How do popular workouts actually work?

With the rise in usage of online platforms by more and more “self-coached” cyclists, I thought it would be useful to describe what the most popular workouts are designed to achieve, and when you should use them.

The online platforms offer a smorgasbord of workouts to choose from, and some include training programs that I suggest you understand fully what they are trying to achieve, otherwise it could lead to disappointment or even injury if not used appropriately.

It is important to be informed about how to use these tools for your own personal training. Each of us is unique and you will need to train according to your own personal needs and importantly, the needs of the events you are planning on riding.

A generic fixed training plan will help up to a point. If you are not very fit or haven’t trained before, then, frankly, doing anything at all will help.

Training, especially for a coach or self-coached athlete is a process of coming up with a plan that will optimise the time spent on training, so that the individual will be the best they possibly can be for their chosen event, given the usually limited time available to train.

If you have been riding and/or racing for a couple of years, a generic plan likely won’t get you to be the best “you” for your event, therefore you will need to understand what your own personal limitations are for the given event and then be able to consider how to use the available workouts to achieve your goals and be the best you can be.

This article looks to explain what the popular types of workout are designed to achieve, so that you will know how and when to use them.

Understanding What You Need

Cycling performance relies on a few elements of your physiology.

- Producing energy for your muscles to keep contracting and producing the power needed for your event. This can be produced in several ways, some are very efficient but slow to produce energy, and some are very fast but inefficient and in very limited supply. Some events will favour the development of one energy system over others. Consider the energy demands of a 100-mile sportive vs a 1k track sprint event. It is vital to understand this in-order to come up with a plan for your training, knowing what will develop the energy systems that are of primary importance for your chosen events.
- Delivering Oxygen and Nutrients to your working muscles at a fast enough rate to keep up with event demands.

- Processing “waste” products from the muscle activation and energy production process, e.g. CO2, H2O (sweat), Heat, Lactic Acid.
- Fatigue resistance in your muscles to keep riding until the end of your event.
- Neurological - signals from your brain to your muscle groups, so that they contract in an efficient and economical manner. This motor-control is a learned skill. This is the primary reason why we see vast improvements in weight-lifting in the first few weeks of training – your brain develops “neural pathways” to engage/fire the muscle groups in an improved manner. Hypertrophy (muscle growth) is not the primary reason for improved performance at the beginning of weight training.

Limitations of Cycling Performance

The two main limiters to performance for endurance cyclists are VO2 Max and Lactate Threshold Power. For shorter event cyclists it will likely be the high power generation via anaerobic and phosphoric metabolism (mostly outside the scope of this article.)

VO2 Max

Apart from a few short events such as 1k track sprint, and short hill-climbs, every other kind of cycling is primarily, like 95%+ an “aerobic” undertaking, meaning that it relies on and is limited by the capacity of the Aerobic energy system. In other words, it is limited by the amount of oxygen you can deliver to your working muscles. The scientific term you likely will have heard for this is VO2 max.

The aerobic energy system is very efficient and will produce large amounts of energy to fire your muscles by metabolising fat with oxygen.

Lactate Threshold

When you start to increase the pace to somewhere around 25 TT pace (“threshold pace”), you will be at the limit of what you can produce with fat+oxygen (aerobic) metabolism, so your muscles will start to use an additional, you could say, emergency, fuel source – Glucose aka Glycogen. The side effect of using Glycogen for fuel is that it throws off Lactic Acid (actually, it’s something called Pyruvate, but let’s not complicate things) as a by-product. Your aerobic system is very adaptable, and it will use Lactic Acid as an energy source when it is present in the muscle.

However, there is a limit to the rate at which the aerobic system can consume the lactic acid, after which point, the lactic acid will start to build up and this is when you will feel burning in the legs. This point is generally known by cyclists as the Anaerobic Threshold, or Lactate Threshold. If you keep riding at this intensity or higher, the lactic acid will continue to build up, and the acidic nature of this will eventually start to inhibit the ability for your muscles to contract, and you be forced to slow down to a very minimal pace.

