PRINCIPLES FOR A RATIONAL ORGANIZATION OF THE TRAINING PROCESS AIMED AT SPEED DEVELOPMENT

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The development of the speed of execution of the specific activity is the main training target for most athletic events. The development of speed should be a gradual process, which should follow after a period of special physical conditioning. The preparation period of training should emphasize the potential for increasing the application of force, rather than an increase in the speed of execution of the activity itself. The author describes the ways in which this principle may be observed during the various macrocycles of the training year.

1 Introduction

In most sports disciplines performance results are determined mainly by movement and locomotion velocity (Figure 1). Indeed all types of training, be they centered on special conditioning, technique and tactics, pre-competition preparation, psychological preparation etc., aim at an increase of speed and of the ability to exploit this capacity during competition. We may, therefore, say that the speed of execution of the competition specific exercise is:

1. a fundamental feature of sports skill;
2. the overall result of the training process;
3. the main objective criterion for an evaluation of the efficiency of the training process.

The features that distinguish a high level athlete are excellent technique, a high speed capacity and the ability to apply great force. In other words, the main training target — increasing the speed of execution of the competition specific exercise — should not be restricted to technical skills.

Since speed is one of the fundamental characteristics of skill, its development must be the starting point of a training programme. It is, therefore, necessary to determine how speed may be developed.

