



THE POWER OF BIG DATA

One of my favorite magazines, besides *ROAD* of course, is *Wired*, which is a magazine about technology. Almost every issue contains some sort of article on human performance which makes sense when you think about it, as pretty much all technology in the world is out there to improve human performance in one way or another. From your cell phone, to the CAT scan machine, to the voice activated GPS in your car, technology is there to help improve ourselves and ultimately our effectiveness and productivity. The July issue [16.07] of *Wired* had a headline that read, "The End of Science-The quest for knowledge used to begin with grand theories. Now it begins with massive amounts of data. Welcome to the Petabyte age". The supporting article written by Chris Anderson, was referred to as "The Power of Big Data". In this article, the author welcomes us into the age where a massive amount of data thrown at any problem will eventually lead to some meaningful and significant answers. The age where computers can crunch more numbers than ever, and algorithms applied to any large enough data set can give us the correlations and patterns that science cannot. It's this sheer quantity of data and the ability to "crunch it" that the author argues is the reason for the end of the traditional scientific method of hypothesize, model and test. This article really hit home for me, since with powermeter data, each ride, each month of rides and every year of rides, the data that you collect becomes bigger and bigger.

The power of big data (pun intended!) is something that really makes a difference for a power meter user. When taken alone, a few data points here and there, your watts or cadence data cannot provide you with any new insight. When you start to capture data every second on your ride, ranges of time become more and more interesting. A whole record of your workout starts to become recognizable as you can point out the hills you went over, or the attacks you made, or the intervals you did. That workout itself allows you to compare within the workout and help you determine if you should have done 5-6 intervals or held a higher cadence, etc. This ability is, in and of itself, very enlightening. In my power training seminars, I have mentioned many times that I believe a power meter satisfies 2 of our primal desires as humans. One, it gives us a way of looking at our workout history and reliving our experience. I know that we all like to relive the "good old times" and talk about the time that Bob attacked up that hill and then the yappy dog jumped out from behind the bush and bit his tire and then got stuck in the wheel going flop-flop-flop like Wil-E-coyote on Saturday morning cartoons. This "reliving of experiences" is made even more permanent by having a power meter file of your ride; it's like having a second-by-second diary of your entire workout. The second thing that a power meter helps satisfy is the desire to learn from our experiences. With the "power of big data" at our fingertips, learning from your rides becomes more and

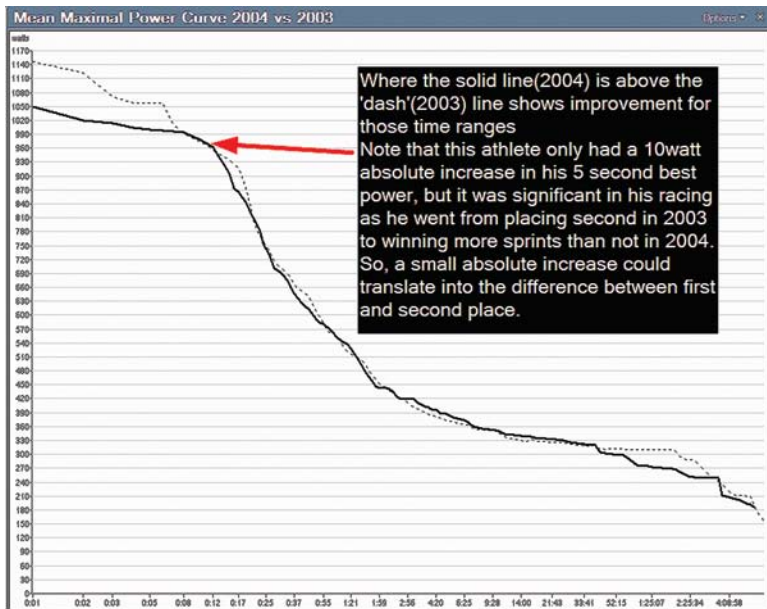


FIGURE 1.

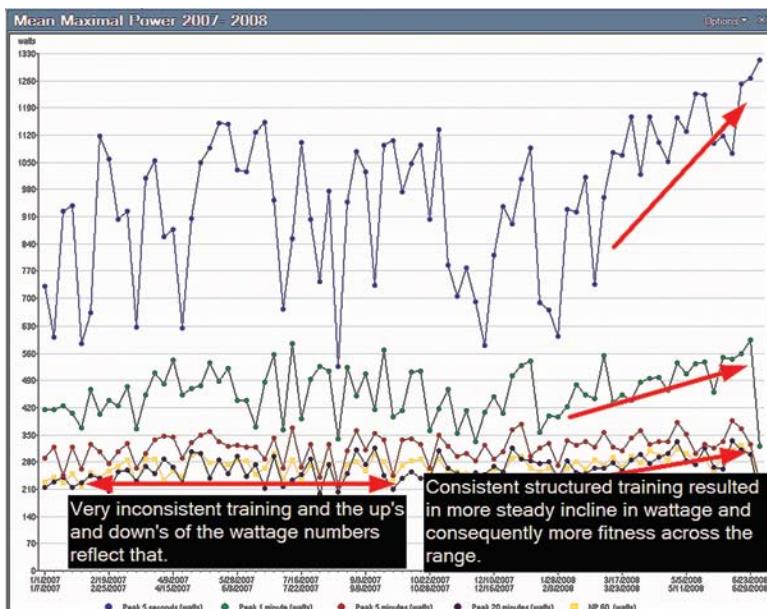


FIGURE 2.