Fractional Utilisation

Elite cyclists will have trained their lactate threshold to be so good that it is very close to their VO2 max (over 85%). The percentage of Vo2 Max where the Lactate Threshold occurs in an athlete is called Fractional Utilisation. A high Fractional Utilisation in addition to a high Vo2 Max, is highly desirable for most forms of endurance cycling. It is the holy grail for a Time Trialist especially. Hower for short-duration events, such track sprinting, those athletes will instead want to develop their anaerobic power and endurance, which will cause the fractional utilisation to fall as a larger proportion of the aerobic system will be swamped, dealing with lactic acid clearance.

Trainability

All of the elements we just discussed can be improved with training. E.g. To improve delivery of larger amounts of oxygen to the muscles, you will need to train to increase the heart capacity/stroke volume (more oxygen per stroke) and create new blood vessels/capillaries to deliver the blood containing oxygen and nutrients (fats) to muscles and also to take the waste by-products back out again.

Once oxygen is delivered it needs to be "metabolised". Therefore, you will need to train your muscles to develop an improved ability to process fat with oxygen, improve lactate processing (lactic buffering), and the ability to clear lactate out of the working to other muscles with capacity to process the lactic acid (lactic clearance.)

Specific workouts are designed to exercise a particular aspect of performance to stimulate the body to make improvements in that ability. Let's discuss what the most commonly used workouts are designed to achieve.

Discussion of the Most Popular Workouts

Let's take a look at several popular workouts and discuss how you should ride them, and what they are designed to accomplish as part of a well-thought out training plan.

Endurance Ride

Almost all cyclists will do a "long" ride every week. It's a great pleasure to get out for ride every week, but what are these types of rides actually achieving?

What does it do?

Develops Muscular Endurance, Aerobic Capacity, Threshold Power, Fractional Utilization of Vo2 Max, Improves ability to use Fat as a fuel source (if ridden with discipline), Cycling Economy and Efficiency.

The Good, Bad and Ugly

These are a low-stress, easy to recover from, and are surefire way to improve Aerobic Capacity, Threshold Power and Fatigue Resistance (Endurance.)

However, it is a very slow process. You will need to undertake many months of riding to accumulate the benefits. To keep improving, you will need to increase training volume, by riding for longer and longer durations and more rides per week.

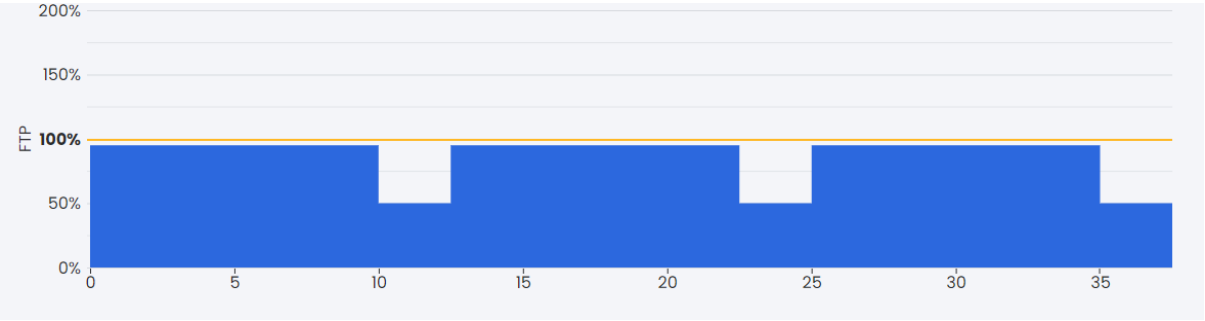
How to do it?