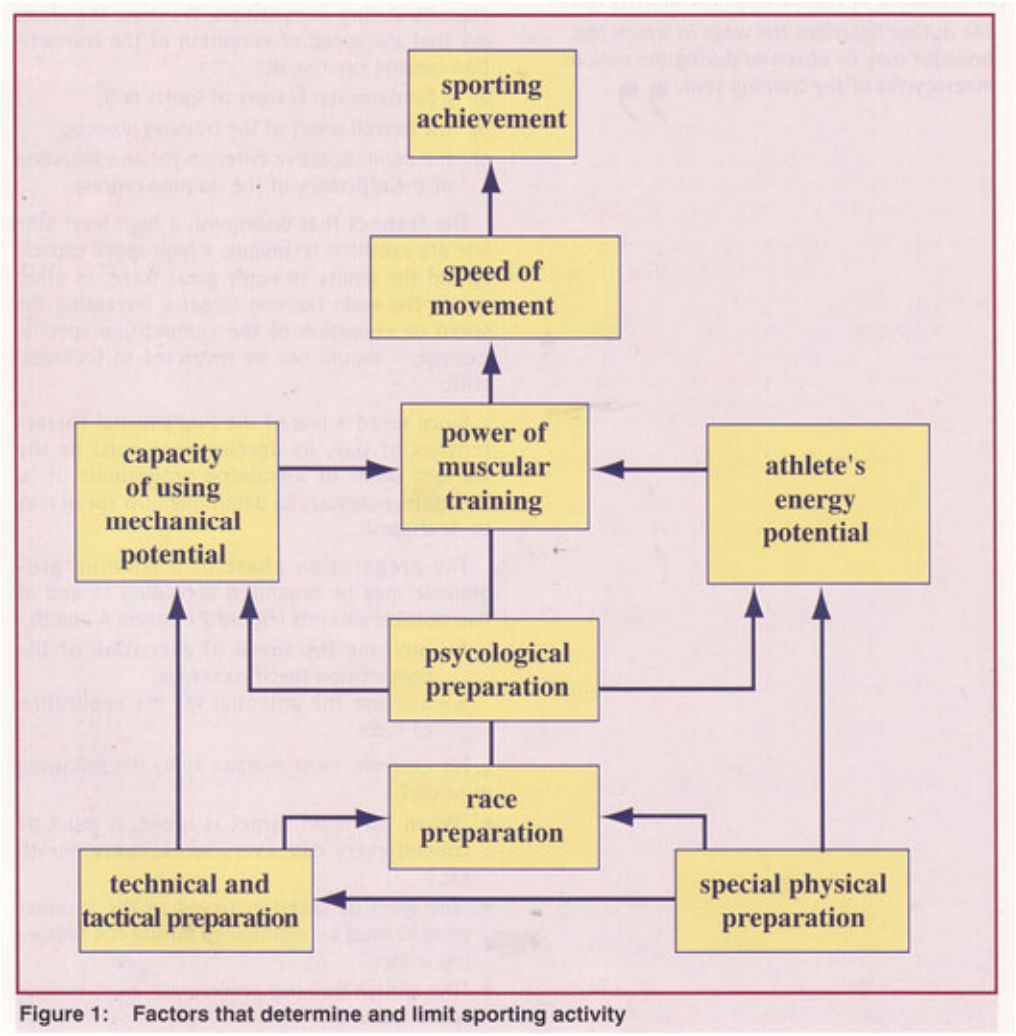

Figure 1: Factors that determine and limit sporting activity

The preparation phase of a training programme may be organized according to one of two possible variants (figure 2 I, curves A and B):

A = increase the speed of execution of the competition specific exercise,

B = increase the potential for the application of force.

For example, most coaches apply the following principles:

- "When the main target is speed, it must be trained every day, every week, every month etc."
- "The level of speed achieved in the summer months must be maintained during the following winter."
- "The winter training programme must include speed training."
- "It is better to run 100km a week at high speed than 200km a week at a lower speed.'

Following this line of thought, coaches tend to choose variant ‘A”, and this is a mistake. The intensification of training in the preparation phase, in particular by performing the competition specific exercise at high velocity, or with a considerable strength effort, increases an athlete’s functional capacity and performance in the short term (Figure 2 II), but does not favor the transformations or morphological restructuring necessary for a further improvement of the specific work capacities and skills. Furthermore, a premature velocity increase negatively influences the development of the degree of training. Thus, in sports disciplines requiring speed-strength, this method causes excessive muscular fatigue (in some cases even injuries) and an alteration of the bio-dynamic structure and rhythm of movements. As a consequence, the morphological and functional specialization process is slowed down, while a motor co-ordination is created that does not correspond to competition conditions. A gradual increase in the intensity of the load, spread over a longer period, produces a greater and more stable development of the functional possibilities (Figure 2 II, curves B and C).

