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Constant pacing may not always be the best cycling strategy, journal paper review taken from:

G. Atkinson, O. Peacock & L. Passfield (2007). **Variable versus constant power strategies during cycling time-trials: Prediction of time savings using an up-to-date mathematical model.** Journal of Sports Sciences, 25(9): 1001 – 1009

The correct pacing strategy is something which is critical for successful race performances and a variety of methods are used by competitors. These range from starting fast and trying to sustain, starting easy and building to produce the elusive 'negative split' or attempting to hold an even pace for the event duration. Some people attack hills on the bike and 'coast' down the other side, others prefer to back off on the hills and save their energy for the flatter sections. There are key variables which dictate the best pacing strategy such as individual fitness levels and event distance.

Length matters

How is it possible that you can drive your car at 70mph on the motorway for an hour and use less fuel than you do driving in the city for the same time, with an average speed of 14mph? The answer to this question is the 'rev counter' in your car, it doesn't matter about average speed, every time the rev counter goes up, you burn fuel and inner city driving involves 1st gear, high revs, 2nd gear, high revs and then stop for traffic before repeating the process. Driving on a motorway involves holding moderate revs for a long time and if the rev counter stays still, your fuel gauge does the same.

Your body works the same way as the car, if you ride at one, steady intensity irrelevant of the course profile, your fuel consumption will be much better. This would require you to 'back off' on the hills and keep your heart rate steady, then push harder on the down hills to prevent heart rate dropping. In effect you are attempting to ride whilst 'flat lining' your HR. Riding in this manner reduces fuel consumption and produces better performances in longer events. This is due to the fact that poor performances in longer events is largely due to people slowing down in the second half and losing a great deal of time.

It's fair to say that if you are not a pro rider and you are riding a long sportive, attacking the hills from the start and varying your intensity is cycling suicide. If you are an ironman triathlete and you adopt the same approach on the cycle section, 26 miles is a hell of a long way to walk.

In shorter events, fuel consumption may not be as big an issue as you have enough fuel to complete a 10 mile time trial without having to worry about your fuel tanks running low. In these events 'even pacing' as explained above may not be the best strategy if you want to produce a fast time.

In shorter events, how does the course influence your race?

Atkinson (2003) identified that hilly and windy courses tend to lead to slower performances in time trials and whilst this may seem obvious, there are some interesting facts to consider. If you are riding a 10 miles course which includes 5 miles straight into the wind, turning round and 5 miles back with a tail wind, you will ride slower than completing a 10 miles course on a 'windless day'. The time that you lose on the first part of the course into the wind is generally not made up on the return leg with the wind behind. If the course involved 5 miles uphill followed by 5 miles downhill there would be a similar effect, you would not make up the time on the downhill section that was lost on the uphill section.

Atkinson et al (2007) used a mathematical formula to examine the relationship between power output, wind speed and gradient incline for several hypothetical riders. They created 3 hypothetical courses completed in a variety of conditions:

1. A 10km time trial course ridden as flat or with alternate 1km sections of uphill and downhill (both 5% and 10% inclines & declines).
2. A 40km flat time trial course complete with no wind or with alternate 5km sections of headwind and tailwind (wind strength 2.2, 4.4 and 6.6 m/s compared).

3. A 40km time trial course consisting of 5km uphill headwind, 5km downhill headwind, 5km uphill tailwind, 5km downhill tailwind, 10km flat headwind and finishing with 10km flat tailwind. The hills were all 1% and the headwinds and tailwinds a constant 2.2 m/s.

The results

In simple terms the results showed that when you are riding on a flat course on a 'windless' day, the best strategy is even pacing. If your bike is fitted with a power meter you should aim to keep it constant for the whole ride. If the course is hilly or windy you should ride the head wind or uphill harder, the tailwind or downhill easier and this will lead to faster times.

Into the strongest headwinds (6.6 m/s) and on the hilliest gradient (15%), those riders who varied their power by 15% saw the biggest gain (if the rider averaged 200 watts for the ride a 15% variation would be 230 watts on the climb and 170 watts on the descent).

Perhaps more importantly, they did the calculations for riders of different ability and found **those with the lowest average power outputs gained the most by varying their power as outlined above**, this means that the weakest cyclists have the most to gain by this strategy!

Why is this so?

We mentioned earlier that you never make up time lost on the headwind section or uphill section when you return with the tailwind or downhill, this is because more of your time is spent going into the head wind or up the hill.

Consider the following scenario

Bob rides a 10 miles time trial which involves 5 miles into a head wind and 5 miles with a tail wind. He completes the first 5 miles at 20mph and the next 5 miles at 30 mph.. therefore he should average 25mph.. right?.. wrong.

The first 5 miles take 15 minutes (5 miles at 20 mph) and the next 5 miles take 10 minutes (5 miles at 30 mph), that's 25 minutes in total and 24 miles per hour.. **trust me, the maths are right!**

Despite the fact that the distances are the same (5 miles out and 5 miles back), Bob spent more time cycling at the slower speed (15 minutes at 20mph and only 10 minutes at 30mph).

To conclude

The authors suggest that riders may wish to change their intensity to parallel the inclines and wind, i.e. the steeper the uphill and stronger the headwind, the harder you ride and the stronger the tailwind and steeper the downhill, the more you recover. **REMEMBER..** this applies to distances up to 40km and not for a 100 mile sportive where the parallel intensity approach could result in a very troubled final 40 miles..

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