

Periodization (or Periodized Training)

Athletes and coaches have subdivided their training into various sub-periods for many years. Although micro cycles can be traced back to Phylostratus in 202 BC, the first modern use was in Germany, used by the coaches who's athletes dominated the 1936 Olympics.

The modern practice of periodized training was largely invented and refined by Eastern-block nations during the Cold War (1950-1970), when sport became the battlefield for contesting ideologies. Despite the efforts of many sport scientists, there is not a sound scientific basis for periodization. However, there is much evidence to show that, on a practical level, it really works.

The modern meaning of the term "periodization" is largely associated with [Tudor Bompa](#), who has written and invented significantly on this topic in the last forty years. Major contributions have also been made on this topic by Vern Gambetta, [Istvan Balyi](#), PeterTschiene and Charles Poliquin.

In its simplest form, "periodization of training" means "dividing the training up into periods". Each period is dominated by one training goal - to get faster; to get stronger; to build endurance; to recover from fatigue; to deliver peak performance. In the real world, these periods, called phases, are not totally devoted to one training mode.

A small detour is required here to review the concepts of overload training. Think of the body as a black box. If you stress one of the systems inside the black box beyond its normal workload, the black box responds to the stress by trying to make that system stronger, strong enough to tolerate the higher stress level.

The black box [body] can, however, only make the system stronger if it is given a rest phase in which to build this stronger system. Training then, consists of overloading the body system that is to be trained, letting the system rest and rebuild, and then stressing it again to a higher level.

Periodization is all about managing this stress-and-rest cycle to optimize improvement and maximize the overall gain in performance. The kind of periodization applied to a particular athlete will be strongly influenced the sport the athlete pursues, the physical characteristics that are required, and the training age of the athlete.

Annual Training Plan:

A generic, periodized annual training plan is classically divided into the following eight phases:

- General Preparation
- Specific Preparation
- Pre-competition
- Competition
- Taper
- Peak
- Relax
- Off-season

[Phases](#) will be described in more detail below.

Each phase can last for many weeks. The characteristics of a phase are that the over all goal of the training remains the same and that the tendency in the training load (up, down, level) remains consistent over the phase. Phases are in turn, subdivided into smaller units, called macro cycles.

The training load, described as volume, is measured in hours, or miles, or weight lifted, or laps or kilometers, largely at the convenience of the sport. Hours are a convenient measure for calculating volume distribution.

Volume is increased during a phase to improve training response, at the expense of increasing fatigue levels. Volume is decreased across a phase to lower fatigue levels, so that improved performance can show through. There are exceptions to these general rules and some phases may maintain the volume at a constant level.

Macro cycles are used to control the training load and the fatigue level generated by training. If the training load is increased continuously over a long phase, say twelve weeks, by the end of the phase, the athlete will accumulate so much residual fatigue that he/she will not be able to train properly. The wise coach will break the phase into smaller sections (macro cycles) that have weeks of increasing load followed by a rest period. The length of these macro cycles is governed by the systems to be trained and the time in the training year.

A typical macro cycle from the General Preparation phase would be three weeks of increasing load, followed by one week of lower load. This is called a 3-1 macro cycle. For endurance athletes working on aerobic capacity, where training is focused on long duration and low intensity, either 3-1 or 4-1 macro cycles are appropriate. During the pre-competition phase, where these same athletes will be working at much more intense training, doing intervals on or above the anaerobic threshold, shorter macro cycles, 2-1 or even 1-1 would be appropriate.

The next level down is the **micro cycle**, which in most sport training coincides with the week. A 3-1 macro cycle, which has four micro cycles (3+1), is most often four weeks long. Micro cycles determine how the training load is laid out during the week. Most of the time the pattern is "a heavy-day, followed by a light-day", a model much honored in the breach. Designing micro cycles is almost another art in itself, as the definitions of "light" and "heavy" must take into account both the volume of training, the intensity of the training, and the [energy] systems trained. Heavy and light are measured and defined in terms of fatigue level incurred and recovery opportunities available.

Building an Annual Plan:

Timing:

If you have followed the periodization logic so far, we are going to:

- Divide our training year into phases,
- Divide the phases into macro cycles, each with 1-5 micro cycles,
- Allocate our training load into daily chunks within micro cycles,
- Allocate our daily training hours to particular training types.

Only at this point do we decide whether to get on our bike, go to the pool, the gym, the track or the sauna!

First define in general terms what your training year looks like:

When does it start [start date]?

When is your first competition [first race]?

When is your most important competition [the peak race]?

From this information, we can work out how many weeks there are between each of these dates, so we can calculate how many weeks are available for each of the phases in our training plan.

