

Pedalling facts

Turning the pedals on your bike doesn't require a lot of thought, but as *Cyclist* discovers, maybe it should

Words PETER STUART Photography LIZ SEABROOK



When it comes to technique, cyclists don't have a great deal to worry about. Compared to swimming,

weightlifting or gymnastics, our sport requires the simplest of movements – rotating a pedal. But while it may be an easy skill to perform, it turns out that it's astoundingly difficult to do well.

To investigate the process I've come to Personal Bikefit (personalbikefit.com) in west London. Here I'll be put through my paces on a Wattbike to analyse what's happening during my pedal stroke and how much power is being generated at each part of the rotation.

'People always think we're looking for problems with pedalling technique, but really we're out to find extra wattage,' says Spencer Wilson, owner of Personal Bikefit. 'Any kink in the pedalling profile represents a spot where watts are sitting waiting to be used.' With a focus on optimising power rather than addressing any aches and pains, we start the session with

As *Cyclist* works away on a Wattbike, a graph displays the balance of the pedal stroke (above). The further out the line is from the centre, the higher the power output at that part of the stroke. If the shape is a figure of eight, power is concentrated too much in the middle of the downstroke. The ideal is a sausage (or velodrome) shape

a functional threshold power (FTP) test – 20 minutes at my absolute maximum power, to see how my pedalling deteriorates under duress.

I know the FTP will be a real strainer, and I approach it tentatively. Ahead of me is a giant LED screen relaying my pedalling output, along with vital statistics such as power and heart rate. I approach the first five minutes conservatively, trying to keep my technique consistent. Once five minutes pass, the numbers are looking good and Wilson is shouting encouragement, so I push up to 350 watts.

With 13 minutes on the clock, I put my head down and begin to push for home. Glancing up from my sweaty misery, I notice my pedalling graph is deteriorating, but in my effort to maintain intensity there's not much I can do about it. It looks like I'm heading

for a personal best in the FTP test, so push on and finish with an average of 349 watts. I notice Wilson smiling, but not because he's in any way impressed with my performance – rather he is contemplating the flaws that have shown up in my pedalling technique.

'Have you ever done an asymmetrical sport?' Wilson asks. Indeed I have, as my youth was spent rowing on stroke side – to the right. My pedalling reflects this precisely, with my body slumping to the right and consequently giving my left leg a more rounded and powerful stroke. That's the simple part. Then we get into the real data.

From peanut to sausage

The analysis of the pedal stroke boils down to a few key indicators, the first of which is the angle at which the pedal stroke reaches its peak power. While ▶



the recovery,' Wilson says. 'The active muscles of a downward stroke are big engines – the quads and glutes. They work together with gravity to make an extremely positive driving action. Pulling up you have hamstring and hip flexor working against gravity – it's not efficient at all and leads quickly to fatigue.' However, there still needs to be a dynamic movement during the recovery, but it's more about 'unloading' the pedal during the upstroke rather than lifting it, to simply take the weight off the pedal while the other leg drives.

The upstroke doesn't seem to be a big problem for me, though. My problem, according to the graph, is an imbalance of my peak power angle, which is a healthy 116° past vertical on my left leg but a measly 102° on my right leg. It's a stark imbalance, and it goes

there's no 'right' way to deliver power, and hence no specific angle that's correct for a peak power output, Wilson indicates that anything in the range of 115° - 125° past vertical indicates an effective pedal stroke. Many newcomers hit peak power at as little as 90° past vertical (ie, when the crank arm is horizontal), indicating that they are probably pushing down on the pedals only vertically, rather than smoothing out the pedal stroke. 'Our aim is that you deliver the power as early as possible, but then generate that peak force as late as possible,' Wilson says.

Aside from the peak power angle, the spread of power between left and right leg is important, as is the shape of the power curve – the computer-generated image that indicates the efficiency of the pedal stroke.

'Wattbike calls the perfect curve a sausage, but I think velodrome is more apt,' Wilson says. The curve demonstrates how much force is being applied at any point of the pedal stroke – the further out the line is, the higher the level of power – and the angle of the curve shows where the power is being generated in the stroke. A very poor power curve will look like a figure eight, with the line returning to the middle of the graph when crossing the axis. This means that power is being produced only in the middle of the downstroke, and little technique is used to round off the pedal stroke in the recovery or

through the bottom of the drive – which is done by pulling the heel back, or as coaches describe it, 'scraping mud off the bottom of your shoe'.

As technique improves, the graph eventually becomes a velodrome shape, meaning that there's a strong generation of power throughout the drive and also the correct technique during the recovery and through the top and bottom of the stroke.