This involves riding at gentle "conversation pace", HR Zone 2 (5 or 6 zone model), RPE (Rating of Perceived Exertion) of around 3/10 for extended periods, e.g. 2 hours+

It is important to exercise good discipline to stay in zone because, generating lactic acid from harder efforts will divert the aerobic system to consuming lactate for a period of time, possibly 30 minutes. This is time that will not be developing your fat-burning abilities, which is the most important thing to develop for almost every form of endurance cycling.

Don't be afraid to change to the small ring and keep your HR and Ego under control! If another cyclist overtakes you, they likely don't have your discipline and self-control!

Steady State Intervals



Riding at a moderate power level for an extended period of time, at or below the Lactate Threshold.

What does it do?

These workouts build endurance when working at a “moderate” power level for an extended period of time, such as for mountain climbs, and Time Trialling.

These will also develop threshold power to a degree, but there are more effective, less fatiguing workouts for developing power at threshold.

The Good, Bad and Ugly

Good for developing the muscular endurance and mental toughness (not to be under-estimated).

These require a lot of will-power to perform, and they build large amounts of physical and mental fatigue, after which good amount of time spent on recovery is required to avoid overtraining and thus preserving the quality of subsequent workouts.

Sweet-Spot (SST) intervals, often seen as “best of both worlds” for time-crunched cyclists can rack up a lot of fatigue very quickly for diminishing returns. Be very careful not to overdo the amount of time spent doing SST intervals. If not used sensibly, they can quickly become “worst of all worlds”, i.e. create lots of fatigue for not much additional gain.

How to do it?

Steady-state intervals usually involve an interval length of around 10-20 minutes each and a total time in zone of 30-60 minutes. Usually ridden at a steady pace and constant power, either as a Tempo (HR or power Zone 3), Sweet-Spot (between Zone 3 and Zone 4, 85-95% FTP), Threshold (Upper limit of Zone 4, near or at the Lactate Threshold.) Recovery between intervals is usually 25-50% of the duration of the interval.

For advanced riders, if you want to be sadistic, ride a single 60-minute interval at threshold, known as “the hour of power” – use very sparingly as it will build fatigue very quickly. Of course those that ride 25-mile TTs regularly will be familiar with this one!

Over/Under Intervals

Blocks of effort alternating between riding at a power above threshold to build lactic acid, and just below threshold to recover whilst still working quite hard.

What does it do?

These develop Lactic Acid Buffering & Clearance, Anaerobic Endurance, Threshold Power, Vo2 Max, Fractional Utilisation of VO2 Max, Muscular Endurance in one workout!

The “over” intervals should be hard enough and long enough to cause a build-up of lactic acid, felt as soreness in the legs. The under intervals are used to clear the lactic acid built up in the over interval, they are easier but are not ridden at “recovery” intensity, they are usually done just below threshold.

Because the HR will rise to a fairly high level by the end of each block, it will cause improvements to Heart Stroke volume and Vo2 Max.

The Good, Bad and Ugly

These are very effective and will lift fitness quickly. They are useful if you need to get fit quickly for an event. If ever there was a “secret sauce” workout, this is it.

They are quite hard to get through in the moment (RPE 7.5-8/10) and will take some mental strength to get through, but you can recover from these fairly quickly. Not recommended for beginners or too early in the training phases. i.e. not in early base period.

How to do it?

2-4 blocks of 10-15 minutes alternating between power “over” FTP and power slightly “under” FTP.

