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Dynamic Systems and Performance in Team Sports
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Dynamic Systems and Performance in Team Sports

1. Abstract

In order to create an appropriate training process for team sports, it is relevant to define a differential paradigm of sport performance. Traditionally, the science of training for sports has
been developed through the study of the needs of several individual sports and, in contrast, its
results are applied to team sports. We strongly believe that the analysis of the dynamic complex
systems theories will provide us the best theoretical basis to construct a specific science of training
for team sports. Accordingly, it is necessary to modify the systematic application of the Cartesian
paradigm in such a way that we can provide more adequate solutions to explain the complexity of
team sports. Our proposal is to build channels of access between these theories and the

different
levels of the training process of team sports.

Key Words

STRUCTURAL TRAINING, TEAM SPORTS, DYNAMIC COMPLEX SYSTEMS.

2. Sport in the 20th Century

Sport in the 20th century is developed by means of its teaching and its training. The teachinglearning
processes are based on behaviorist theories ("what is observable") such as psychology, pedagogy, didactics and methodology. The training-performance processes are based on mechanistic theories ("what is measurable") such as physiology, physics, medicine and biomechanics. These sciences –through their contributions- have been useful to construct an atomist and multidisciplinary sport model; in other words, a model based on the "mind-body"
dualism that has been the subject of ongoing debate since the beginning of the human knowledge.

The Classical Paradigm

In the classic paradigm there exists a reproduction of models by ... "contrasted evolution". The
model is reproduced depending on:

-The evolution of the rules.
-The evolution of the competition demands.
-The evolution of the knowledge of the coach.
-The evolution of the social and economic valuation of sport.
-The evolution of technology and research applied to sport.

All of them are external, alien to the athlete. The model is made up from the sport and from society.

Fundamentals to Practice

Behaviorist and mechanistic theories have developed certain practices to achieve these goals.

-Practices of global tendency (during the first stages of sport learning): global training and small
games.
-Practices of an analytic tendency (during stages of sport performance): technique, tactic and physical conditioning.

Both are developed by quantitative practices of linear and progressive sequences of analytical
exercises.

The player is constructed in order to fulfill the demands of a certain model that at the moment
"dominates" a specific sport.

This paradigm, now in recession, has dominated our culture for several hundreds of years, during
which it has been constituted our occidental society and considerably influenced the rest of the
world.

Such a paradigm consists of an entrenched set of ideas and values among which we can mention
the following: the vision of the universe as a mechanical system that is a compound of pieces, the
vision of the human body as a machine, the vision of living in a society as a competitive struggle for
survival, the belief in the unlimited material progress of society by economic and technological
growth... (Capra, 1998).

3. Sport in the 21st Century

Sport in the 21st century is developing by means of an integral development of the athlete ("mindbody")
as a whole. Its teaching and training are a unique optimization process of the athlete.
Cognitivism and structuralism - supported by organizational biology, neural-sciences, systems
theory, information theory, and ecological theories - achieve the auto-modeling or auto-structuring
of the athlete.

Consequences: New Paradigm

The aim is to achieve the auto-structuring by means of "differential optimization," and this is
obtained by:

-The establishment of technical-tactical skills in which the player demonstrates a certain competence.
-The observation of the impact that competition causes to the player.
-The constant acquisition of new knowledge of the player about the game, training and himself.
-The formation of the own social image.
-The achievement of the knowledge of the player during practice by means of technology and
research tools.

All of them are related to the athlete. The proposals are taken from the athlete.
If proposals are taken from the athlete, it is necessary to modify our thought, ideas and values
about the sport/person as a living being that constantly seeks the dynamic interaction between
what is rational, analytical, reductionist, linear, competitive, quantitative (for individual sports) and
what is intuitive, synthesizing, holistic, non-linear, cooperative, and qualitative (for team sports).

The Athlete According to These Theories

Based on the new paradigm, we are able to interpret the athlete as a hyper-complex structure that
is made up of interactions and retroactive actions between the following structures:

-Conditioning structure.
-Coordination structure.
-Socio-Affective structure.
-Emotional-Volitional structure.
-Creative-Expressive structure.
-Mental structure...?

Each structure must be considered as the expression of underlying processes.
This means that the processes - a complete network of dynamic connections among all the systems
- become apparent through what we call networks.
Also, what we traditionally call capacities are just forms of isolated evaluation of part of the processes that occur in some systems which makes up a determined structure.