"Start date" to "first race" includes the first three phases, Gen.Prepare, Spec.Prepare and Pre-comp.

"First race" to "peak race" includes Competition and Taper phases.

"Peak race" to year-end, includes Peak, Relax and Off-season.

Given these three dates, YPI can easily generate a first draft of phases for you to edit. At this point, you will know the start, end date, and duration for each phase.

Now you have to decide how many hours to train during each phase. Adding up the hours in each phase to gives the training load for the year [total hours]. This calculation is easier to do backwards!

Volume:

Given the total volume, it is possible to calculate the hours per phase, based on a classic annual volume curve. Where does this "total volume" figure come from?

- How many hours did you train last year? Add 10%.
- What is the sport norm for your age class?
- Ask other athletes/coaches in your sport about total volume;
- Experiment with YPI - choose a number and see what kind of hours per week you get at 100% volume. Is it too high or too low?

The volume curve is somewhat sport specific, but in general has a similar shape in all annual plans. The basic volume curve built into YPI increases through the preparation phases to some peak value (100%) at the top of the Pre-competition phase. Volume is adjusted downward by 40-50% for the Competition phase, which assumes a level volume load. Volume decreases again in the Taper phase, dropping to perhaps 25% of the maximum volume. The Peak volume depends on the nature of the competition. After this comes the unloading phase called Relax, in which the total volume maybe around 30-40% of maximum volume, followed by Off-season, with a further decrease in volume.

Given the total volume, YPI will help you do the calculations that will give you an appropriate volume curve for your training plan. Using the built in macro cycle buttons, and then the built in micro cycle buttons, you can very quickly get to the point where you know, logically, how many minutes will be optimal for a particular training day.

Emphasis:

Emphasis governs what kind of training you should be doing at which time in the year. The options are:

- Mental,
- Tactical,
- Physical,
- Technical.

The balance of these four elements is very phase and sport specific. For example, in an endurance sport, where the general preparation phase starts 5-6 months before the competition phase, the balance might be:

- Mental, 10%
- Tactical, 0%
- Physical, 85%
- Technical, 5%

Ten percent may not seem much, but for an endurance athlete training 10-14 hr per week, 10% is 60 to 90 min./week Ten to fifteen minutes, five days a week over 12 weeks, can go a long way.

For a biathlete, who uses the general preparation phase to work on shooting skills as well as for endurance training, the ratio would look more like this:

- Mental, 2%
- Tactical, 0%
- Physical, 83%

- Technical, 15%

Formal mental training can be decreased as precision shooting involves practicing the mental skills of focus, concentration and attention control.

Intensity:

In books and articles that describe periodised training plans, the intensity curve is usually a near-reciprocal of the volume curve. As volume increases, intensity goes down; as volume goes down, intensity increases. This reciprocal arrangement should result in fatigue loads that are consistent with the athletes training capacity.

Effective aerobic training requires low intensity training over long durations (long slow distance), applied over a long time period. Training the anaerobic system requires very intense activity over short periods of time (interval training) and it responds quickly to training load. Happily, endurance athletes can train these energy systems sequentially and end up with a classic Intensity vs Volume profile.

Intensity is a sometimes a hard item to come to grips with. It usually refers to physical intensity of effort, but doesn't have any consistent measurement across exercise types. For a track and field athlete who normally runs 3000m races, running 4 x 400m intervals at 90% race pace is more intense than jogging 1600m at 50% race pace. But how does that compare with spending an hour in the weight room doing hypertrophic exercises? Each sport has its own way of coming to grips with this comparative scale. As a general guideline, the more fatigue produced per unit time, the more intense the activity. Other general measurements of intensity are based on perceived effort (1 -10 scale), or on relative heart rate. YPI uses heart rate zones and converts this information into an estimate of fatigue level ([Banister](#)).

Phase Details:

General Preparation:

Is usually the first phase of any periodized plan. In this phase, training focuses on developing a foundation for the sport performance. This is where the athlete trains those systems that are slow to change, for example the aerobic energy systems. Long term changes, such as increasing muscle mass and strength would also be targeted in this phase. Training is aimed primarily at overall fitness. Athletes in more technical sports would also use this phase to work on significant technique changes or to tune new equipment. Volume/load would be increasing throughout.

Specific Preparation:

Is a continuation of the preparation phase, but signals a transition into more sport specific training. For example, a cross-country skier who was mostly running and biking in the General Preparation phase, would begin to include more and more roller skiing into the training program during this phase. Also during this phase, the athlete would begin to work on systems that train more easily than those targeted in Gen. Prep. For example anaerobic energy systems, speed and power. Volume/load would be increasing throughout, with peak volume (hr./week) higher than in General Preparation.

