

INTENSITY

How to Plan & Gauge Your Most Beneficial Training Efforts

By John Hughes

Want to have more power and drop your buddies on the weekend ride? Or build endurance for a tour later in the summer or for a fall century? Or have some snap in your legs during your commute so you have more energy for the family when you get home? Or maintain your fitness as birthday after birthday rolls around?

Intensity is the key!

For the Bluegrass Festival in Telluride, Colorado, we camped on the high school football field. We wanted comfort so we made 20 trips carrying all our gear to midfield to set up. Afterwards to load out, I hired 3 high school freshmen that were earning money for basketball camp. They each easily lifted one of the 60-lb. (27-kg) sandbags we'd used to anchor the canopy against the wind. One frosh put a sandbag on his shoulder and grabbed a heavy water cooler, too.

“You da man!” I said.

“Squats!” he replied.

At age 16 he'd learned that intensity pays off.

The difference between top bike racers and we mortals is that they *vary* the intensity while we ride at about the same level of effort most of the time. Changing the intensity of workouts is *the* fastest way to improve.

Eddy Merckx famously said “Ride more!” when asked how to get better. Don't have enough time to ride more? Ride smart! By varying the intensity.

As we age—I'm 61 and know—cardiovascular capacity, endurance, strength and power all decline. However, by continuing intense workouts on the bike and in the gym we can significantly slow the *rate* of decline in these key performance factors:

- **Muscle power**—a muscle is composed of many fibers. The more intensely we exercise when riding, lifting weights, etc. the more fibers we activate and keep strong.
- **Muscle oxidative capacity**—to deliver power, muscles need oxygen to burn fuel. Most of the decline of oxidative capacity that occurs with aging is related to decreased fitness.

- **Endurance**—endurance tends to be limited by the perception of fatigue, which results from the accumulation of metabolic byproducts in the muscles. Intense workouts improve the body’s ability to process these byproducts.
- **Body weight**—as we age we tend to put on weight. It’s slow—a pound or 2 a year—but it adds up. Intense exercise is the most efficient way to control weight. The harder you work out, the more calories you burn per minute. Further, after an intense session your metabolism stays revved up for a while and burns more calories.
- **Lung elasticity**—lungs slowly stiffen as we age, making it more difficult to suck in large amounts of air for big efforts. If we continue to exercise and breathe hard, our lungs stay more supple.
- **Stroke volume**—the heart is a muscle. When we go hard it expands more fully and pumps more blood per stroke. But a heart gradually loses elasticity and stroke volume—unless we continue to exercise intensely through the years.

Caution! Before beginning any exercise program or significantly changing your current program, you should inform your doctor and get his or her permission.

Exercising With Intensity

Imagine you are riding a gentle climb so easily that you are barely working. The road gets a little steeper and you need a bit more power to maintain speed, but you’re still whistling or chatting with your friends. The road continues to get steeper. Now you’re talking in short sentences, but you can still get all the oxygen you need. You are riding *aerobically* and using your *aerobic* energy system.

The hill gets steeper and you stop talking. You can’t get enough oxygen so your *anaerobic* energy system kicks in. Your aerobic metabolism continues to produce power and your anaerobic system provides the additional energy you need to keep climbing. As the grade continues increasing, your anaerobic energy system produces a greater and greater proportion of your total energy.

- **Aerobic metabolism:** metabolizing fat and glycogen (muscle fuel derived from carbohydrates) with sufficient oxygen. At low intensities you burn mostly fat. As you ride harder the proportion of glycogen metabolized increases.
- **Anaerobic metabolism:** metabolizing glycogen without enough oxygen. This produces lactate for fuel and lactic acid as the byproduct. Scientists call the area where significant lactate starts to accumulate in the blood the *lactate threshold* (LT). You know you are reaching the threshold when deep breathing turns to panting.

Training at different intensities has 3 very desirable effects:

- **Fat burns more efficiently.** If you ride at an almost too-easy pace you're training your body to use more fat for fuel. The amount of glycogen a body can store is limited—just enough for 2-3 hours of hard riding—but we all carry enough fat to fuel much longer, less-intense rides.
- **More power before anaerobic metabolism kicks in.** Training with proper intensity enables you to ride farther up a steepening hill using just aerobic energy before tapping into the anaerobic system.
- **More power on all parts of a climb.** By training toward the steep top of the hill you'll increase the power available on the easy and moderate sections.

If you are new to exercise, training will allow a higher heart rate before the lactate threshold is reached, a good thing. If you are already fit, don't expect much change, if any, in your LT.

