Block periodization vs. traditional theory.

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Many generations of scientists, coaches and athletes have tried to build a training system that would yield the best performance results. Their efforts have focused on three general problems:

- How to design the rational training plan for a sufficiently long period?
- How to implement such a plan optimally? -
- How to reach the most favorable combination of all athletic abilities exactly at the time of the main competition?

All these problems belong to the ***training periodization***, which is described as the purposeful sequencing of different training units (long duration, medium duration and short-term training cycles and sessions) so that the athlete can attain the desired state and the planned results. Because training periodization contains many variables and depends on many influential circumstances, the ideal model can exist only in theory. Nevertheless, each year we take another step towards more conscious planning and more complete understanding of training as a whole.

This chapter summarizes the two most prevalent views of training periodization: (a) the traditional approach which has been predominant for a long time, (b) the block periodization design, which has come into widespread use among high-performance athletes during the last decades.

1. Traditional theory of periodization: basics and limitations

Training periodization was founded initially during the 1950s in the former USSR and was established as a scientific concept by Matveyev in 1964. This theory was disseminated in Eastern Europe (Ozolin,1970; Harre,1973) and later in Western countries (Dick, 1980; Martin, 1980; Bompa, 1984; Yessis, 1987), and constituted a compulsory part of training planning in high-performance sport. In general, the periodization theory exploits the periodic changes in all human biological and social activities. For a long while, the theory was accepted as the universal basis for training in any sport and for athletes of any level of competence. The first criticism and trends for reform appeared at early 1980s in elite sport as the experience of top coaches stood in contrast to the entrenched theories. New approaches proposed by creative coaches and scientists appeared. Extensive discussions by sports experts took place in the 1990s in East and West European sports magazines. Let us first examine the basics of traditional theory and their limitations from the viewpoint of high-performance sport.

1.1.1. The scope of traditional theory

The cornerstones of periodization are formed by a hierarchical system of training units that are periodically repeated (Table 1.1). The upper level of the hierarchy belongs to the Olympic Quadrennial cycle, juxtaposed with the greatest events in sport world life. The next level of the hierarchy is represented by the macrocycles. A macrocycle usually lasts one year but can be shortened to half a year and even less (this flexibility in the annual cycle subdivision is irrelevant to the block periodization approach). The macrocycles are divided into training periods. The training periods fulfill a key function in traditional theory because they divide the macrocycle into two major parts: the first for more generalized and preliminary work (preparatory period); the second for more event-specific work and competitions (competition period). In addition, a third and shortest period is set aside for active recovery and rehabilitation. The next two levels of the hierarchy are reserved for the mesocycles (medium-size training cycles) and microcycles (small-size training cycles); the bottom part belongs to workouts and exercises, which are the building elements of the entire training system.

Table 1.1

Hierarchy and duration of the training units

Training units	Time duration	Mode of planning
Quadrennial (Olympic) cycle	Four years – period between Olympic Games	Long-term
Macrocycle, perhaps annual cycle	One year or several months	
Training period	Several months as a part of the macrocycle	Medium-term
Mesocycle	Several weeks	
Microcycle	One week or several days	
Workout or training session	Several hours (usually not more than three)	Short-term
Training exercise	Minutes (usually)	

The repertoire of periodic training units provides sufficient freedom for training design. Although external factors, such as competition calendars and seasonal changes, dictate culmination phases and restrictions in training, a coach can select the sequencing, content and duration of training cycles and define the particularities of each training mean and method.

A further consideration of the traditional approach points out the general characteristics of the above-mentioned periods and subdivides them into several stages. The training content of each stage should be concretized with regard to workload volume

and intensity (Table 1.2).

Table 1.2

General characteristics of training periodization in the traditional approach (based on Matveyev, 1981; own modification)

Period	**Stage**	**Aims**	**Workload**
Preparatory	General preparatory	Enhancing the level of general motor abilities. Enlarging the repertory of various motor skills.	Relatively big volume and reduced intensity of main exercises; high variety of training means
	Special preparatory	Development of the special training level; enhancing more specialized motor and technical abilities	Load volume reaches maximum; intensity increases selectively
Competition	Competitive preparation	Enhancing event-specific motor fitness, technical and tactical skills; forming the individual patterns of competition top-performance	Stabilization and reduction of volume; increase of intensity in event-specific exercises
	Immediate pre-competitive training	Accomplishing event-specific fitness and attaining readiness for main competition	Low volumes, high intensity; fullest modeling of forthcoming competition
Transitory	Transitory	Recovery	Active rest; use of variable pleasant activities

Initially the traditional approach presupposed one macrocycle a year; a typical design is presented in Figure 1.1.

