Very Technical
What determines your stroke rate –
OR
[The Editor's Title]
"Why swimming well is so challenging"

Platypus Press is pleased to reprint this informative, and technically and practically challenging article by Hobart Dolphins Coach, Steve Richards

Good Times

What determines your stroke rate?

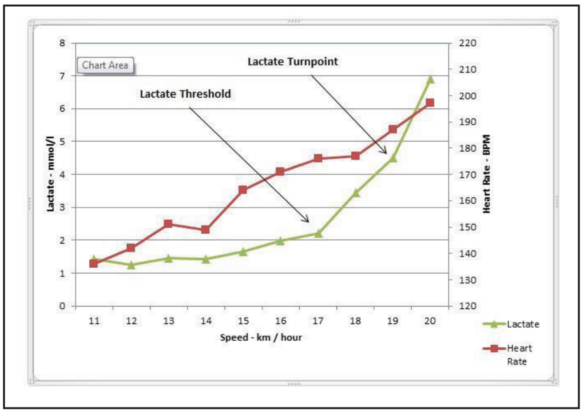
Is it directly proportional to how fast (or hard) you want to swim? If you raise your stroke rate, you might go faster, but what's the maximum you can maintain for a long distance? What happens to stroke length (how far you move with each stroke)?

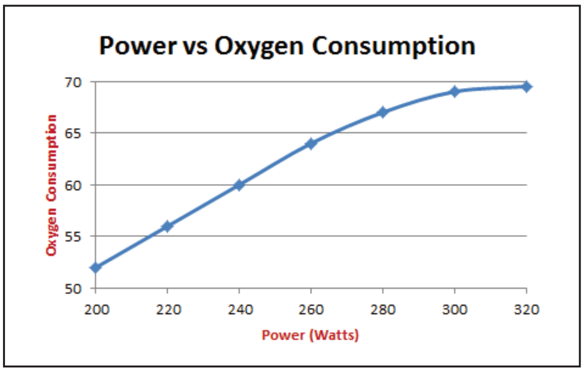
As most of us now know, Masters Swimming Tas generously supported the purchase of some swim training gear, including 3x TechTocs and 5x "Wetronomes". The latter fit under the swim cap and beep at intervals anywhere from 1-120 sec. The beeping is audible underwater, so you can set a stroke rate, or lap intervals (which allows you to keep to a particular lap time, so long as you finish a length on the beep). This means not having to look up at the clock. They have a couple of uses straight off: setting a CSS (critical swim speed, or maximum aerobic) pace; and setting your ideal stroke rate, which is worked out using a "ramp test".

I've spoken before about CSS pace, and we've been using it in training already.

It's the maximum pace you can sustain during training avoiding any anaerobic effect. The graphs [Ed. at the top of the following column] show results from riding a stationary bike at different speeds (indicated by km/h on the left and power (watts) on the right).

What you can see is that as you go faster your heart rate increases in proportion, but there's a point where oxygen consumption doesn't increase but lactate production does. This is because aerobic metabolism (that which uses oxygen to break down fuels for energy) has a maximum rate, and after that, to get more energy, muscles start breaking down carbohydrates and turning them into lactic acid ("lactate") rather than CO_2 and water. The problem with this "anaerobic"





metabolism is it's not very efficient and can't go on for very long because muscles don't have that much carbohydrate stored.

We can also only tolerate so much lactic acid buildup. But aerobic metabolism responds well (albeit slowly) to training.

The muscles adapt by boosting oxygen delivery to the muscle (by growing more capillaries) and increasing aerobic metabolic capacity (by growing more mitochondria, the energy producing organs inside cells). But these take time – weeks to months – to occur. Note also that with these changes your basal metabolism will increase too – a little side benefit!

The trick is to do the majority of your training in the aerobic heart rate zone – because if you start getting into the

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anaerobic zone you develop speed but no endurance.