Fitness and Goals

The ability to ride at different intensities helps you succeed in your cycling goals.

- For general fitness, train both the aerobic and anaerobic systems. Each promotes cardiovascular and muscle fitness differently.
- Club rides of several hours use mostly the aerobic system for endurance, even on brisk rides, and also draw on the anaerobic system for sharp climbs, sprints, chases, etc.
- Centuries and touring rely even more on aerobic metabolism, as does randonneuring. The most efficient long-term pace is when you stay in your aerobic zone rather than going anaerobic at any point.
- Racing uses aerobic energy but, of course, fires up the anaerobic system more often. A very fit racer can stay at LT for a 1-hour time trial. Road races are a mix of aerobic and anaerobic riding.
- Commuting and casual recreational riding are mostly aerobic. Some intense riding can increase power so you have less fatigue at moderate paces.

Gauging Exertion

You ride to *have fun*. You probably also ride to improve your fitness and performance. To get better you need to train the different metabolic systems. This requires a way of assessing how hard your body is working. Here are 3 methods:

- **Perceived exertion** is the simplest, requiring no equipment. It means learning to listen to your body.
- A **heart monitor** tells how fast your heart is beating. However, heart rate is determined not only by how hard your muscles are working but also by how well you slept, if you are excited or stressed, how hot it is, if you are dehydrated and other factors.
- A **power meter** measures the wattage you are producing at any given instant. It's the most accurate method, but it requires the most specialized equipment and learning how to interpret complicated data (which is beyond the scope of this eArticle).

Once learned, the rate of perceived exertion (RPE) has several advantages over a heart monitor (HRM). RPE is:

- Simple. You don't have to interpret numbers and remember training zones.
- More accurate. You are gauging how hard your muscles are working rather than how fast your heart is beating, which can be influenced by factors other than exertion.
- More reliable. Feedback is not subject to equipment blips or failures.
- Safer and more fun. You can look at the road and scenery instead of figures on a gadget.

Human power production is a continuum. For training purposes we can divide it into different sections or zones. Gunnar Borg originally developed a rating system from 6 to 20 to gauge perceived exertion and then simplified it to a 1-10 scale (0 is no exertion).

I have my own way of gauging intensity specifically for cyclists, and I give the Borg equivalents. Because power production is a continuum, the different paces and RPEs blend into each other.

- **Digestion pace:** This is how you'd ride after a big breakfast or lunch, an RPE of 1-2. It's the pace for active recovery rides.
- **Scenery pace:** You can chat in full sentences about the scenery or anything else, an RPE of 2-3. This pace builds endurance and trains the aerobic system to burn fat more efficiently. Even lean riders have enough fat to help fuel a longer ride, so training this system is important.
- **Hill climbing and headwind pace:** You're on a long, steady grade or riding into the wind. You're working hard enough so that you can't whistle but can talk in short phrases, an RPE of 3-4. At this pace you're improving cruising speed and training your aerobic system to burn glycogen.

- **Sub-barf pace:** Making a hard, sustained effort, an RPE of 4. This is the pace for a 20-40 km time trial or racing up a hill. You're riding anaerobically to train the lactate system to burn glycogen *without* enough oxygen—we all know that feeling.
- **Eyeballs-out pace:** This is the classic hammering pace, maximum effort for just a few minutes with eyes bugging out, an RPE of 5 or more.

How to gauge intensity also depends on who you are. Some people like data and keep extensive training logs, some people don't care for numbers. If data are useful to you then you may want to use a heart monitor.

Maximum heart rate is determined by genetics and age, not your physical condition. Defining exercise intensities based on max heart rate would be like telling you what size shoes to wear given your age.

Similarly, lactate threshold is influenced by your parents and age. However, LT is also a function of how fit you are, so the various heart rate training zones are defined relative to your LT.

Finding Your Lactate Threshold

To gauge intensity with a heart monitor you need to estimate your lactate threshold. Here's how:

Ride a time trial of 25-35 minutes. The TT can be an out and back, a loop with no stops or a hill climb. Warm up thoroughly. Then start your HRM and race the TT. Note your average heart rate, time and average speed.

If you do this as a personal TT your average heart rate will be very close to your lactate threshold. If you ride in an organized time trial, the competition will make you go a little harder. Then your average heart rate will be about 103% of your LT.