Figure 1.1. Traditional presentation of annual cycle with one macrocycle (one-peak annual periodization)

The one-peak annual cycle was particularly suitable for seasonal sports (like skiing,

skating, rowing etc.) but did not meet the demands of sports where athletes competed in any and all seasons (like fencing, swimming, ball games). Later modifications admitted two and three macrocycles within the annual cycle. Each macrocyle is subdivided into three periods, which are characterized by specific combinations of training aims and workloads (Figure 1.2).

Figure 1.2. Presentation of annual cycle with two- and three macrocycles (two- and three-peak annual periodization)

The mesocycles, the medium sized training cycles, have been interpreted in different ways. Several authors offered eight sub-types of mesocycles, the other ones more. The students remember their titles until the exams and forget at once after them; the coaches didn't use these terms or utilize several "home-made" definitions. The Block Periodization Concept proposes much simplified mesocycles' classification; the coaches keep it in mind without excessive efforts (1.2.3).

The microcycles, as the shortest training cycles, elicit fewer contradictions. Despite the lack of unanimity among authors in regard to the names of the different microcycles, the following summary of many publications may help to make some order (Table 1.3.)

Table 1.3.

Microcycle types identified basing on summary of many publications

Name*	General characteristics
Adjustment, involving, initializing	Medium load level, gradual increase in workload
Loading, developmental, ordinary	Increased load level, use of big and substantial workloads
Impact, shock, microcycle of extreme load	Use and summation of extreme workloads
Pre-competitive, tuning, peaking	Medium load level, the use of event-specific means and drills
Competitive	Sport and event-specific performances
Restoration, regeneration	Low load level, use of the wide spectrum of restoration means

* The underlined title is the version preferred by the author

1.1.2. Merits and demerits of the traditional approach

The traditional theory of athletes' training was formulated at a time of very limited knowledge and scientifically proven guidelines for coaching. Traditional training periodization, which adopted up-to-date know-how of the 1960s, was a breakthrough for coaching and training science. Many of the elements postulated then remain valid to this day, including the hierarchical taxonomy and terminology of training cycles, differentiation between general and specific athletic preparation, seasonal trends of exercise volume and intensity, basic approaches to short-term, medium-term and long-term planning, etc. Of course, it would be unrealistic to expect that all of the ideas proposed more than four decades ago remain applicable today. Several of the principles of athlete preparation have no importance in the alternative Training Block approach.

Example. The *principle of unity of general and specific preparation* was postulated in traditional theory with regard to high-performance training emphasized the importance of event-specific means within long periods of generalized preparation, where this specificity could be ignored, and, conversely, the importance of general exercises during long competitive periods, when specific means are totally predominant. The *principle of continuity* was relevant when athletes lost motivation to train during long periods of monotonous training far from serious competitions. The principle of *wave-shape training design* was important to prevent the overloading so potentially prevalent during the prolonged periods of hard workloads typical of traditional planning.

The traditional design is appropriate for low-level athletes. However, it does not work well for high-performance athletes. Traditional theory entails a number of contradictions, which dramatically reduce the effectiveness of preparation (Table 1.4.).

Table 1.4.

The main contradictions of the traditional training approach for high-level athletes (Issurin, 2007).

Factors	Contradictions	Consequences
Energy supply	Concurrent performance of diversified workloads can not be provided by sufficient energy supply	Energy is directed to many targets while the main target doesn't get appropriate priority
Restoration of different physiological systems	Because of differing periods of recuperation in different physiological systems, athletes do not get sufficient restoration	Athletes suffer from fatigue accumulation and can't concentrate efforts on main targets

Compatibility of various workloads	Exercises of various modalities often interact negatively due to energy deficit, technical complexity and/or neuromuscular fatigue	Performance of certain loads eliminates or reduces the effect of previous or subsequent workouts
Mental concentration	Performance of stressed workloads demands high levels of mental concentration that can't be directed at many targets simultaneously	Mental concentration dissipates; a number of exercises are performed with reduced attention and motivation
Sufficiency of training stimuli for progress	The sport-specific progress of high-level athletes demands large amounts of training stimuli that can't be obtained by concurrent training for many targets	Complex simultaneous development of many abilities doesn't provide sufficient improvement for high-level athletes

