RUNNING MONTHLY

MARCH | 2016

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- 20 FACTS YOU NEED TO KNOW -
- GUIDE TO THE TOP RACES -
- GET YOUR PACE RIGHT -

CONTENTS

MARCH 2016

08

06

20

AVOIDING THE WALL

SPLITS in a marathon often make painful viewing. If you haven't hit the dreaded wall yourself, the chances are you have seen instances where runners have gone off at what they thought was a comfortable pace and then virtually crawled home over the last 5-10k, miling perhaps well over a minute slower than their first-half pace.

Starting just slightly quicker than you are capable of maintaining for 26.2 miles can have a massive impact at the very end. But how do you know what shape you're in and, thus, establish an even and appropriate tempo – especially if you've not run the distance before?

Our article "Smashing through the wall" (p12) poses an interesting alternative to the popular internet calculators which predict pace for one race distance based on what you've done in another. The trouble with the latter is that they are often unreliable when it comes to the marathon.

The controversial idea promoted by Dr Christof Schwiening – a physiologist with a handy marathon PB – is that your optimum pace can be predicted by a calculation that takes account of only your training tempo and volume. It sounds too simplistic – and indeed, for the faster runners, it won't work too well. But he maintains it has worked for himself and many others.

Given the fascination with online training logs which easily show you your average pace and mileage, no doubt many of you will be keen to try it out. Further, when so many people get marathon pacing so badly wrong, any predictive method that manages to slow people down when the gun goes off must surely be a good thing.

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Subscriptions and back issues
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Cover: Virgin Money London Marathon (Mark Shearman)

Could a formula based on training pace and volume stop you struggling at the end of a marathon?

Mark Shearman

SMASHING THROUGH THE WALL

Physiologist Christof Schwiening explains a revolutionary method of predicting optimal pace for the 26-mile distance

Few manage to run the second half of the marathon faster than the first to achieve a negative split. Most begin too slow, some dramatically, around mile 18 with an increasing sense of exhaustion. Something terrible happens to their physiology, which turns what was an easy pace into one that is impossible to maintain. While many will blame a missed gel, drink, poor carbo-loading or a tight muscle, the trigger is likely to have been pace over the preceding miles: if only they had started more slowly!

Optimal pacing is one which is just slow enough to allow the marathon to be completed at near flat pace – it is one that produces the fastest possible marathon time. To determine that pace requires some knowledge of how an individual's physiology responds to the stress of running.