The 1st Contribution of the Systems Theory to the Development of Training

This systematic and holistic conception of the player will provide clues about the conditions under
which the athlete must develop his training activity in order to obtain his differential autostructuring.
As a result, the own contents of the structural training appear; despite the
understanding that it can provide new elements to the training of "individual" sports, it is much
more appropriate for "team" sports in which the constant interaction among objects-partnersopponents

requires high levels of auto-structuring of all constituent components.
Therefore, high variation content and high variability practice are most relevant.
As pointed out in the new paradigm, teaching and training are a single element of optimization of
processes which will become apparent as properties of each aforementioned structure, because
these properties can only be considered from two standpoints:
-The dynamic inter-activity of all the systems.
-The constancy of their global interactions ...
We must construct specific exercises of structural training that provide such continuously dynamic
inter-activity; in contrast to the repetitive and analytical training exercises typically used by individual sports and based on other theories.
Practical Conditions
These practice requirements are offered by Preferential Simulation Situations. This must be defined
such that the conditions of the work are determined to fix a “preferential” performance on some of
the functional systems of the athlete.
First, are the stable levels that ensure the consistency of the interactions: Here we will build the
base of the training system. It is implemented through certain movement forms that the athlete
performs during the practice of his sport. These movement forms must include basic coordination
elements that support the sport’s technical foundations. They are practiced in specific situations
containing relevant information that must be processed in order to perform the proper execution
of the coordination simulation.
Next, are the levels of variability that provide Dynamic Interactivity: Firstly, the simulated situation
must always make use of the Cognitive Structure. Next, relations with the teammates-opponentsobject
must be established to feed the Socio-Affective Structure. And lastly, the Emotional-Volitional Structure must be engaged by living out specific moments of personal challenge and
commitment.

The 2nd Contribution of the Systems Theory to the Development of Training

One of the essential properties of any life manifestation is the irreducible tendency to construct
multi-level structures of systems inside of systems. These structures are a consequence of varied
inter-active processes among systems of differential complexity that take shape as a network in
which no one system is the most important.
This triggers the need to modify the laws of the traditional training, inasmuch as synergy relations
are more used than progressive training loads and sequential planning is substituted by differential
priority. Many other principles based on the hierarchical and linear conception must be substituted
by inter-connected multi-level guidelines.

Practical Consequences

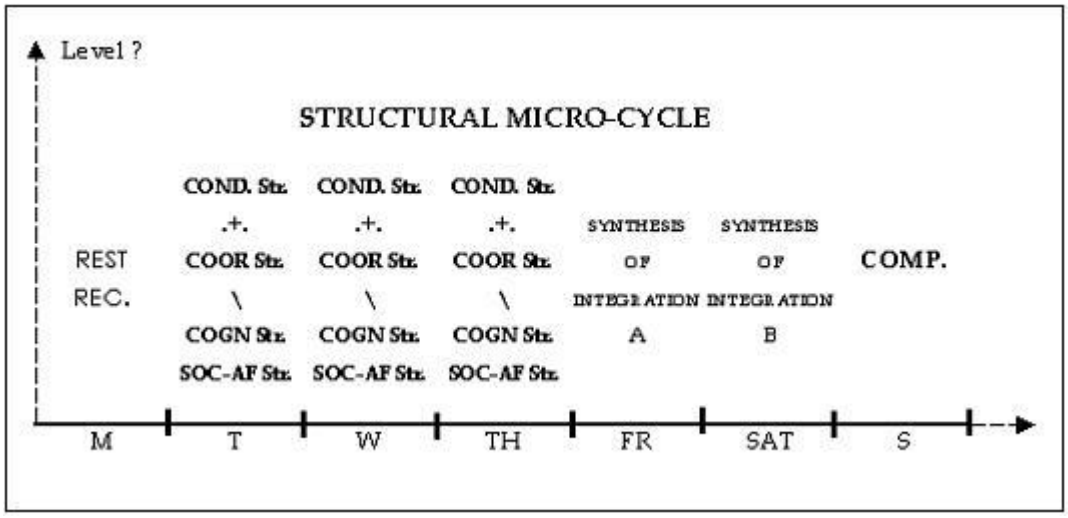

Figure 1. Model of a Structural Micro-cycle.

Every day of the training week, there are differential priorities that must be adjusted to the needs
of the athlete. All differential priorities are equally integrated in the total synthesis prior to competition.
The total contents of each micro-cycle are in relation to previous micro-cycles, as well as future
micro-cycles. This is based on different inter-connection guidelines so as to obtain the highest
levels of structural optimization.

The 3rd Contribution of the Systems Theory to the Development of Training

We know that the function of the components of such networks is to participate in the production
or transformation of other components of the network. Thus, the output of these network processes is self-organization; the differential auto-organization based on processes of qualitative
production which bring about each unique human being.
On the whole, the so-called improvement of performance cannot be evaluated by quantitative
criteria that are alien to the person; on the contrary, they should be evaluated by qualitative proposals which are based on the interpretation that the own athlete is able to complete at any
moment and from any perspective of the discipline that he performs.

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