For instance, preparatory period training for top-athletes in endurance, combat sports, ball games and aesthetic sports presupposes the development of general aerobic ability, muscle strength and strength endurance, improvement of general coordination and general explosive ability, basic mental and technical preparation, mastery of the tactical repertory, and treatment of previous injuries. Each of these targets requires specific physiological, morphological and psychological adaptation; many of these workloads are not compatible and cause conflicting responses

Study and example. The highly qualified male swimmers were followed up during eight weeks of the early season preparation. The athletes performed a strenuous fitness program combined with extensive swimming, which included resisted exercises and power drills directed to the development of swimming-specific strength. The total number of workouts was usually 9-11 per week The training outcomes were evaluated by strength estimates: maximal force of tethered swimming ($\boldsymbol{F_{tsw}}$), dry-land explosive strength ($\boldsymbol{F_{exp}}$), and dry-land strength endurance (***SE***). The fitness program resulted in a remarkable enhancement of strength endurance, while the swim-specific strength and explosive strength didn't improve (Figure 1.3). During this entire period the swimmers improved their swimming preparedness, evaluated mostly by endurance tests. Therefore, the global aim of the fitness program was not obtained: although the swimmers enhanced their strength endurance, they did not improve their maximal swim-specific strength, and their explosive strength ability decreased. Although a substantial part of the fitness program included maximal and explosive strength drills (about 30% of the time expended for a dry-land program), the expected training effect was dramatically impaired by negative interaction of these workloads with the strength endurance routines and extensive swimming program (personal archive of author)

Figure 1.3. Maximal force of tethered swimming ($\boldsymbol{F_{tsw}}$), explosive strength ($\boldsymbol{F_{exp}}$) measured as the force value achieved during 0.2 s of isometric effort in stroke simulation, and strength endurance (***SE***) measured as the power output during two minutes of two-arms stroke simulation on the isokinetic machine in high-level swimmers during an eight-week fitness program; bottom part – training time expended for fitness program (white boxes) and for swimming routines (grey boxes)

Indeed, the maximal strength progression requires muscles hypertrophy and enhancement of the neural mechanism of muscular contraction. The last one is of primary importance for improving of explosive strength ability. The extensive endurance workloads capture the metabolic energy that is necessary for anabolism during post-exercise recovery, and this suppressed the muscles' hypertrophy. On the other hand, enhancement of the neural mechanism is conditioned by the state of the central nervous system and the sensitivity of the neuro-motor pool (Klausen, 1990). The observations of coaches and athletes' self-reports evidence that the strenuous high volume training program caused permanent fatigue; eventually, the state of the central and peripheral neural factors is far from optimal level, which is favorable for the improvement of the mechanism of muscular contraction.

Similar conflicting situations were marked by many coaches, but not all of them assessed their critically. However the most prominent coaches decided a long ago that developmental programs for maximal and explosive strength and for strength endurance should be separate. The problem among high-level athletes is that their progress demands large highly-concentrated workloads, that can not be managed simultaneously for a large number of targets.

One additional drawback of the traditional theory is its inability to provide successful participation in many competitions. Indeed, even the three-peak annual cycle design does not satisfy the international sport trend towards competitions throughout the year. The multi-peak tendency that is in obvious contradiction with traditional planning is very characteristic of modern top-sport. Let's consider the above-mentioned multi-peak tendency in the example of the world-star track and field athletes.

Example. There are preparation's data of three world leading athletes: Marion Jones (USA), Sergei Bubka (Soviet Union, since 1991 Ukraine), and Stefka Kostadinova (Bulgaria) - Table 4.5. Each of these three athletes had pre-season and season preparation lasting about 300-320 days. As can be seen in the table, the time span when these athletes competed and reached the peak-achievements, and when they had relatively lower results varied between 135 – 265 days: This is obviously that this long time span can not be subdivided into traditional preparatory period and competition period. On the other hand, the basic abilities of these athletes (maximal strength, capacity of aerobic regeneration) should definitely be maintained on a sufficient level during the 5 to 8 month span. Therefore, the appropriate training

cycles for basic abilities and recovery should be incorporated into the program. The traditional scholastic scheme doesn't allow a solution to this problem, and the inability to provide such a preparation design by means of traditional approach is obvious.