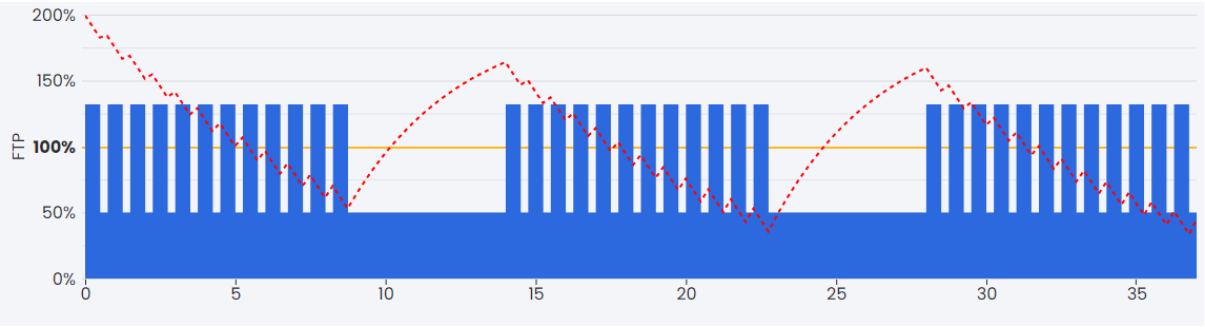
Examples;

Over: 1-minute at 106% FTP, Under: 1-minute at 90% FTP – a progression of this is to go to 2-minutes “over”, 1-minute “under” or even 30-seconds under.

After a period of time, you can progress to the more advanced “Significantly Over”;

“Over” for 45 seconds at 115-125% FTP, Under: 15 seconds at 80-85% FTP

Microburst Intervals



Blocks of alternating periods of short, sharp effort, power zone 5-6, followed by similarly short recovery intervals, repeated many times over. RPE 7.5-8/10.

What does it do?

These develop Aerobic Capacity/VO2 Max, Lactic Acid Buffering & Clearance, Threshold Power and Anaerobic Endurance

The Good, Bad and Ugly

Very effective and quick to recover from.

Needs a bit of trial-and-error as it can be difficult to judge the intensity, especially of the recovery intervals to maintain MH > 80% Max HR. There is a lot of variability of ability across individuals, so there is no "one size fits all" with these.

How to do it?

2-4 blocks of 9-15 minutes alternating between high power and easy(ish) recovery.

The "on" intervals can be from 10-seconds to 40-seconds with similar recoveries. Classic examples are;

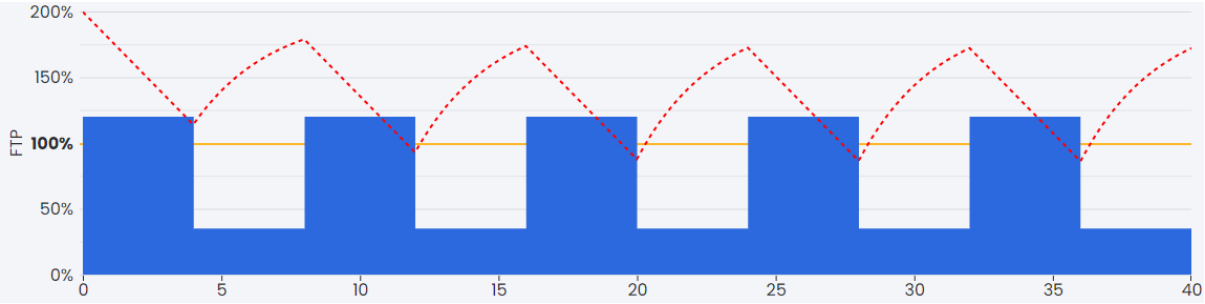
30/30 - 30-seconds "on", 30-seconds "off", 30/15, 40/20, 20/10 – aka "Tabata Intervals".

Usually the "on" interval is done at around 140% FTP for Tabata intervals as this is what the scientific research that led to the development of these intervals, found to be the most effective.

You should start to feel the lactic acid building through each "on" interval after the first couple of intervals and your HR should be rising to within 80%+ of Max HR by the end of the block. Intensity is usually set in the range of 106%-130% FTP.

The intensity of the recoveries should not allow the HR to fall too much, so that the next "on" interval takes the HR high again. It is important to know that the recoveries should not feel easy as per other interval recoveries. They are not an "off" recovery interval as such. The idea is to improve the ability to recover when still riding quite hard. Start at 50% of FTP for the "off" intervals. This can be tweaked to meet event demands. For example CX and Crits have many surges and repeated efforts, so it is important to develop the ability to recover quickly whilst still riding hard.