Pre-competition:

This is the phase where the athlete prepares specifically for competition. The peak volume (hr./week) in this phase may be less than in the previous phase, or it maybe more depending on the sport type, training history and the length of the Competition Phase. Generally, if the volume is less, the intensity of training will be increased. A good rule of thumb is to try to keep the fatigue level constant as the volume goes down and intensity goes up. Macro cycles will be shorter, tending to 3-1, 2-1 and sometimes 1-1.

Competition:

In order to perform well, the athlete should be relatively rested. To accomplish this, the total volume and the fatigue levels are reduced significantly in this phase. Peak volume may be reduced to 50% of the highest previous peak volume. In sports where the competition season is relatively long, the early races will be treated as training races. Racing effort is counted in the training load. Between races, training will focus on exercises and drills that keep the athlete tuned up for racing. Significant effort will be put into recovery activities. The slope of the volume curve may be flat, with many 1-1 or 2-1 micro cycles, matched to the competition schedule.

Taper:

This phase is primarily designed to lower the accumulated fatigue level to as low a value as possible, while optimizing the race-readiness of the athlete. Volume is gradually lowered across the phase while training focuses on short, intense training efforts followed by mental and physical recovery activities. Taper length depends on the sport and on training age. Generally speaking, the older the athlete, the longer the taper; young children and teens have relatively little endurance, but recover quickly. Another rule of thumb is, the shorter the event, the shorter the taper needed, probably reflecting the different residual fatigue levels experienced, for example, by sprinters and marathon runners. A two-week taper phase would use a 1-1 macro cycle, with a decreasing volume. Volume would be about 25-30% of peak volume.

Peak:

This is the peak performance time. It may be only one competition lasting two days, or it maybe a week or more of play-downs leading to a final competition. Emphasis is on mental preparation, performance and recovery. Fatigue levels may go well above normal competition levels by the end of a peak period if recovery is neglected.

Relax:

This is a de-tuning phase, in which the training load and it's intensity is gradually lowered from the levels experienced in the competition phase. The volume of training at the peak of this phase may be higher than in the competition phase, but the intensity will be lowered and the focus will be on recovery. Volume decreases across the phase, which is generally only one macro cycle.

Off-season:

Strictly speaking, this is not a training phase, it is a stage in the year devoted to recovery and regeneration, particularly mental recovery. Rifle shooters put away their rifles and go fishing, hockey players get out their golf clubs and go walking, cross-country skiers go hiking, etc. It is also the time to take care of chronic and repetitive strain injuries. No particular volume constraints, although activity should not drop off suddenly, or fall too far below the beginning levels anticipated for the first macro cycle of the next general preparation phase.

Macro Cycles:

Macro cycles are subdivisions of Phases. Each Phase is subdivided into one or more macro cycles. Macro cycles are usually from two to five weeks long. Each week is a [micro cycle](#). A two-week macro cycle would contain two micro cycles. A five-week macro cycle would have five micro cycles. The way you divide up the weeks in a Phase depends on the number of weeks in the phase and its purpose: loading, maintaining, competition, taper, unloading, etc.

Longer macro cycles are usually found in loading-phases. As a consequence, macro cycles are rarely longer than five weeks, because four to five weeks of increasing volume of training without a rest can lead to injury and over training and certainly lead to debilitating residual fatigue levels.

Preparation phases are usually more than five weeks, sometimes longer than ten. A ten week phase could be divided into three macro cycles: 4, 4, 2, or two macro cycles: 5, 5. One would normally avoid a 3, 3, 3, 1 pattern because of the single week at the end [because it would follow a recovery week and precede a low week in the next macro cycle, leading to three low weeks in a row (see below)].

Preparation phases are normally loading phases, i.e. the volume increases over the duration of the phase. Working on the principle of "load and recover", loading macro cycles are usually divided into a loading period, followed by a rest period. For example, a five-week macro cycle could be divided 4-1, i.e. four loading weeks, followed by a lower volume recovery week.

Here are some examples that are pre-coded in YPI Planner:



1-1: High followed by low. Useful in competition phase, especially where athletes compete on weekends. A repeated pattern of 1-1 cycles gives a sequence of load and taper weeks [micro cycles]. The 1-1 macro cycle is frequently used in taper phases for unloading. Also used to include a special training block in a phase.



2-1: Two loading weeks, followed by a recovery week. Useful in phases where intensity is high, requiring more frequent rest and recovery.



3-1: Three loading weeks, followed by a recovery week. A utility macro cycle, most often used in preparatory phases.



4-1: Four loading weeks, followed by a recovery week. Used mainly in endurance sports in preparatory phases where high volumes of low intensity work are required for aerobic training.



