

# When Stronger Isn't Faster

Force, Strength, Work and Power. These are all terms which we equate with a fast cyclist. Yet, technically speaking, only one of these terms includes a component of speed. Want to know which one? Then keep reading. We tend to use force, strength, work and power interchangeably to describe a fast cyclist. We speak about a 'strong rider', a 'powerful rider', a rider who 'forcefully pushes' on the pedals, and a rider who is a 'workhorse'. These all imply a fast rider. Let's start with some definitions.

"Force" is defined as the ability to accelerate an object, in other words, to cause it to move. In our case, it means the ability to move the pedals which propel the bike which propels the rider. Force is a measure of the energy required to move an object and is measured in terms of Newtons (named after Sir Isaac). The force required to turn a pedal while in a high gear is greater than the force required to move a pedal when in a low gear.

"Strength" is the body's ability (more specifically the muscles' ability) to generate a force. It requires strength to generate a force to move the pedals. Let's take two hypothetical cyclists. They weigh the same and are riding in the same gear. Rider 'Hare' is able to ride up a hill at 100 rpm. Rider 'Tortoise' is only able to ride up the same hill at 90 rpm. Which one is stronger? Answer: They are both equally strong because they are both exerting the same force to ride up the hill. That's because force and strength don't have a speed component. So, pedaling faster doesn't imply one cyclist is 'stronger' than the other. The faster cyclist is just putting out the same force more frequently.

"Work" is defined as the ability to generate a force across a specific distance, so it is Force x Distance and adds a movement component to force. It is measured in Joules. When you pedal through the pedal stroke or move a bicycle over a certain distance, you are doing 'work'. Likewise, riders Hare and Tortoise did the same amount of work to climb the hill.

"Power" is defined as the rate at which you can do work. It is the amount of work you can do over a given period of time, or Work/Time or (Force x Distance)/Time. It adds a time component to work, adding a component of speed. It is measured in Watts or Horsepower. So of the four, power is the measure associated with speed. Ride Hare is putting out more power to climb the hill than his friend Tortoise. They both put out the same amount of force and did the same amount of work, but Hare did it faster and thus is more powerful.

Generating power on a bicycle is a combination of gear size and the rate at which the pedal revolution is made. There are two ways to generate more power: 1) use more force per pedal stroke (push a bigger gear at the same cadence), and 2) put out the same force on the pedals but do it more quickly (spin the same gear faster). While these may seem like two sides of the same coin, to your body, two very different physiological systems are required. To pedal with more force (i.e. push a larger gear) you need to use more leg strength. To

pedal the same gear faster does not require any more strength but requires a good aerobic system to allow the muscles to work faster.

Jan Ullrich was famous for pushing huge gears. This required great strength and his thighs were a testament to this. After Lance fought back from cancer, he had lost many pounds of muscle mass and therefore lost strength. To ride fast, he found he had to pedal faster rather than generate as much force as he used to. Jan was undoubtedly the 'stronger' rider, but Lance was more 'powerful'. So the stronger rider isn't always necessarily the faster rider. However, when everything else is equal, the more powerful rider always will be the faster rider.

On a side note – the sport of “power lifting” involves bench presses, deadlifts and squats. These people lift tremendous amounts of weight, generating huge forces and doing a lot of work. But are they in fact ‘power’ lifters? Actually, not so much. They do a lot of work but do it relatively slowly. You can generate more power squatting down and jumping up than a power lifter who is squatting 400 pounds slowly, because of the speed component. The sport of “weight lifting” includes moves such as the clean & jerk and snatch. These are moves done rapidly with heavy weights. Weight lifters generate huge power (lots of work done quickly). They got the names ‘power lifters’ and ‘weight lifters’ backwards, I believe!

All of this previous discussion isn't just an academic exercise (although it sure sounds like it!). Hopefully you can begin to see how an understanding of power and it's components can enable you to build a training program to increase your power. In future articles I will be getting into this further.

To receive my new cycling training newsletter, you can sign up for it on my website, [www.CyclesportCoaching.com](http://www.CyclesportCoaching.com) or click [here](#).

Ride on -- David Ertl

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