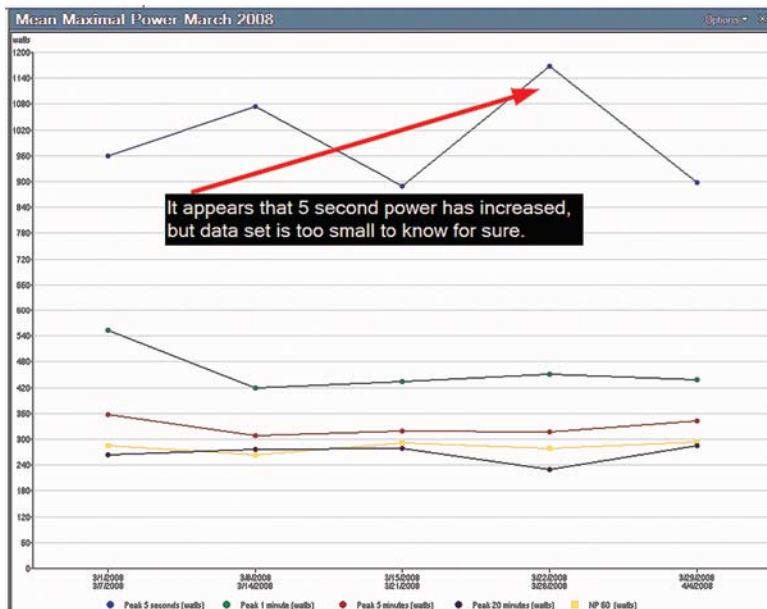


FIGURE 3.

more viable. The more data the better and even just looking at one individual workout and comparing intervals to one another allows you to possibly learn from them.

Where the power of big data becomes even more valuable is when we put it together over a longer period of time, or we collect even more data making the data set even larger. An individual ride is great, but a week of rides is better, a month even better, a year even more so and multiple years of data is amazing. I have one client that has been using his SRM since 2003 and religiously recorded every single ride he has done in the last 5 years, which makes his data set quite large and also highly valuable for analysis purposes. I have been able to track and direct his progress over the past 5 years and in that time, learn about his specific responses to his training dose, pinpoint the type of training that brings him into form and know with a high degree of certainty that the current training is correct. That sort of knowledge is priceless and not something that coaches or athletes have had the ability to ascertain in the past. Only with the power of big data, have we been able to make sense of the hundreds of rides that athletes have done over time. Let's look at an example. In the screenshot opposite, you will see this athlete's mean maximal power curve over several years. This is one of my favorite ways to view changes in physiology over a longer time period. In Figure 1, we see 2 lines; 1 is solid black, which represents the best numbers from all the athlete's rides in 2004. The dash line is same thing but from 2003. When TrainingPeaks WKO+ software goes through every workout for the time period and compares it to every other workout and looks for the very best wattage values for each time period, then the power of big data really starts to shine. The mean maximal power curve helps us to learn that the shape of curve tells us about the strengths and weaknesses of the athlete, and by comparing curves from 2 time periods, we learn how each physiological area has changed.

Back to figure 1, if you look closely you will see that the solid black line (2004) is above the "dashed" line in many places, this indicates that the wattages were higher during those time periods, or proof of substantial improvement. When the more recent line (solid 2004) is greater than the second line only in certain places, it points to specific physiological areas that have improved. Maybe your power at Vo2 Max improved or your Sprint improved or your Functional Threshold improved. By analyzing lots and lots of data, you can see these trends and review the truth about what is really happening with your fitness.

Let's look at another example of the "power of big data." In this example, we are looking at the mean maximal power periodic chart, which shows your peak watts for specific times that you select. These are then charted over whatever time period you want to see, say for example your 2007-2008 season. In Figure 2, we see data for this athlete over that exact time period and by looking at the chart, it's immediately obvious at how much more consistent his wattage numbers are this year and how clearly he has progressed throughout the season. Especially notice the steady progression of the green line and blue line, which is his 1 minute and 5 second bests, which relate to the anaerobic capacity and neuromuscular power systems respectively. When all of the best wattages are charted for each week over a year or two of data, it is much easier to see changes to the training regime, incremental improvements and new personal bests. Let's take a look at Figure 3, which is from the same athlete, but now only his March 2008 data, which is a smaller slice of the data set. In this figure we see that it appears the 1 minute (green line), and 5 minute (red line) has decreased, while the 5 second (blue line) and 60 minute (black line) appear to have increased.

The point being is that without a larger view and data set, the true increases and decreases in wattage are hard to see. Since fitness changes over a longer period of time than just in 4 weeks, it's hard to say what is going on by looking at these numbers for certain. Referring back to Figure 2 allows you to see the bigger picture or the "forest" above the trees and that's the power of big data.

In conclusion, when we consider the incredible number crunching power of personal computers now, and combine that with the ability to record incredible amounts of data, the "power of big data" really does start make sense for us lowly cyclists. We are not curing cancer or calculating satellite orbital trajectories, or creating world peace, but cycling gives you that sense of personal satisfaction that is hard to find in other places in life. Using a power meter to help remember your experiences and learn from them can be deeply satisfying; while the power of big data can help you become even more successful. *R*

HUNTER ALLEN is a USA Cycling Level 1 coach and former Professional Cyclist. He is the co-author of *Training and Racing with a Power Meter*, co-developer of CyclingPeaks Software, and is the CEO and Founder of the Peaks Coaching Group. He has coached more than 500 athletes ranging from professionals to fitness enthusiasts, and has helped many athletes achieve dreams and goals that they didn't think were possible. He specializes in coaching cyclists with wattage meters and is on the forefront of coaching with cycling's newest tool. He has online training programs available at TrainingPeaks.com/hunter and you can contact Hunter directly at PeaksCoachingGroup.com.