Custom: The custom macro cycle option can be used to generate any sequence of micro cycles [weeks] that are required within a macro cycle. For example, a five week macro cycle could be designed as: two-up, one-down, one-up, one-down, if so desired. The custom macro cycle function allows the YPI user to override the phase's loading factor and/or calculated volumes, and set the micro cycle volume(s) to any desired value. Most useful in competition phases.

1-0: Used for one-week phases, e.g. a Taper or Peak phase. Automatically assigned a one week macro cycle and a single micro cycle by YPI.

In YPI, a phase can be loading, unloading or maintenance. If the workload is increasing, then YPI increases the volume of training in each successive macro cycle. If the volume is decreasing, YPI decreases the work volume in successive macro cycles. For maintenance phases, the amount of work per macro cycle is pro-rated to give a flat volume curve.

Within each macro cycle of loading and maintaining phases, the chosen loading pattern is followed, e.g. a 2-1 macro cycle in a maintenance phase would contain two loading plus one recovery micro cycles. In an unloading phase, the sequence is reversed, giving a pattern of micro cycles with decreasing volumes within the macro cycle: one high followed by two low, providing a gradual taper in volume.

Micro Cycles:

Micro cycles are sub-parts of macro cycles. Generally seven days long (one week for convenience) micro cycles can be longer or shorter, but are rarely longer than two weeks. Unlike macro cycles, which have a distinct load - recovery pattern, there is no generally agreed model for how to vary volume or intensity within a single micro cycle.

There are some generally applicable rules of thumb:

- Follow a heavy-volume day with a lighter volume day.
- Follow an overload activity with recovery activity.
- Avoid training that stresses the same energy system(s) on successive days.
- Allow sufficient time for recovery between workouts.
- Approximately 50% of training time should be recovery activity.
- Put one rest day in every micro cycle.

These generalizations are derived from high performance situations where athletes are training year round and often seven days a week. They must of course be modified for younger athletes, recreational and masters athletes, fitness exercisers, etc. to allow for their different physiology, ambitions, practice times, etc.

To make micro cycle planning easier, YPI Planner provides a number of pre-calculated micro cycle patterns. When the user clicks on one of these buttons, the program calculates the time per day for each day of the micro cycle, based on the pattern chosen and the underlying loading goal of the Phase. Once calculated, the pattern can be customized and the total time for that micro cycle adjusted.

Some example pre-programmed patterns from YPI are:



Low - high, no days off. Sometimes used in severe overload situations.



High - low, Friday off. Typical for athletes who only have lots of time to train on weekends.



Low - high, Sunday off. This pattern gives both the athlete and the coach a day off on the weekend.



Race week/Pre-race week: Could be a race week for short duration events. Could be used in the last week of a taper phase in endurance sports, with races scheduled for the week afterwards.



Mid-week rest: Used for high intensity low volume micro cycles, for example, just before a taper - peak sequence.

If you have followed the process to this point, the calculations will have provided you with a plan that shows how much volume you should plan to do in on a particular day in a particular week during the year.

Daily Training Tasks:

This is the lowest level of the plan - what to do today. This is the area in which it is most difficult to be prescriptive, either in theory, or particularly in software. This is the point where the training volume calculations meet the purposes of the training plan, the specifics of a particular sport, together with the capabilities and training history of the trainee.

The training literature yields only a few generalizations:

- Follow an intense practice session with a less intense session.
- Follow an overload activity with a recovery activity.
- Allow sufficient time for recovery between workouts.
- Avoid training that stresses the same energy system(s) on successive days.
- Avoid training that stresses the same mental system(s) on successive days.
- Approximately 50% of training time should be recovery activity.

- Avoid dehydration. If not, re-hydrate as soon as possible.
- Eat sufficient calories in a balanced diet.

The general thrust of the plan is outlined when you think about Emphasis (see above) and Intensity (see above). In the YPI Diary, where detailed daily planning takes place, this issue of training emphasis is made concrete on a weekly or micro cycle basis.

In YPI, the user fills out an Intensity table that lists, for each phase, the proportion of training that should [ideally] be spent on each aspect: Mental, Technical, Tactical and Physical training. Physical training is further sub-divided into training intensities based on heart rate zones: Z1, Z2, Z3, Z4, Z5 and Strength, expressed as a percentage of the time available.

YPI Diary uses these percentages to calculate the minutes per week that should be spent on each aspect of training. These are the ideal, or target amounts. When you fill out the planning part of the Diary, adding training activities to specific time slots for each day, YPI keeps a running total for each aspect on-screen. The user can compare the target volumes with the plan-to-date as training tasks are added to the week. It is up to the user to distribute the allocation(s) over the training week (micro cycle) using the general guidelines given above. The user-allocated training tasks are not constrained