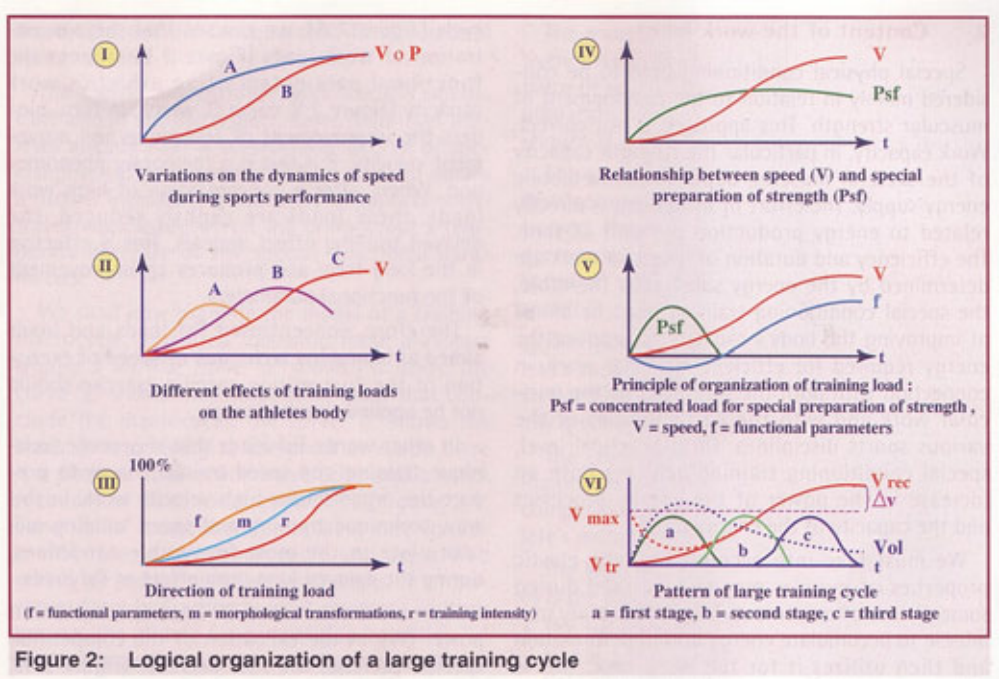

Figure 2: Logical organization of a large training cycle

In cyclic sports disciplines, combat sports and games, a premature intensification of high velocity work causes asthenic reactions — unproductive reactions that are meant to protect the organism from abrupt changes of the acid-base balance. Premature work loads requiring considerable anaerobic energy, applied to athletes who are not adequately prepared for this type of work, cause an excessive load on the cardiac function and a thickening of the artery walls, which delay the development of peripheral circulation and hinder cardiac activity itself. These factors may, in turn, cause a myocardial dystrophy. There is also a reduction of the oxidative capacity of the skeletal muscles, because mitochondrion integrity is disturbed and, therefore, speed at the anaerobic threshold level decreases.

Therefore, at the beginning of the macrocycle it is necessary to intensify the function (Figure 2 III, curve f) only to the extent that an optimal level is reached that will favor the transformations or morphological restructuring of the organism (Figure 2 III, curve m); the loads must be special extensive loads. It will then be possible to intensify the work regimen (Figure 2 III, curve r) and thus improve the athletes capacity to exploit the newly achieved functional level for the competition specific activity.

From this point of view, the variant 'B' (Figure 2 I), which is based on a gradual increase of speed or intensity of muscular effort, allows a programmed preparation of the muscular apparatus for the future intensive work regimen, while developing also the athlete's capacity to perform the competition specific exercise at moderate intensity. In cyclic sports disciplines and in games, work performed at optimal speed (anaerobic threshold level which progressively increases) favors:

1. the programmed development of cardiac chamber volume and myocardium potential;

2. adequate reactions of the peripheral vasa;

3. morphological and functional perfecting of slow twitch and fast twitch muscle fibers.

However, moderate velocity work, performed over a relatively long period of time, may delay the adaptive process to high velocity work that is necessary to achieve the programmed result. Furthermore, in cyclic sports and games, the functional specialization of the muscle groups is slower than that of the vegetative system and this is a limiting factor as regards special work capacities.

Therefore, an increase of the level of special conditioning, the main objective of which is the intensification of the work regimen of the motor apparatus, must precede an increase of the velocity level, so as to avoid excessive fatigue (Figure 2 IV, curve Psf). Special physical conditioning training must be aimed specifically at the muscles principally involved in the competition specific exercise.

Subsequently, the execution of this type of training at progressively higher velocities (up to maximum level) becomes a factor of the intensification of the work regimen (Figure 2 II, curve V). In this way the intensification process occurs in conditions that are very similar to those met in competition, but it does not cause excessive fatigue, due to the preceding special conditioning.

This training strategy allows an overall increase in intensity, which is very important for high level athletes. Another positive aspect is that it takes into account the adaptive inertia of the various functional systems and does not hinder the programmed adaptations to the particular conditions of sports practice. The implementation of this strategy requires the special physical conditioning work to be concentrated at the beginning of the macrocycle (Figure 2 V, curve Psf).

2 Content of the work loads

Special physical conditioning used to be considered mainly in relation to the development of muscular strength. This approach is not correct. Work capacity, in particular the strength capacity of the skeletal muscles, depends on metabolic energy supply. The effort of movement is directly related to energy production per unit of time. The efficiency and duration of muscular work are determined by the energy substrates. Therefore, the special conditioning training must be aimed at improving the body's capacity to produce the energy required for efficient muscular work, in connection with both the specificity of the muscular work and with the particularities of the various sports disciplines. On a practical level, special conditioning training achieves both an increase in the power of the energy processes and the capacity of the energy supply.

We must take into account that the elastic properties of muscles may also be used during some phases of movement. This is the ability of a muscle to accumulate energy during deformation and then utilizes it for the work task. This is called "elastic energy recovery" and it significantly increases the economy and efficiency of movement in running and jumping, for instance.