PACING BASED ON RACING

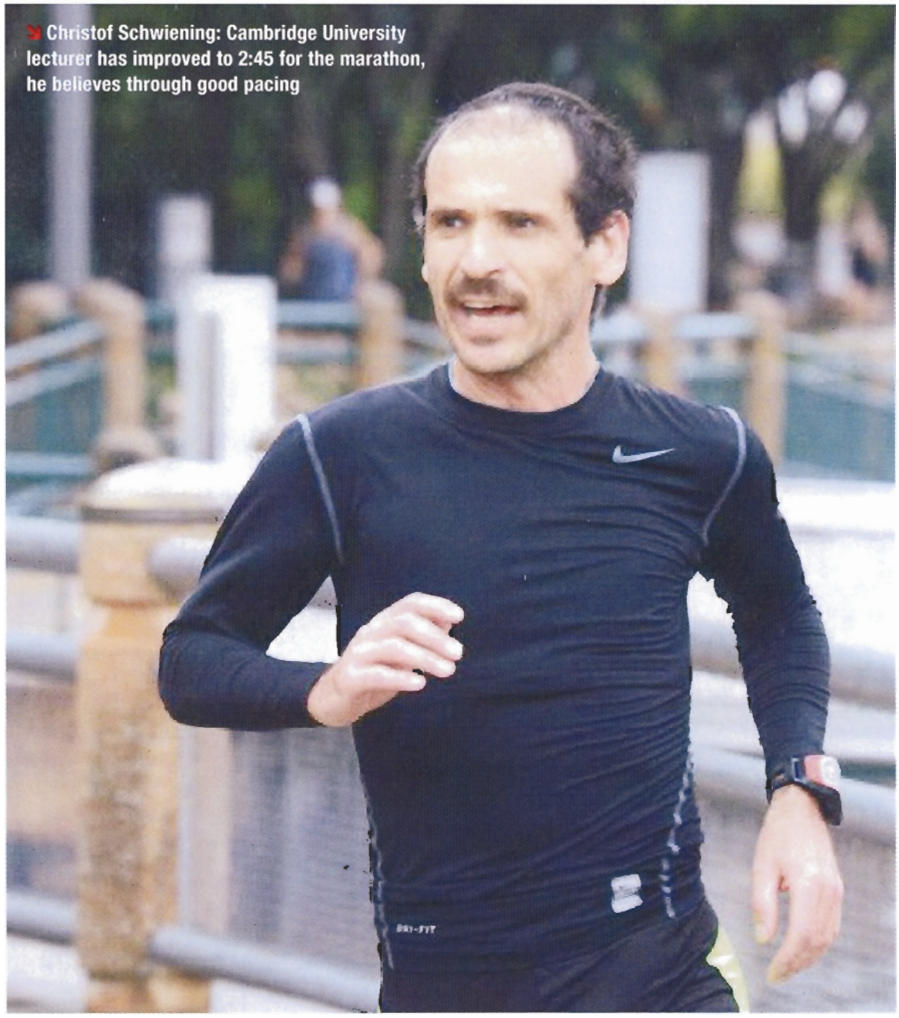
The most common technique for doing this is to race a shorter distance than the full marathon. This race performance can then be used in an equivalent running performance formula, of which there are many (Riegel, Cameron, Purdy, WMA age-grading), to predict marathon performance. Unfortunately, such scaling algorithms are often overly optimistic, especially for slower runners. The problem being that the mechanisms that limit short-distance running are somewhat different from those that limit runners in the marathon. A rather better technique would be to assess those elements of physiology directly.

PACING BASED ON PHYSIOLOGY

To probe the mechanisms that fail during the marathon requires running closer to marathon distance, but doing so at race effort is too damaging during a training period. However, heartrate data from longer runs, at reduced effort, can be used to predict marathon performance reasonably accurately. Three main metrics are required – metres per heartbeat, heartrate drift – ideally from about a dozen runs – and average sustainable marathon heart rate. Metres per heartbeat is analogous to miles per gallon for a car. Each heartbeat delivers an amount of oxygen to the body and the further you can go on each beat of blood the faster you can complete the marathon. But, even at flat pace, heartrate gradually drifts upwards for a variety of reasons, including thermoregulation. The more trained you are, the less the drift. From the metres per beat and the heartrate drift rate, one can estimate the pace that will produce a certain average marathon heart rate. The complexity of the calculation (in other words, correcting metres per heartbeat for resting heart rate) and an understanding of the inherent variability of heart rates mean that few runners use what is a potentially powerful predictor, which critically does not require race efforts.

"THE FORMULA PREDICTS MARATHON PERFORMANCE BASED SOLELY ON HOW FAR AND HOW FAST YOU HAVE RUN OVER THE EIGHT WEEKS ENDING ONE WEEK BEFORE THE MARATHON."

There is, however, a technique that allows runners to assess how well trained their physiology might be to endurance running without the need for complex calculations. It is a little known, highly surprising and remarkably useful relationship between training load and marathon performance. Its value goes considerably further than pacing alone.



Christof Schwiening: Cambridge University lecturer has improved to 2:45 for the marathon, he believes through good pacing

PACING BASED ON TRAINING

Without external stress our body gradually withers away and it is only by training that we can either maintain or build fitness. We know that, within limits, more training produces a faster marathon runner. It therefore seems logical that there must be some link between training load and marathon performance time.

In 2011 Giovanni Tanda produced a simple formula for predicting the relationship between training and performance (http://bit.ly/1ThsQYv).

His formula was not the first to do this, but it has some very useful properties. First, it uses two very simple measures that most people who use GPS watches should have access to (total distance run and time taken). Secondly, the formula works rather well (roughly five minutes accuracy) and finally the formula predicts reasonably for both ends of the ability spectrum.