CSS is designed to maximize your aerobic work rate, so you get the biggest stimulus for these aerobic adaptations in muscle, without switching to developing anaerobic capacity. The latter is less time-consuming to develop (at least physiologically, technique is another thing altogether!), taking only days to a few weeks.

Generally, speed work is done after a solid base of endurance work. CSS is measured by doing a 400m as fast as you can, then after a rest, doing a fast 200m, subtracting the difference and dividing by 2 to get the pace you should maintain for each 100m. Setting a Wetronome to this pace then swimming 400-1000m at this pace saves having to look at the clock.

CSS pace should be re-measured every 2-3 months to readjust for changes wrought by your training. You'll notice that the annual plan [Editor's note. the plan referred to is that set for the Hobart Dolphins Club] incorporates these principles into our yearly program – a lot of endurance work, regular (2-3 monthly) re-measuring of CSS pace, and then more speed work in the 3-5 weeks leading up to a competition.

But back to where we started – with what is the optimal stroke rate.

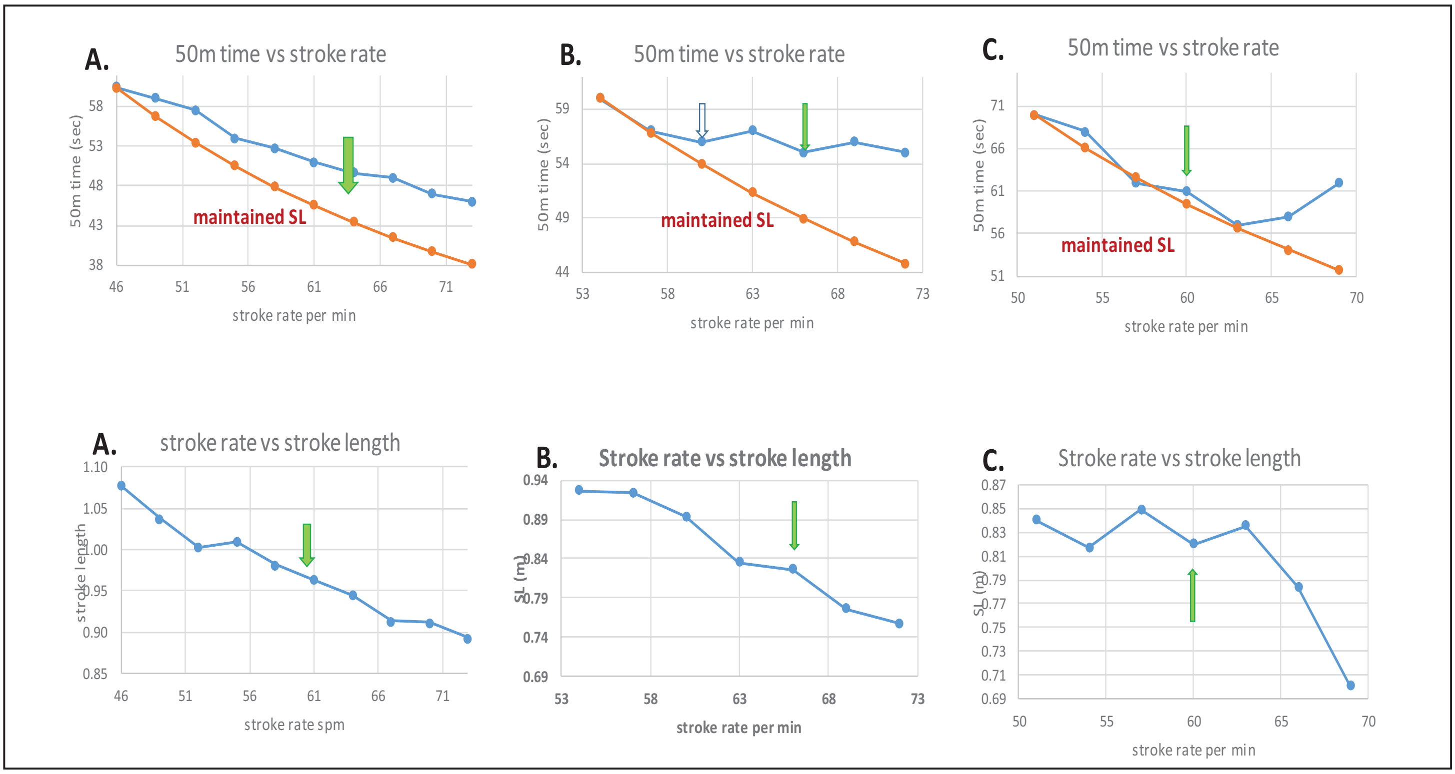
A lot of us focus on trying to get the maximum stroke length – i.e. to complete a length in as few strokes as possible. But this kind of efficiency does not necessarily translate to speed. For that you need to increase stroke rate.