Movement may be considered biomechanically adequate, when both metabolic and non-metabolic energy are efficiently employed. Therefore, intensification of the work of the muscular apparatus through Psf, must be intended not only as the development of muscular strength but also, and principally, as the increase of the body's energy potential and of the capacity to employ it in competition specific conditions. This leads us directly to the principle that the improvement must be structural, involving all the properties of muscle (contractile, oxidative, elastic). Depending on the specificity of the considered sports discipline, this will favor an increase either in the capacity to apply maximum or explosive strength, or the development of local strength endurance.

If we apply this principle to the organization of a macro-cycle (Figure 2 IV), we can see that the concentration of work loads (Figure 2 V) reduces the functional parameters of an athlete's work capacity (Figure 2 V, curve f), which, in turn, hinders the improvement of technique and movement velocity. But this is a temporary phenomenon. When, after a concentration of high work loads, these loads are slightly reduced, the delayed training effect appears. This is effective in the long term and produces an improvement of the functional parameters.

Therefore, concentrated Psf loads and loads aimed at improving technique or speed of execution of the competition specific exercise should not be applied simultaneously.

In other words, Psf loads should precede technique training and speed training, so as to prepare the organism for high velocity work. In this way, technique training and speed training will take place in the most favorable conditions, during the delayed long term effect of Psf loads.

The maximum value of velocity (V_{max}) and power (W), in the execution of the competition specific exercise, will first decrease (Figure 2 IV, bold curve representing V or W) as against the values achieved in the previous season, and then increase gradually to equal and finally exceed former values.

The use of concentrated work loads is significant also in another aspect. Since high level athletes already have a considerable degree of special physical conditioning (Psf), in order to obtain a further increase it is necessary to apply concentrated work loads, which will bring about a temporary decrease of the special functional parameters.

We shall now examine the model of a training macrocycle, organized following these principles (Figure 2 VI). The curve “a” shows Psf loads; the curve “c” shows the competition loads that conclude the macrocycle; the curve “b” shows the loads corresponding to the point at which there is a change of direction in velocity and a quick recovery of functional capacities (Figure 2 V, curve f). “b” loads, therefore, play a very considerable role in the macrocycle and are aimed mainly at producing adaptive changes, in preparation for a high velocity work regimen; i.e. they prepare the athlete for competition condition “c” loads. Competition loads are the means to increase the capacity for special work (figure 2 V, curve f) and the speed of execution of the exercise, to its maximum possible value.

The macrocycle, therefore, includes three relatively independent phases, the common denominator of which is the principal training goal the preparation of the athlete for the competition (Figure 3).

The preparatory phase is aimed mainly at developing, by means of special physical conditioning, the athlete’s motor potential, which is a prerequisite for the work concerned with the speed of execution of the competition specific activity.

The special phase aims at improving the athlete’s capacity to perform the competition exercise at high (maximum possible) speed, by modeling competition conditions (loads).

The competition phase aims at achieving the minimum possible speed of execution of the competition exercise and at perfecting the athlete’s motor skills.

The logic dictating the succession of the phases is the following:

- The achievement of the athlete’s multifunctional preparation in readiness for the high velocity work regimen of the preparation phase.
- The perfection of the athlete’s capacity to perform the competition exercise at high speed and the creation of the prerequisites for an efficient performance during the special phase.

- The accomplishment of the principal training goal of the macrocycle — the personal best level of speed; this must be planned for and achieved at the time of the more important events.