Whether you use RPE or an HRM to gauge intensity, it's a good idea to repeat a baseline time trial every 4-6 weeks on the same course under the same conditions. If your time is dropping then your power is improving. If you are using RPE, your power will increase and your LT may also increase at the same perceived exertion. If you are using an HRM your average heart rate for the TT may go up, in which case you should redefine your heart rate zones.

RPE and Heart Rate

As noted above, there aren't discrete jumps in energy production. We just work a little harder and one level of intensity becomes the next one. Thus, the heart rate percentages like the RPE numbers blend into one another.

Purpose	Workout	Hughes RPE	Borg RPE	Heart Rate
Aid recovery	Recovery	Digestion pace	1-2	<75% LT
Build endurance	Endurance	Scenery pace	2-3	75-88% LT
Increase cruising speed	Tempo	Headwind pace	3-4	88-95% LT
Increase power	Sub-LT	Sub-barf pace	4	95-100% LT
Increase tolerance of lactic acid	Supra-LT	Eyeballs-out pace	5+	>100 LT

Intensity Training Made Simple

Before we look at how to use the different levels of intensity, let's review briefly how training works. The concept of conditioning is simple whether you are exercising for fitness, racing or anything in between.

Overload => Stress => Recovery => Adaptation

For continued improvement there must be progressive overload. If we just do the same rides every week and don't stress our bodies any differently, we don't improve. So we need to increase one of these key factors at a time:

- How *much* we ride
- How *often* we ride
- How *intensely* we ride

Training includes *recovery* as well as progressive overload and stress. Our bodies adapt to stress during recovery, not during the overload itself. Let these 4 principles guide you:

- Increase just one type of overload at a time: volume, frequency or intensity.
- Mix hard, moderate, easy and off days each week.
- Progressively build your training for 3 or 4 weeks, then cut back for a recovery week before ramping up again.
- Every 2-3 months take a physical and mental break for a week. Do just a few hours of *easy* riding, hiking or playing catch with the kids.

As you add intensity to training you also need to train more responsibly. It's essential to give your body time to rest, recover and grow stronger.

Mix of Workouts

For training purposes we divide the cycling year into different seasons, each with a different purpose and different types of workouts. The mix of workouts is also influenced by your goals and the type of riding you enjoy.

As a guide, here's the approximate amount of time to spend each week in various activities in each period. Plan your training in terms of *time* rather than *distance* because how far you actually ride will depend on terrain, wind and other factors.

The upcoming percentages are ranges to accommodate different types of riding. If you enjoy social club rides, touring, centuries and/or commuting use the lower end of the ranges. If you like fast club rides and/or racing go with the higher figures.

Preseason. The purpose is to get used to riding again coming out of winter. If you've been moderately active, a month of preseason is enough. If you are coming off the couch, 2 months will be better. The vast majority of your effort (70-80%) should be at the *endurance* pace, which will improve stamina and efficiency, especially the ability to use fat for fuel. Other rides and activities should be at the *recovery* pace. The preseason is a great time to mix in other things you enjoy. Hike, swim, run, snowshoe, cross-country ski—get out and have fun while improving fitness.

Base Period. The purpose is to continue improving your endurance, capacity to transport oxygen, blood supply to muscles and ability to burn fat. This should be the longest of the periods so you build a solid base for the more intense training later. If you are a fitness or club rider, 2 months will do it. If you ride centuries or race, 3-4 months would be better. As a rule of thumb, this Base Period should be at least 50% longer than the following Build Period. If cycling is your main sport, most of your exercise should be on the bike. You're still building endurance so 60-80% of riding should be at a conversational pace. You can start adding intensity with some brisker *tempo* riding (10-20%) and continue to include recovery activities, which may be non-cycling.

Build Period. The purpose is to increase power while maintaining an endurance base. A month is sufficient to start getting the benefits; 6-8 weeks are better. Now it's time for a bit of *sub-LT* riding (10-15%) and continued *tempo* riding (10-20%) with most of the remainder at the *endurance* pace as well as some recovery activities. For the more intense rides the time includes warming up and cooling down.

Main Season. The purpose is to enjoy riding, maintain the fitness and power you've built, and reach your goals. Continue some of the intense types of riding that generated your improvement, although you don't need to do as much—unless *sub-LT* and *tempo* efforts come naturally in your favorite types of events.

During the Preseason and Base Period you can help your fitness with strength training. I recommend core exercises and stretching throughout the year.

Between each period include a very easy recovery week so you are ready for the next level.