'A big misconception is that you have to actually pull up on the pedal during



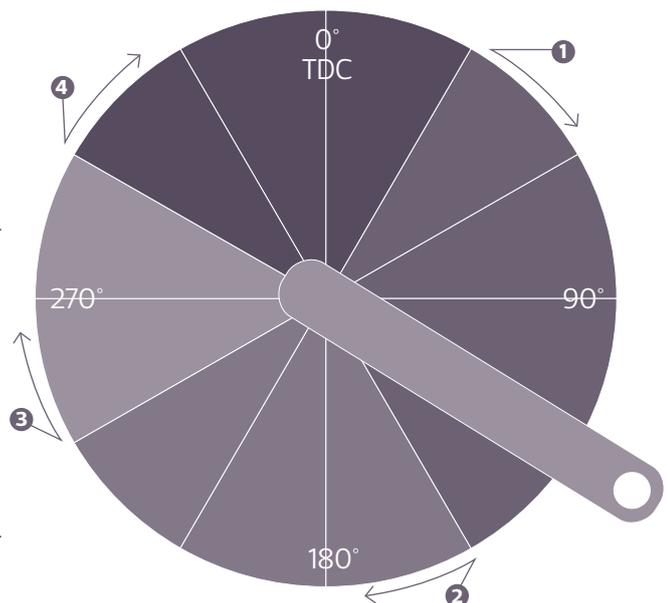
Smoothing the circle

British Cycling coach Will Newton explains how to optimise your pedal stroke

1. Pushing down on the pedals comes naturally. You don't need to concentrate too much on this stage – just do it.
2. Through the bottom of the pedal stroke, imagine you're scraping mud off your shoe – pulling backwards.
3. Unweight your foot so that you don't lose any power, although actually pulling upwards gives only minimal benefits, if any.
4. Rather than just letting the pedal coast over the top, use an 'ankle flick'. Your toe should be pointing down (plantarflexion) initially, moving to a heel-down position (dorsiflexion) ready to get the power down soon after top dead centre (TDC).

Other drills for a smooth pedal stroke...

- As you go over TDC, pretend you're sliding your foot forwards into a shoe.
- Imagine you're turning a double-length crank and making big circles with your feet.
- Increase your cadence so you're happy pedalling smoothly at 100-120rpm.





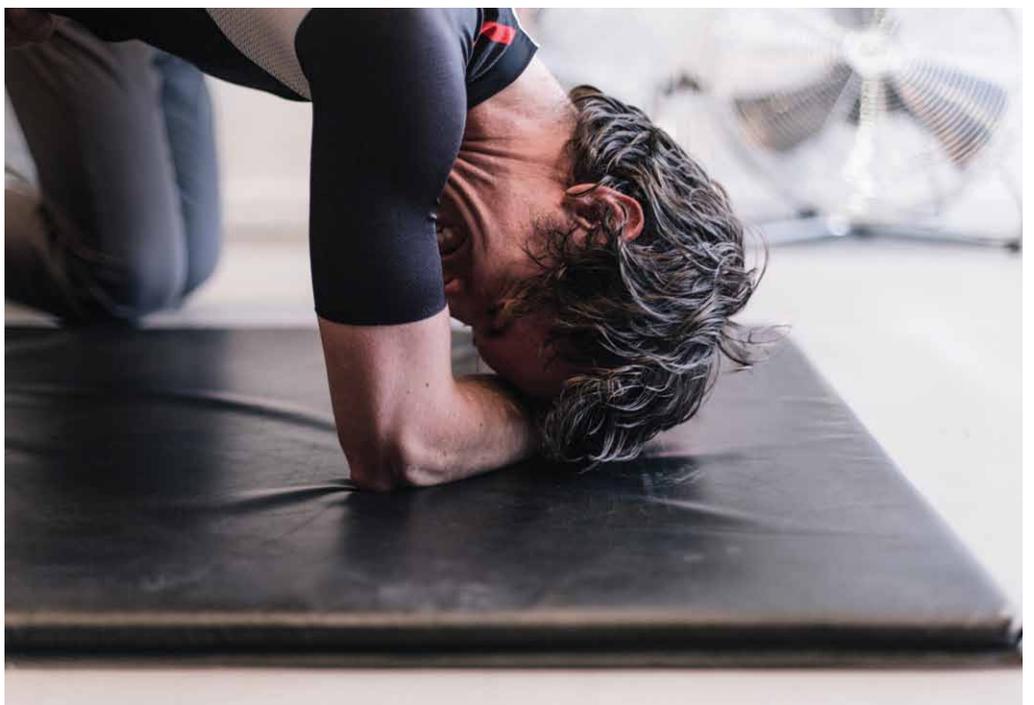
▶ hand in hand with a significant dip at the top of the graph, where my right pedal moves feebly over the top of the pedal stroke, sacrificing further watts.

I feel a little discouraged, but Wilson emphasises that it could be a great deal worse, and shows me some previous examples that look like tiny disorientated starfish to prove the point. For me, crucially, there's power to be gained. 'I think we could quite easily add another 10% to your FTP simply by making your pedalling more efficient,' Wilson says, to which my ears prick up with enthusiasm.

Stabilising the stroke

'You over-rely on your left oblique muscle,' Wilson says. 'That creates a pelvic lift and rotation. This in turn creates unstable pelvic balance and positioning, hence your angles of peak force.' The solution is to isolate the muscles that create the imbalance and try to strengthen them.

We head into the gym to go through some exercises, the first being a lateral leg raise. I'm stunned to see how difficult it is to simply raise my right leg to the side in a controlled way, when my left leg lifts freely. We work through a handful of other slightly humiliating exercises, including a side plank and single-leg straight-leg deadlift, which continue to show my gaping muscular imbalance. Already it's obvious how the lack of stability of my back and glutes has forced me to pedal in quite an unusual way – compensating for



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my imbalances to create what looks like a normal pedal stroke.

Returning to the Wattbike, I try to implement some of the changes to create a platform for my pedals to whirl around smoothly. Encouragingly, my profile is beginning to flatten out, and look a little more like a velodrome than a peanut shell.

With the prospect of 10% more power there for the taking, I'm keen to tackle my bad habits, but Wilson makes clear that it's a long journey of stability exercises and stretching. 'This is 100% a matter of work in progress for almost every rider. We get some clients near perfection, but they have three weeks off the bike and ignore stretching, and we have to start over again,' Wilson says. 'Your body is naturally lazy and will always look for the easiest way out.'

On my ride home I start to battle with my body's laziness, focusing on my technique and motivating myself to do my exercises every day. I realise this may turn into a protracted struggle, but the prize is worth it – 10% more power. ❁