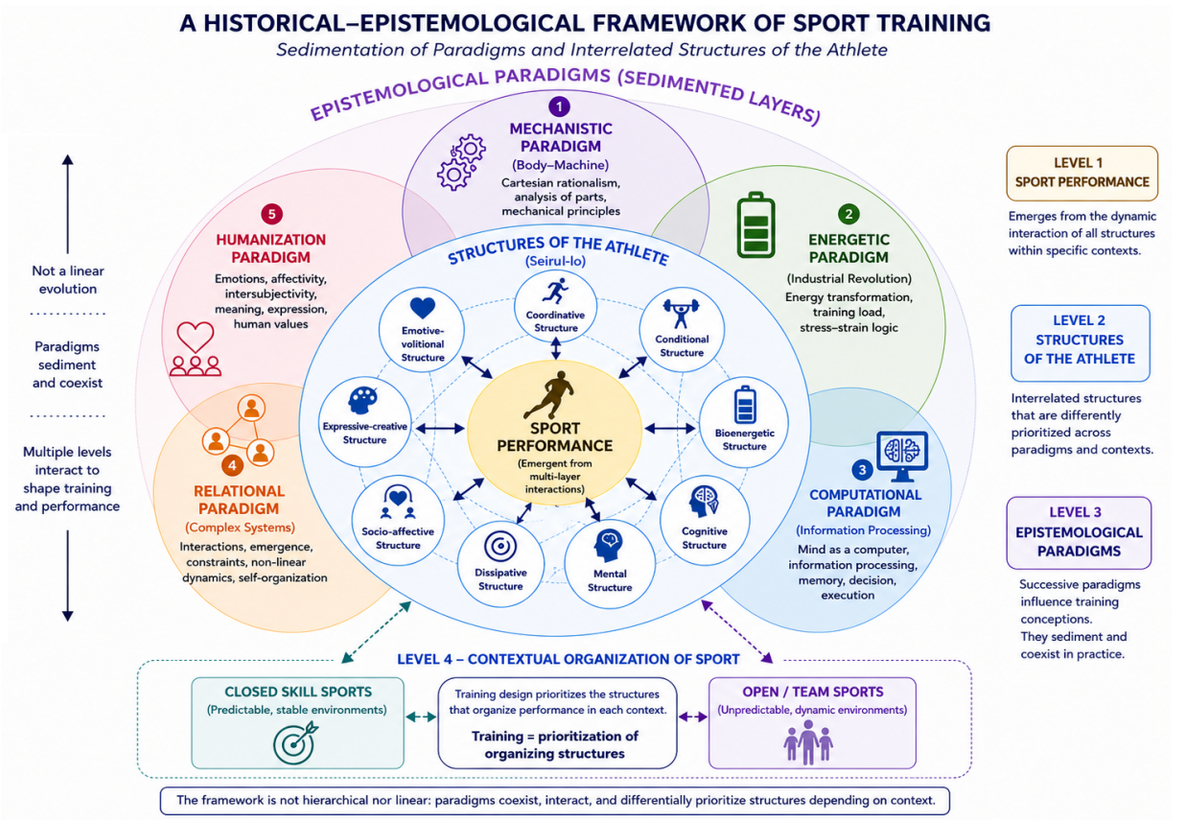

Fig. 1. Historical-epistemological Framework of Sport Training

Networks, Interactions, and the Emergence of the Relational Paradigm

Perhaps the deepest transition currently underway is the shift from isolated entities to the primacy of relationships. Ecological theories, dynamical systems, and complexity sciences have introduced a view in which behaviour emerges from organismic-environmental couplings (Gibson, 1979), constraints (Newell, 1986), and non-linear interactions (Balagué et al., 2013), rather than from pre-programmed internal operations.

In team sports, this relational sensitivity was pioneered by Pierre Parlebas. He described the player within an open and dynamic field, in constant exchange and permanently affected by a collective structure, leading to perceptive-motor and interpersonal constellations (Parlebas, 1967a). Several of his concepts align with this modern paradigm, such as adaptability (Parlebas, 1967b), internal logic and communication networks (Parlebas, 1968), and uncertainty (Parlebas, 1970b).