Of course the formula has limits. It is based on aerobically limited marathon performance (first and second half splits within four minutes. It cannot know that you get blisters and have to stop at halfway to deal with them!

The formula predicts marathon performance based solely on how far and how fast you have run over the eight weeks ending one week before the marathon. The formula assumes a normal "diet" of marathon training, although my tests with a range of subjects suggests that speed work, tempo runs, hills and long runs are all unnecessary. Simply putting in the miles at a sensible pace is sufficient to produce the predicted performance.

Near halfway in the London Marathon is where many start to slow down

Mark Shearman

The sliders on this page (http://bit.ly/245883l) show the predicted marathon time (and junk mile pace) for a range of weekly distances and paces. In my tests, on a range of runners, the equation appears reasonably accurate and is not just correlative but also causative (in other words, it is possible to achieve a marathon time close to the predictions if you bias your training to simply hitting those averages).

The table (left) shows average daily distance (km) and pace (mins:ss per km) for a range of marathon finishing times (3:30-2:45). The "average training pace" row shows typical values for those following standard marathon training plans. The "easier alternative" row shows values of distance and pace that Tanda (2011) predicts would produce a similar performance time. These paces are slower and have allowed runners that I have helped to achieve PBs.

As a 49-year-old I struggled to achieve a daily 12km run at 4:30 per km to get my sub-three marathon. By

	3:30	3:15	3:00	2:45
Average training volume/pace	7km 5:15 per km	10km 5:00 per km	12km 4:30 per km	16km 4:15 per km
Average daily training time	36 mins	50 mins	54 mins	1 hour 10 mins
Easier alternative	9km 5:30 per km	13km 5:15 per km	17km 5:00 per km	22km 4:45 per km
Time	50 mins	1 hour 10 mins	1 hour 25 mins	1 hour 45 mins

Daily training loads (distance, pace and time taken) and an easier (slower but longer) alternative calculated from Tanda (2011) to produce marathon finishing times in the range 3:30 to 2:45 (hh:mm) if averaged over eight weeks ending one week before the marathon.

Your marathon performance is mainly the result of how far and how fast you train, says Christof Schwiening

Mark Shearman

slowing down and running further I progressed to 2:45. Thus, not only for me but now for about 20 other runners, this equation has facilitated PBs by revealing the mathematical relationship between distance, pace and performance times.

While it is often said that running further and slowing down allows improved performance, being able to quantify the values is critical and has enabled a set of ordinary runners to achieve remarkable marathon times. Such equations can reduce the amount of guesswork required in both setting training loads and also pacing. There is more information here: christofschwiening.blogspot.co.uk

Of course, this formula has its limits and common sense tells us that it is impossible to predict with absolute certainty what might be possible. But, what it tells us is that marathon performance is mainly dependent on how far and how fast you train – the tempo work, speed work and how far your longest run was are of lesser importance. It was fitted to 22 runners (46 marathons: 2:47-3:36 finishing time) with a BMI of less than 25.

If your marathon finishing time or BMI falls outside of this range the formula will work less well. It will also fail if you add a training or racing load that the formula does not know about. So, if you run with a heavy rucksack, with weights in your shoes or run up and down hills or train extensively using an exercise bike it will fail. If your training log includes runs with lots of walking (in other words, if you count your football game as training) it will fail. If your marathon is hillier and warmer than your training runs, it will also fail. Like all things in life understanding the limits of applicability allow for optimal exploitation – in this case allowing runners to assess where their training has taken them or to bias their training towards a specific goal

There is no snake oil or easy fix here – marathon training is hard work. But, with such equations we can calculate approximately what that work is worth in terms of performance times.

CHRISTOF SCHWIENING is a 49-year-old lecturer (cellular neurophysiology) working in the Department of Physiology, Development and Neuroscience at the University of Cambridge. He took up running in 2009 and since his first marathon performance of 4:03:45 (Cambridge, 2011) he has improved to 2:45:10 – in Frankfurt last year.