Staying Motivated

When one bicycles for fitness, regularity is the key to benefits. I am not referring to the kind of regularity discussed in ads for fiber-rich cereals --why else would someone consume something akin to bits of cardboard, even when sugar-coated? Instead, I am referring to frequency of bike outings. You have to take advantage of the fine weather this time of year (well, it starts out fine most mornings) to achieve your fitness goals. But is it better to frequently ride shorter routes, or less frequently ride longer routes?

My experience has been that my fitness, weight, and recreation goals have been advanced more by frequent, relatively short and intense rides than by making the longer, less intense rides commonly done in organized groups. This will seem heretical to some, but what do they really know? Most advice is based on anecdotes, or studies conducted by Phy.Ed grad students and faculty, and becomes conventional "wisdom" by being repeated over and over again in media or internet articles on the subject -- even if the foundation is shaky (i.e. an "urban legend").

So I'll add my own anecdote to the others. Most mornings I ride Hwy 36 for 10K to Amante Coffee, have an iced coffee, and ride the 10K back; about 12 1/2 miles in total. The ride time is a bit more than 45 minutes, considerably slowed by the 2K steep climb back up to my house in the foothills.   Most would consider this to be a short ride. I have made much progress since Spring by doing this most every day, nearly as fast as I can. My tolerance for pain is probably no better than yours, so it helps to have a concrete objective to stay motivated: catching up to riders in front of me and/or keeping riders behind me. There is a palpable sense of satisfaction in doing this that is worth the temporary discomfort. When I return, I am so spent by the effort that my appetite is suppressed, making it easier to limit eating and drinking to moderate amounts immediately after, when I otherwise might have gorged. If the key to weight loss is to keep calories consumed less than calories spent, a short intense effort seems to assist the former as well as the latter.

Most mornings there are a few riders who unwittingly provide the extra motivation. But this morning's "Boulder 70.3 Ironman Triathlon" provided a plethora of motivators (around 1800 registered!),   many of whom were desperately attempting to hold their aerotuck position on those Torquemada Time Trial Bars. Those able to keep their forearms down on them, for extended periods riding on the flats, have an enormous advantage. This is because reducing aerodynamic drag is the most important factor in riding faster on anything but long, steep hills. This is true even when you toodle along at only 15 mph., much less at the 20+ mph speeds typical on Hwy 36 between Boulder and Lyons. Time trial bars were first used successfully by Wayzata, MN resident Greg LeMond, when he pulled-off an upset victory in the Tour de France -- whipping the hapless leader Laurent Fignon by 58 seconds in the final time trial to win the race by 8 seconds. Once Fignon realized that he was falling behind LeMond's intermediate times, he got out of the saddle to put maximum force on the pedals, standing up and rocking the bike back and forth in a display of aerodynamic ignorance that hasn't since been seen in the Tour. One can only hope that French aircraft are designed by more savvy people.

I once worked out with Greg at a [toney gym](#) in Minnetonka, MN, where I learned that he is made out of different stuff than the people I saw this morning. For mile after mile, he could stay down while pedaling over 30mph. I can't even stay down on the handlebar drops for long without neck strain, due to unusually strong trapezius muscles and related issues arising from Olympic-style weightlifting in my youth. So I achieved aerodynamics by riding recumbent bicycles.

In part, recumbent bikes achieve good aerodynamics by being somewhat closer to the ground, where bikespeed-induced "apparent" wind is lower. Have you ever wondered how a fly or other insect can walk along your car's hood while you barrel along at 70mph? The friction from the hood keeps a (small!) layer of air above it stagnant. If the fly rears up for any reason, he is in big trouble, as his creepy little body comes in contact with the apparent wind created by the car [stick your hand out the window to experience it]. More importantly, on most recumbents it is difficult for the rider to bend over forward to limit the drag. But it is quite easy to lean back on a recumbent. On my recumbent, the seat back tilts backward, reducing the effective frontal area presented by my upper body to the apparent wind -- see below:

In the photo, the angle of my upper body is 50 degrees away from vertical. I could recline further, but then my neck (and probably yours, too) has trouble keeping my head in the position required to see the road. Another benefit from reclining is to shift part of the bodyweight off the butt and on to the back. If you don't shift the weight, the butt can start to ache from the constant pressure -- a condition known as "recumbent butt" (no kidding!). Note also that when riding, my legs will straighten out in front of me -- another factor that will reduce the frontal area more than if they hung down on either side of the bike.

For those of you willing and able to tolerate some 9th grade math, I will illustrate the speed gains achievable by reducing the frontal area in this and other ways. At relatively high speed (certainly 20mph is high enough), rolling resistance of the bike/rider combination will be negligible compared to drag as speed reducing factors. Then, the relationship between the speed achieved at the rider's power output P, the effective frontal area A_e (i.e. frontal area times the coefficient of drag) and the density of air ρ is

$$Speed = \left[\frac{2P}{\rho A_e}\right]^{\frac{1}{3}}$$

To use this formula, suppose you figure out a way to decrease the bike/rider combo's effective frontal area by 25%. On a conventional bike, this could be done by getting down on the time trial bars, by spending hordes of money on stuff like aero down tubes, flat spokes or even disk wheels (the latter will lower the drag coefficient and hence reduce the effective frontal area), or by some combination of these things. For the same power level, the rider's speed could increase by around 10%, as shown below:

$$NewSpeed = \left[\frac{2P}{\rho * .75 A_e}\right]^{\frac{1}{3}} = \left[\frac{1}{.75}\right]^{\frac{1}{3}} Speed = 1.10 * Speed$$

A 10% increase in speed is significant: someone riding 20 mph before could now ride 22 mph without increasing power output. The rider would cover almost 600 yards (about 1/3 mile) more over a 10 minute period. Over a 3 mile stretch, one could overtake someone with a lead that big. Note that the bike's weight is not a factor in this calculation. If you could ride 20 mph with the larger effective frontal area, you could ride 22 mph after reducing it by 25%.

On a recumbent, the easiest way to reduce the effective frontal area is to tilt the seat back by an angle θ. Approximating my body by a rectangle (I am built more like a fireplug, but that is harder to mathematically model), a crude approximation for the lower effective frontal area is:

$$NewA_e = (\cos\theta) A_e$$

For example, if I don't tilt the seat back at all, $\theta = 0$, $\cos\theta = 1$, and of course there is no reduction in the frontal area. With my seat tilted back 45 degrees, the new effective frontal area would be around 70% of the old area (because. cos 45 = the square root of 2 divided by 2); a reduction of 30%, and hence could result in a 12% increase in speed, i.e. one could achieve a bit more than 22 mph. I ride with the seat reclined by around 50 degrees, but more radical recumbent designs place the rider in a near-horizontal position, thus reducing the frontal area even more at the expense of rider ease in starting and stopping, as well as potential numbing of the feet. As an exercise, calculate that the speed increase arising from a 50% decrease in effective frontal area would be around 25%. That is huge, and could easily be achieved by use of a fairing, which significantly lowers the drag coefficient.

A caveat is in order: the effective frontal area is created by both you AND the bike. Lowering the seat doesn't reduce the frontal area of the bike or the legs; only the upper body's effective frontal area is reduced. So the cosine calculation probably overstates the reduction in effective frontal area achieved by lowering the seat, and hence overstates the speed increase associated with laying back.

But it definitely *does significantly help.* With my streamlined position and lower bike height, on the flats I passed many of those Boulder Ironman triathletes. On the upsides of hills, some others would pass me but I would patiently crest and then hammer downhill to exploit my aerodynamic advantage. Pretty soon I passed them. Of course, lots of others passed me and kept ahead. The motor still matters!