Table 1.5.

Multi-peak annual preparation of world-star track and field athletes (based on Suslov, 2001; own modification)

Athlete, disciplines, best achievements	Example	Number of peaks in season	Typical intervals between the peaks	Total time span for competing
Marion Jones; 100-200m running, long jump; 3-time Olympic Champion 2000; 5-time World Champion	Season 1998	10*	19-22 days	200 days
Sergei Bubka; pole vault; Olympic Champion 1988; 5-time World Champion; world record holder	Season 1991	7**	23-43 days	265 days
Stefka Kostadinova; high jump; Olympic Champion 1996; 2-time World Champion; world record holder	Season 1998	11***	14-25 days	Winter - 20 days; spring and summer – 135 days

* There are eight peaks in running and two separate peaks in the long jump; all the peaks were on the level of her personal season best results;

** All the peaks were within 3% zone of the personal season best result; namely –595-612 cm;

*** All the peaks were within 3% zone of the personal season best result; namely –200-205 cm

The above marked disadvantage of traditional planning was noted by many coaches, who modified the annual chart and inserted relatively short-term training cycles with highly concentrated workloads to ensure multi-peak preparation. These were, in fact, the precursors of the alternative training periodization. A few decades ago high-level coaches could be heard lamenting: We build up massive foundations of basic abilities, but when we complete the tower of specific fitness, the foundations are mired in a bog. This gloomy outlook reflected the practical observation that prolonged development of basic abilities doesn't guarantee the maintenance of these abilities at the high level that was achieved over time (the phenomenon of training residuals was conceptualized later, see 1.2.1.). Unfavorable seasonal trends in physiological and sport-specific variables

were noted and commented upon in many follow-up studies of the preparation of high-level athletes; the pattern of these typical changes is presented in Figure 4.1.

Study and example. The group of highly qualified kayakers was followed up during their yearly preparation designed following classic theory. The incremental stepwise test was utilized to determine velocity of Anaerobic Threshold ((V-AT) and mean distance velocity in all-out performance (Vd). Peak Force on the paddle (PF) and Stroke Rate (SR) were obtained with the help of portable telemetry system. The anthropometric measurements allowed to calculate muscle mass (MM). As can be seen in Fig.4.3, the long period of general preparation (preparatory period) caused a substantial increase of aerobic endurance (V-AT), muscle mass and strength ability (peak force on the paddle). During the relatively long period of highly specialized competitive period, extensive aerobic workloads were replaced by more intensive event-specific exercises, maximal strength exercises affecting anabolism were reduced and even rejected as a harmful for racing technique. As a result, the velocity of Anaerobic Threshold and peak force decreased during the competitive period, and muscle mass diminished prior to competition. It is worth noting that mean distance velocity reached maximum for the targeted competition; this progression was obtained by means of increased stroke rate despite reduced force application to the paddle. It is obvious that the timing pattern for developing different abilities was far from optimal (Issurin et al., 1986).

Figure 1.4. Mean distance velocity (Vd), velocity at Anaerobic Threshold (V-AT), Peak Force on the paddle (PF), Stroke Rate (SR) and Muscle Mass (MM) of the high-level kayakers during one annual macrocycle (based on Issurin et al.,1986).

1.1.3. Why the traditional planning approach should be revised

As can be inferred from this description, the drawbacks of the traditional training concept were a crucial factor in seeking an alternative approach. These limitations included:

- restrictions created by the simultaneous development of a number of motor and technical abilities;
- the inability to provide multi-peak preparation, i.e. successful participation in many competitions;
- limitations imposed by excessively prolonged periods of basic and sport-specific preparation.

Moreover, the tremendous changes in world sport over recent decades had a strong influence on the evolution of the training process. While the variety and uniqueness of

each sport makes it difficult to be specific, these changes can be summarized in general as:

- a drastic increase in the number of competitions and competitive performances;
- a remarkable reduction in the total volume of training workloads;
- the appearance of new concepts affecting the planning and designing of alternative training periodization.

Increase in the number of competitions

An evident tendency in contemporary sport is participation in competitions through the whole season (Table 1.5) and a remarkable increase in competition days throughout the year (Figure 1.5).

Figure 1.5. The number of competition days for international class athletes in different sports; data obtained from internationally recognized experts in the sports mentioned (Issurin, 2007).