VO2 Max Intervals



Block of intervals in power zone 5, (RPE 8) lasting between 3-8 minutes each.

What does it do?

These develop Aerobic Capacity/VO2 Max, Lactic Acid Buffering & Clearance, Anaerobic Endurance, Threshold Power.

These work by keeping HR at 80%+ of Max for as long as possible, causing large volume of blood to enter the left ventricle of the heart, causing it to enlarge, thus increasing stroke volume and the volume of blood that can be delivered with each heartbeat.

Prominent sports scientist Professor Stephen Seiler has made extensive studies in this area and has found that 4-minute and 8-minute intervals cause the best increase in VO2 max for well-trained athletes.

The Good, Bad and Ugly

Ideally HR should kept >80-90% HR Max for as long as possible during the interval. It may take a couple of intervals before this happens. Because HR lags behind power, it can be hard to judge the intensity level using HR. With a bit of trial and error, you will find a power level that will get your HR into the correct range eventually.

A variation is to have an initial interval at the start of a block that is much higher power than the remaining intervals to accelerate the rise of your HR into HR zone 5. The remaining power should maintain the HR level.

A slightly more advanced alternative is the “Billat” Interval. An initial big effort to raise HR to >80-90% Max, then the rider maintains and adjusts the effort/power level to keep HR in the target area.

How to do it?

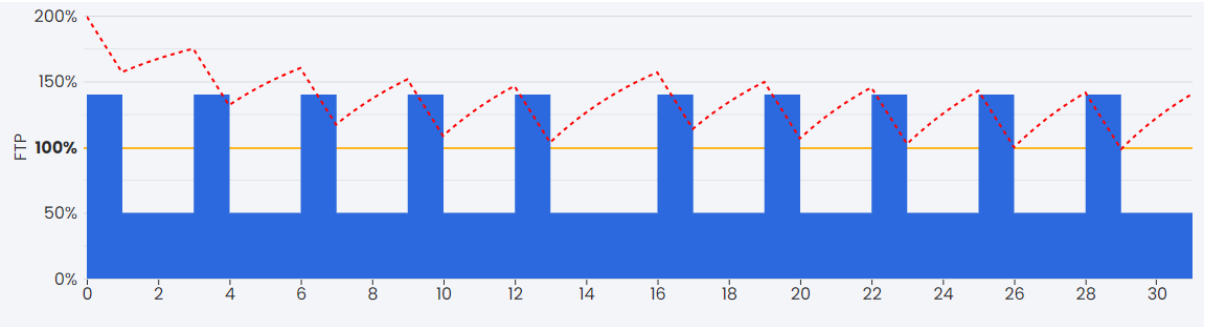
3-8 blocks of 4-8 minutes in power zone 5 to maintain HR >90% max HR, especially in the latter intervals. Recover for the same duration as the intervals with easy spinning.

e.g. 8x4-minutes @ 110-120% FTP or 4x8-minutes at 103-110%

Further variations include:

1-5-minute “Pyramids” and “Russian Steps”, although these will give an element of lactic acid buffering and clearing benefits in addition to the VO2 max gains. There is also an element of anaerobic endurance benefit. These are great for CX and Crit racers that need to train to do repeated hard efforts with short recoveries between.

Anaerobic Endurance Intervals



Intervals around 1-3 minutes in duration in power zone 6, although variations in duration and intensity can vary 30s-3-mins @ zone 5-6. It is not practical to use HR for determining the intensity of these intervals.

What does it do?

Use these to develop the ability to use glycogen for high power delivery for extended periods – anaerobic capacity and anaerobic endurance.