Approximate Time / Week in each Type of Riding
(includes warm-up and cool-down)

Period	Purpose	Recovery Pace	Endurance Pace	Tempo Pace	Sub-LT Pace
Preseason	Get used to riding	20-30%	70-80%		
Base	Build endurance	10-20%	60-80%	10-20%	
Build	Increase power	10-20%	50-70%	10-20%	10-15%
Main season	Have fun, ride events & maintain fitness	10-20%	Main rides	5-15%	5-10%

Beware of Excess Stress

If you will be racing, include some *supra-LT* riding in the Build Period and Main Season to improve your tolerance for lactic acid and to increase your VO₂ max. But remember, a little of this very high intensity goes a long way. If you're not racing, I won't fault you for avoiding the pain

Heed the words of Neal Henderson, director of Sports Science at Colorado's Boulder Center for Sports Medicine and USA Cycling's Coach of the Year in 2009. In an interview with *VeloNews*, he said, "I try to seek the point of maximum adaptation to the minimum of training stress, rather than to try to achieve the greatest level of fatigue. Excessive fatigue does not guarantee improvements or adaptations."

In a talk, Henderson added that 75% of the athletes he sees overtrain (too much and/or too hard), 10% under-train and 15% get it right—usually pros, who are paid to race. When in doubt, err on the side of less volume and less intensity.

Examples for Incorporating Intensity

Here are 3 examples of how to mix the different intensities into an exercise week.

- **Health & fitness riding.** If you can exercise 3 hours a week, consider structuring the time this way:
 - 30 minutes of *endurance*-pace riding
 - 30 minutes of *recovery*-pace riding or easy activity
 - 60 minutes of more-intense riding—a mix of *tempo* and *sub-LT* paces—split over 2 or 3 days with about half the time for warm-up and cool-down
 - 60 minutes of core exercises and stretching split over 3 or 4 days

If you can add a 4th hour, do 45 minutes of strength training split over 2-3 days and increase the *endurance*-pace riding time. If you can add a 5th hour, do more stretching and *endurance*-pace riding.

- **Club riding.** If you like brisk weekend rides of several hours, consider the following weekly program after you've built a base with plenty of *endurance*-pace:
 - 2-4 hour (or longer) club ride
 - recovery activities totaling at least 90 minutes
 - midweek *tempo* ride of 60-90 minutes, including 20-30 minutes for warm-up and cool-down
 - midweek intensity ride of 45-75 minutes, including 20-30 minutes for warm-up and cool-down
 - 60 minutes of core exercises and stretching split over 3 or 4 days
- **Centuries and touring.** If you enjoy touring, centuries or longer endurance rides here's a sample week after you've laid your endurance base:
 - *endurance*-pace ride building up to 65-75% the duration of your event(s), e.g., a 4.5- to 5.25-hour ride if you're preparing for a 7-hour century
 - 2 or 3 recovery activities totaling at least 90 minutes
 - midweek *tempo* ride of 60-75 minutes, including 20-30 minutes for warm-up and cool-down

- midweek intensity ride of 45-60 minutes, including 20-30 minutes for warm-up and cool-down
- 60 minutes of core exercises and stretching split over 3 or 4 days

Types of Workouts

Some riders like structured workouts with timed periods of intensity and recovery. Others prefer unstructured workouts just mixing intense efforts with easy cruising.

Both approaches work! And you don't have to stick to just one or the other.

Unstructured Training

Endurance (conversational pace, RPE 2-3, 75-88% of LT). Endurance rides metabolize primarily fat with some glycogen and require lots of oxygen.

- **Club rides.** On longer rides with friends or your club, pay attention to your pacing and keep talking. Don't ride too hard or you'll lose the benefits of endurance training. Don't worry about time off the bike—stop for coffee, admire the views, enjoy the ride.
- **Commuting.** Arrange your schedule so you can ride to work and back several days a week. An ideal commute is a short *recovery*-paced ride in the morning—don't even break a sweat—and then an *endurance*-pace ride as long as 60 minutes on the way home.
- **Family outings.** If the family doesn't ride with you, arrange to meet a few hours away for a picnic or other excursion.

Tempo (headwinds/hills pace, RPE 3-4, 88-95% LT). Tempo rides metabolize glycogen with oxygen. These rides should begin with 10-15 minutes of warm-up, followed by tempo pace, which may include some recovery breaks, and end with 5-10 minutes of cool-down.