At least three factors have determined the trend in competition activity:

- **Increase in the number of competitions** in international and national tournament programs: in the last two decades, international sport federations have initiated and supported the organization of traditional series of grand prix, world and continental cups, memorial trophies etc., which have become popular among top athletes and the sport media; similarly, national federations have built extensive competition schedules intended to engage a larger population of sub-elite athletes in ambitious preparatory programs;
- **Financial motivation of top athletes** has increased substantially: the premiums potential prize-winners can receive became obvious stimuli to reach peak-performance levels more frequently than proposed in the traditional periodization chart. At the same time, second echelon athletes have also modified their competition strategy to imitate the top athletes' patterns;
- **The contribution of competitions** to training stimuli has increased dramatically; more frequent competitions break routine training and change the relation between loading and recovery; advanced coaches exploited more frequent competitions to intensify the athlete’s preparation.

Reduction in total volume of training workloads

This factor refers to the considerable reduction in total volume of training workloads among high-performance athletes. Figure 1.6 illustrates this tendency for representatives of different sports from different countries. A number of circumstances can be cited for this global trend:

Figure 1.6. Total time of training in one year among the international class athletes (data obtained from internationally recognized experts in the sports mentioned); Gymnastics-R – Rhythmic Gymnastics, Running-MD – Running middle distance (Issurin, 2007).

Remarkable progress in training methods and sport technologies. Up-to-date knowledge of long-, medium-, and short-term training effects makes it possible to design training programs that prevent excessive workloads, which were often the result of insufficient understanding or critical appraisal. Monitoring technologies for heart rate, blood lactate, movement rate and technique have been incorporated into training routines so that acute and immediate training effects are now much more measurable and predictable. In particular, the modern approach to training planning has made it possible to replace the slogan "more miles make champions" to "knowledge gives power". This factor closely interacts with the next one.

Worldwide sharing of successful experiences among coaches. It is obvious that the modern world of elite-sport has become more open and dynamic. International training centers host athletes from different countries for training camps and extended preparation. Coaches' clinics, seminars and courses engage experts of world renown, who don't hesitate to lay out – for all to see and hear – items that were once classified as "top secret". Many successful coaches from countries that regulated experience-sharing by means of strictly enforced sport policy have taken the world as their stage. These are coaches possessing long-term experience in the use of extreme and sub-extreme training workloads, from the time when general training volumes were strictly prescribed. They knew that a substantial part of these excessive workloads was not useful, if not harmful, and now they share this knowledge with colleagues from many countries.

Increases in the number of competitions and starts. The excessive training loads were partly superseded by more pronounced competitive activity.

Rejection of illegal pharmacological programs. It is no secret that some illegal pharmacological interventions facilitated certain athletes' physiological responses, such as muscular hypertrophy and speedy recovery, and affected performance at higher workloads. Doping control – before, during and after competitions – initiated by the International Olympic Committee in the mid 1990s has become an indispensable part of modern sport and has helped to prevent the use and sharing of these harmful technologies in high-performance sport. One concomitant result was to reduce the capacity to maintain high-load training programs.

Social and political changes in post-communist countries. It is common knowledge that the highest workload volumes were performed by athletes of former communist countries where athletic preparation was strictly centralized. Integrative parameters of the training process (such as total mileage, total time expended on training, etc.) were imposed on national teams in the form of planning directives. Very often these directives proposed excessive training workloads as a tool to obtain more successful athletic

performances. The social and political changes that these countries underwent were followed by the democratization of elite-sport, a reduction in administrative pressure and liberation of the coaches allowing them to display individual initiative. On the other hand, the economical upheavals engendered by the political changes in these countries exhausted most of the financial resources available to top sport. As a consequence, total workload volumes were substantially reduced. In a rippling effect, this change influenced training volume trends in other countries and caused load reductions there as well.

All of these circumstances and factors contributed to the search for alternative training approaches, which were offered by creative coaches and scientists with a practical orientation. Not every attempt to reform the traditional system was successful; however, revision tendencies gradually became stronger and more desirable for preparing high-performance athletes in the new conditions of markedly more competitions, a highly developed sport industry and a more open sport society that demanded a revamping of the training system. As a result several new concepts were implemented in practice and created the foundations for alternative periodization and advanced training theory.

(to be continued)