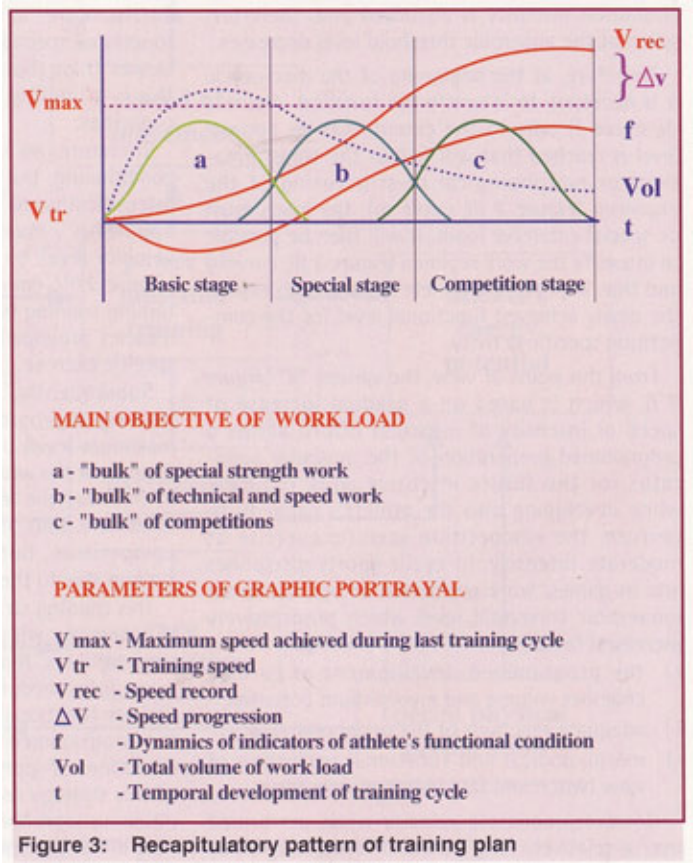

Figure 3: Recapitulatory pattern of training plan

The following are general considerations concerning the model of a training macrocycle (Figure 3):

- Curves “abc” represent the different principal directions of the loads, not their volume!

- Depending on practical conditions, it may be necessary to include the so-called transition phase (or the conclusive phase). The duration of this phase, and the need to include it or not, depend on the intensity of the competition season.

- In the case of high level athletes, the model of a training macrocycle depends more on efficient planning than on the competition calendar. This concept must be applied with a certain degree of creativity, taking into account the motor specificity of the sports discipline, the rules and the traditional calendar.

  For example, there may be two macrocycles in one year (Figure 4). In this case, the main events are included in the second cycle, and this fact

determines the principal training goals and the content of each macrocycle. If there are three competition periods in one year, models II and Ill can be used, always allowing for the specificity of the sports discipline, the general goal set for that year and the importance of the events (control competitions, qualifications, and main competitions).

The macrocycle must always be organized with the actual situation in view. In some cases, speed will show an undulatory trend with a general tendency towards an increase. This may be associated with more intensive high velocity work in the second macrocycle, when there should be an intensification of the speed work and a reduction of the volume of special conditioning training. In some activities, such as boxing, weightlifting and volleyball, the macrocycle may include only two phases. The first one would be centered on special conditioning training, the second on special preparation, leading to the actual competition.

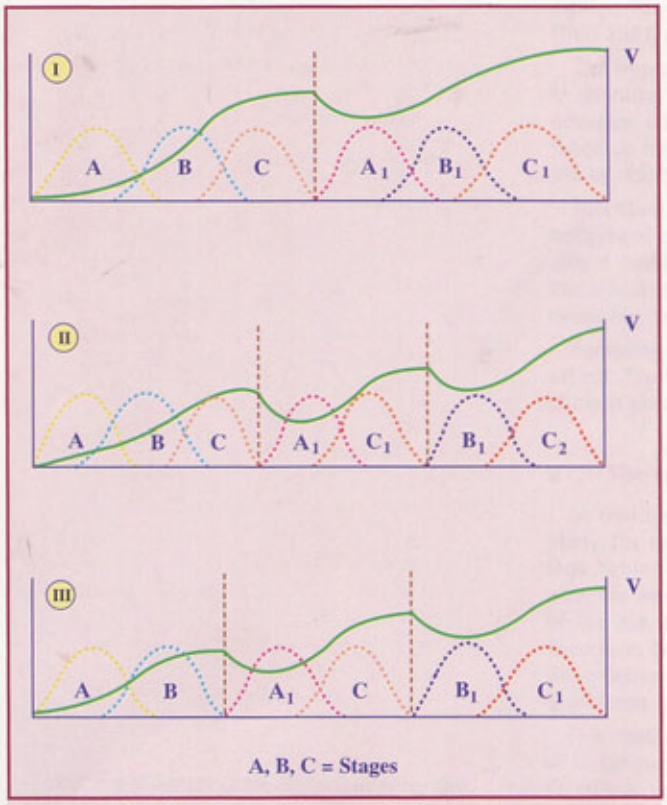

Figure 4: Outline of possible annual training plans