From this perspective, performance cannot be explained solely through individual capabilities, but through emergent patterns of coordination (Araújo & Bourbousson, 2016). This idea directly challenges a deeply rooted historical assumption: that training the parts will improve the whole. By recognizing that collective behaviour arises from interactions (Silva et al., 2013), it highlights the relevance of the socio-affective structure in regulating cooperation and opposition among partic-

ipants, as well as the dissipative structure that characterizes self-organising processes in complex systems.

Consequently, coaches may need to prioritise representative interaction contexts over isolated capacity development when designing training tasks. This redefines the roles of both the coach (Wood et al., 2023; Woods et al., 2020) and the physical trainer (Sánchez-López, 2025), moving away from rigid methodological prescriptions toward a more contextual understanding of practice. From this perspective, the task for coaches is not to determine which approach is universally "better", but rather to identify which principles and training conditions best fit the learning and performance requirements of athletes in specific contexts (Lindsay & Spittle, 2024).

Humanization of Training in the Big Data and Artificial Intelligence Era

While artificial intelligence and big data expand capacities for measurement and prediction, a complementary trend is emerging: the humanization of performance. Júlio Garganta (2016) argued that the future of sport will be characterized by a growing humanization of practice, in which understanding people beyond data becomes a central professional competence.

From this perspective, emotions, affective bonds, and intersubjective processes cease to occupy a peripheral role and instead become core dimensions of training. This view is grounded in the idea that action is intimately filled with emotion, and that cognitive and motor structures are modulated and modeled by affectivity (Parlebas, 1970a). This shift highlights the growing relevance of the emotive-volitional structure, which regulates motivation, commitment, and intentionality in performance, as well as the expressive-creative structure, which underpins the capacity for adaptive, original, and meaningful motor solutions.

Paradoxically, the greater the technological sophistication of sport, the more relevant the irreducibly human becomes. This does not imply a replacement of previous paradigms, but rather a progressive integration of multiple levels of analysis, recognizing that behind every energetic demand, conditional load, and relational interaction, there is a human athlete whose behaviors are also shaped by meaning, intention, and expression.

Integrative Framework of Sport Training

Figure 1 presents an integrative representation of the framework developed in this paper. Sport performance (level 1) is conceptualized as an emergent phenomenon arising from the dynamic interaction of structures of the human athlete (level 2). These structures are differentially prioritised by successive epistemological paradigms (level 3), which do not replace one another but rather sediment and coexist over time. Finally, their relative importance varies according to the internal logic and contextual organisation of each sport (level 4), guiding the prioritisation processes that underpin training design.

Practical applications

This integrative framework provides coaches and sport scientists with a conceptual tool to critically interpret contemporary training methodologies and training tasks. In turn, this deeper understanding enables more informed decision-making based on the following points:

- Before adopting a new methodology or copying a training task, ask yourself where it comes from. What assumptions about performance make you believe this method or task will work? Understanding its origins helps avoid adopting practices simply because they are popular or widely used.
- Use the framework as a coaching checklist when designing or reviewing training tasks. Ask yourself: What am I really training? Which historical paradigm best explains this task? Which structures of the athlete are being primarily developed? What aspects of performance am I leaving untrained or underrepresented? Is this task coherent with my game model and the performance demands of my sport?
- Use the framework to question training trends instead of following them. This prevents unnecessary changes in training practice driven by marketing or anecdotal success.
- Review your weekly training plan to check whether all training tasks point in the same direction. If most tasks develop the same structures while consistently neglecting others, your programme may lack balance or fail to reflect the demands of your sport.
- Adapt your methodology and tasks to your context. The conceptual framework highlights that each training paradigm has strengths and limitations. Instead of applying a one-size-fits-all approach, select or combine methods based on the athletes' age, competitive level, performance goals, and the specific demands of your sport.
- Use the framework as a reflective tool at the end of each training cycle. Periodically analyse your program and ask yourself: Why am I training this way? What assumptions guide my decisions? What aspects of performance might I be overlooking? This reflective process can help coaches refine future planning and make more informed methodological decisions.

Every training task reflects a particular way of understanding sport performance. The purpose of this framework is not to tell coaches which methodology is right or wrong, but to help them become aware of the assumptions behind the decisions they make every day. Ultimately, asking "Why am I training this way?" may be one of the most valuable questions a coach can ask when designing more coherent, context-specific, and evidence-informed training programmes.

Conflicts of Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the author used ChatGPT OpenAI in order to support English translation and generation of Figure 1. After using this tool, the author reviewed and edited the content as needed and took full responsibility for the content of the published article.

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