The Good, Bad and Ugly

This is a very specialist workout, most useful for hill-climbers, CX and Crit Racers. They can be detrimental to threshold power because of the additional lactic production associated with glycogen training that will reduce your “anaerobic threshold” power.

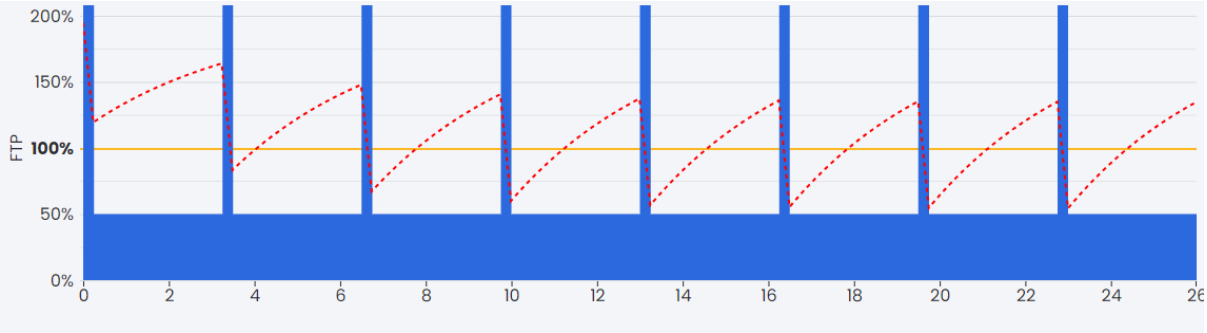
Not to be undertaken lightly. Suggested use after extensive pre-season training in the lead to a season start or within a few weeks of an A-priority race.

How to do it?

There is a lot of variation on how to do these. Depending on the demands of your event, you can set the intervals up to be between 30s and 3 minutes. Shorter duration would generally go hand-in-hand with higher intensity. Generally speaking, these should be ridden in power zone 5-6 (Vo2 Max to Anaerobic Capacity).

Due to the short duration and high intensity of these intervals, it is not practical to use HR to set the intensity level.

Sprint Intervals



Ride at maximum effort/power for short bursts, 6-20 seconds.

What does it do?

Develops the Phospo-Creatine (PC) energy system, which delivers energy very quickly, but only has enough capacity for 10-15 seconds at maximum effort.

The Good, Bad and Ugly

Not strictly of practical use to most amateur cyclists, but it is useful for developing all-round ability, as well as muscle and bone density amongst Senior/Veteran athletes, so I generally recommend doing some sprints to everyone. Besides, it is fun doing them! The cost metabolically is very low, so it doesn't take much to recover from them.

However, do not attempt to do sprints too early in the training cycle. Ensure you are well warmed up as it is possible to tare muscles and ligaments if not ready and prepared.

How to do it?

These involve riding at 100% maximum power from between 6-20 seconds, usually up a slight incline. Allow 2-3 minutes recovery between efforts.

These are very versatile. Depending on what you want to develop you can adapt these to suit. Here are a few suggestions.

If you ride at maximum for 6 seconds or less, then you should have almost zero recovery cost because you will only be using the free-floating ATP and will not need to use any other energy systems. For this reason, these are great to add to your endurance ride, especially during a recovery week.

To develop your absolute peak power output, ride at full power, starting from your usual cadence, up to a very high cadence for 10-15 seconds. Chose an appropriate gear so that you don't end up spinning without gaining speed.

To develop sprint endurance, ride at maximum power and cadence and hang-on for 15-20 seconds.

For development of the ability to repeat sprints (CX, Crits), shorten the recovery as you see fit, to say 15-30 seconds.

Final Thoughts

I hope this is a useful guide to help you plan your training according to your cycling needs. Hopefully it gives some insight into how they affect your body and cause improvements or detriment (anaerobic capacity vs FTP.)

It should now be clear why it is important to understand the physiological demands of your chosen event, so that you can then choose the **relevant** training plan and workouts in order to develop those elements.

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