Stroke rates vary from around 50 per minute (counting each arm cycle as a stroke) to nearly 70 for some of our swimmers, while Olympians can be anything up to 110!

Most of us are aware that if we sprint we tend to lose technique and become a bit "thrashy", and this means that while our stroke rate goes up, stroke length suffers, meaning that speed does not relate directly to effort! This is pretty obvious from the graphs from swimmers A, B and C below.

A is the fastest swimmer of the 3, then B then C, and all three have quite different swim styles.

B is a "swinger" style swimmer with a high natural stroke rate (indicated by the **green** arrows), while A is more of an over-glider with a long stroke but a pause at the start of the stroke, while C is a smooth swimmer, albeit with a slightly foreshortened catch phase of the stroke. Notice that as stroke rate increases, the 50m times decline continuously (blue line, upper graphs)



for A, and for C, but C starts to lose speed at higher stroke rates.

Surprisingly, B maintains the same speed at a much lower stroke rate than her normal rate (and presumably with less effort). This "ramp test" is a good way of finding a balance between stroke rate and speed, although it is best to also keep track of relative effort, because while C sped up significantly at 63 spm, it was also at significant effort!

The cost for most swimmers of higher stroke rates is not just increased effort, but a loss of stroke length (lower panels). "A" started with a longer stroke length but experienced a rapid decline as stroke rate increased, while B maintained stroke length for a while, but then lost it in direct proportion to the increase in stroke rate. Swimmer C maintained stroke length well, (although started out shorter than the other two, so speed was compromised), only losing "shape" at the highest stroke rates.

Of course, ideally we'd all like to maintain stroke length as much as possible, although there will always be *some* loss of stroke length with increasing stroke rate. But reducing your drag will reduce the losses.

What's the orangey-red line on the graphs? This is the extrapolated 50 times versus stroke rate if each swimmer managed to maintain the same stroke length. What a teaser!

So what can we take away from this?

Firstly, for longer distances, there may be for many of us a stroke rate other than our current one that best balances stroke length, effort and speed, and the Wetronomes may help find this.

Coach and author Steve Richards

Secondly, it's clear that working on technique (catch, stroke shape and timing, streamlining, upper-lower body 'coupling' etc.) will help us retain more of our stroke length as we speed up stroke rate for races. While the former might give you some immediate relief, the latter is more of a longer-term goal, but brings significant pay-offs.

Friends catching up

At a recent get together over lunch, there was plenty to talk about amongst MST friends.

Katherine Daft said that "the group had all known each other through Masters Swimming since 1990. There were "plenty of photos to reminisce over and we assisted Pauline (Samson) to identify some of the faces in the photographs that she had collected and compiled" said Katherine.

(L-R) Perri Brereton 1985, Sheree Chisholm 1990, Judy Hyndes 1991, Pauline Samson 1989, Katrina Henry 1991 & Katherine Daft 1990

One of the earliest photos in the collection was taken in 1987 and was of the Hobart AUSSI Masters Swim Club.

"We could all recall the sharing of accommodation in 1992 at the National Swim Meet in Melbourne.

It comes back to the motto of FUN, FITNESS and FRIENDSHIP! for Masters Swimming.