- **Rolling hills.** Ride up each hill breathing deeply but able to talk a bit. Recover on the way down.
- **Headwind.** Ride into the wind early and then enjoy the tailwind home. It's a great workout and good fun.
- **Brisk after-work ride.** Increase your average speed by 1-2 mph (1.5-3 km/h). Remember, you are riding more briskly, not time trialing.
- **Hustling.** Up the pace to get home before dark or approaching rain.
- **Paceline.** Take pulls in a brisk (not racing) paceline.

Sub-Lactate Threshold (sub-barf pace, RPE 4, 95-100% LT). Intensity rides metabolize lactate from glycogen without enough oxygen. As always, start with a warm-up and finish with a cool-down. To be most effective, a *sub-LT* effort should be 3 minutes or more.

- **Hammer hills.** Use the same course you use for *tempo*-pace rides, just go harder.
- **Race to the city.** Start several miles away and race to the city limit sign.
- **Escape & chase.** Send a rider down the road. Let a 1- or 2-minute gap open, then chase back into contact.
- **Fast group.** Riding with a group that's faster is a classic way to improve fitness.

Supra-Lactate Threshold (eyeballs-out pace, RPE 5 and up, >100% of LT). Because of their great intensity, these efforts have to be shorter, just a couple of minutes or less.

- **Hill accelerations.** Hammer short hills and go even harder toward the top.
- **Sprinting.** Flat out for city limit signs.
- **Dogs.** Outrunning a dog, the classic speed training from the movie "American Flyers."

Structured Training

Endurance (conversational pace, RPE 2-3, 75-88% of LT). Same type of riding as in unstructured training.

Tempo (headwinds/hills pace, RPE 3-4, 88-95% LT). Tempo efforts are long.

- **Intervals.** Start with 2 or 3 intervals of 8 minutes, with 4 minutes of recovery between each. Increase the number and/or duration of the intervals week by week, maintaining a 2:1 work:recovery pattern, until the work intervals total about 60 minutes.
- **Farm roads.** If your area has a grid of farm roads, ride briskly to the next road, then easily to the next intersection, then hard, etc. Or you can ride around a rectangle. Two miles hard, right turn and a mile easily, right turn and 2 miles hard, right turn and then easily back to the start. Or use mileage markers along a road.
- **Aerobic time trials.** After a month or so of *tempo*-pace rides, race a 60-minute *aerobic* time trial. Go steady and fast, but not so hard that you can't talk a bit.

- **Paceline pulls.** Take consistent long turns at the front of a paceline, say for 7 or 8 minutes.

Sub-Lactate Threshold (sub-barf pace, RPE 4, 95-100% LT). These efforts are more intense but shorter.

- **Intervals.** Start with 4-6 intervals of 3 minutes with a 2-minute recovery between each. As you progress, increase the duration while decreasing the number, for example, to 3x10 minutes with 4-minutes recovery.
- **Time trials.** Design a course that takes at least 20 minutes to ride, and challenge a friend to race you. Or compete in a club's weekly TT.
- **Hill climbs.** Time yourself on a local hill that takes at least 20 minutes to climb.
- **Hill repeats.** Start at a specific point and climb hard for a certain time, e.g., 5 minutes. Spin back down and recover for a couple of minutes. Attack the hill again and try to go a little farther. Start with 2 or 3 repeats. As you get stronger increase the number and/or distance.

Supra-Lactate Threshold (eyeballs-out pace, RPE 5 and up, >100% of LT). More intense yet, and even shorter.

- **Intervals.** Start with 2 or 3 intervals of 2-3 minutes with 2 minutes of recovery. Build to 3 or 4 intervals of 3-4 minutes.
- **Hill repeats.** It's often easier to push yourself to the limit on hills than on a flat road. Use the intervals progression on a hill.

Go for It!

Breaking out of your routine by *varying the intensity* is the fastest way to improve your cycling. Whether you are riding for fitness, going out with the club on the weekend, training for a century, racing or just riding casually, adding intensity will overload your body in beneficial ways—if you include recovery days and weeks to let yourself grow stronger.

By riding differently from day to day you'll also enjoy cycling more. Varying the intensity opens more routes and increases the number and kind of riding partners. You can mix in an easy after-dinner ride with your significant other, a mountain bike ride (great unstructured intensity), a fast club ride and perhaps a monthly time trial.

The variety, progress and enjoyment will improve your motivation. At the end of the week you're more likely to say "That was great!" and look forward to the next one.

We started riding as kids because it was play. Bet I can beat you to the top of this hill! Let's see who can go fastest in this tailwind! Keep playing, keep it fun and let the intensity come.

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