Running by Feel

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About me:

I am Principal Lecturer in Sport and Exercise Science at the University of Worcester where I teaches on subjects related to exercise physiology and interdisciplinary determinants of sport performance. I gained my PhD by using decision-making theory to explain the way in which intensity is regulated during self-paced exercise. A former middle-distance runner, I have won English Junior and Scottish Senior titles over 3000 m and 1500 m on the track.

800m race, 1m51s – August 1996

1. introduction

This manuscript is for any runner who wants their running experience to be as ‘good’ as possible. ‘Good’ is a very vague term and can include various possibilities: it could mean ‘successful’ in terms of performance against others or against the clock. It could also mean enjoyable, healthy, fun, long lasting, or any other goals you may have. I do not claim that the ideas presented are the ‘best’ – readers will have their own ideas on whatever this is. This book is simply written to reassure those put off by elaborate training schedules, physiological monitoring, and ‘sciencey’ sounding stuff that it is possible to have a good running career without confusing yourself with the mumbo-jumbo. In fact, not only is it not necessary, I argue that such a data driven approach is potentially counterproductive.

You will find no academic citations in the text because I feel they are often little more than ‘speedbumps’ that distract from the flow of reading. However, all ideas presented are based on scientific theory as well as the experiences of myself and other runners.

2. Are you running or 'working'?

It should seem obvious that the fact that some of us voluntarily choose to run would automatically make it a 'leisure' activity. This is very different to work which most of us do largely because we are given money to do it and not necessarily because we find joy in the activity. Whilst many runners maintain a healthy attitude towards their sport, many of us (myself included) fall into the trap of making what should be a recreational activity into yet more work. I start the book with this chapter, because I consider the most important factor in making your running experience 'good' to be the reasons you even do it in the first place.

Recently, generally fed up, I 'retired' from running (not for the first time). Although this was a big decision for me, I doubt anyone else would have noticed. Instead of running, weekday evenings were now spent cycling around the country lanes, lifting weights, or generally doing whatever I wanted, and this became quite an enjoyable routine. Over Easter I was down in Cornwall and on an early Sunday morning took my two girls down to the beach at Gwithian. This is where I spent much of my youth running up and down sand hills after school. I showed them one of the dunes I used to train on, and they were quite impressed by the size and steepness of it, to the extent that they bet me I couldn't run up it now. Challenge accepted, after a couple of minutes warm up I launched into the climb at full speed. Surprisingly this felt pretty good, and quads burning I made it to the summit without walking. In fact, I managed it three more times with a walk down recovery each time. I enjoyed the experience so much, that a couple of days later I was down at the dunes again, trying to recreate my youth by summiting as many of the hills I used to train on as I could. Yet again I had a tremendous morning.

After these two sessions, the old enthusiasm for running returned, along with thoughts of a comeback. Perhaps it was time to start training again? This enthusiasm didn't last long though – training was a chore and within a couple of weeks all motivation had gone, running was boring, and I was back on the bike instead of running with increasing regularity. I rationalised this by telling myself that I must have been mentally and physically fresh for the hill sessions, and that it was unrealistic to expect to be able to train and recover properly when deep into teaching time with a heavy workload.

Whilst there may well be some truth in this explanation, I have recently come across a different line of thinking presented by philosopher (& runner) Mark Rowlands in his book running with the pack (https://www.amazon.co.uk/Running-Pack-Thoughts-Meaning-Mortality/dp/1847082025). Rowlands describes the difference between activities performed for either *instrumental* or *intrinsic* value. Activities which provide instrumental value are performed because you 'get' something as a result, whereas activities with intrinsic value are performed for their own sake and, although you may still gain some positive spin offs, these are independent of the activity itself.

Any activity completed only for its instrumental value is basically 'work'. Thinking about it, this covers most of the things I do. My job is obviously of instrumental value (although I could make the argument that some of the elements of academic work also have intrinsic value), but what about sport & leisure time activities? This seems to depend on the reason for doing something. As soon as 'running' becomes goal directed 'training' with the aim of achieving some specific future level of performance, then it is no longer running for running's sake, but is basically more 'work'. It's perhaps not surprising then that trying to follow a structured training schedule simply resulted in fatigue and loss of motivation. What intrinsic value is there in grinding out a series of intervals in the dark on a cold and windy evening?

In contrast to ‘work’, Rowlands goes on to provide the definition of a ‘game’ proposed by Bernard Suits. A game is anything whereby you voluntarily use an inefficient means of achieving a goal. My ascents of the sand hills were therefore a game. It was worth going up to the top as there were some great views over towards St Ives. However, it would have been easier to get there by walking up the slightly shallower grassy paths to the side rather than by attempting to sprint on soft sand just to get the view. What was gained by using this inefficient means of getting to the top? There was no stopwatch, no results on the internet, and no spectators to massage my ego (unless you count my 8- and 10-year-olds who were far more interested in building sandcastles at the bottom than they were in watching my efforts). My only explanation is that it was fun, precisely because there was absolutely nothing important resting on it. The activity was basically meaningless, meaning that the value in the activity was completely intrinsic – there was no external gain being sought.

All very philosophical, but it has got me thinking a bit about goal setting. Is there a real danger that this process can turn what is supposed to be a leisure time activity or recreation (at least for the vast majority of athletes i.e. those who are not professional) into another job? You could say that you exercise to relieve stress, make you healthy etc, but again this would turn the activity into one whose value was instrumental – you do it *in order* to become healthy. On the other hand, if you run for the purpose of simply doing the activity, then reduced stress, good health, and high performance might be nice positive side effects.

3. The arbitrary nature of goals

Having established the problems inherent in setting extrinsic goals, it is worth going a little further and exploring the essentially arbitrary nature of many of the goals we set for ourselves, especially those that are numbers driven.

Running a long way is not particularly difficult for a healthy able-bodied person. I might not like it, but if I were asked to run a marathon for some reason next weekend, I am sure I could. By taking my time, not rushing, taking breaks when necessary and feeding if required, I would get there in the end, hopefully without doing too much damage.

In a 1975 interview with British adventurer Kenneth Crutchlow, Joe Henderson asked him what preparation he had done for a run from Los Angeles to San Francisco. Crutchlow's response:

"Oh, none at all. I wouldn't do any special training. The challenge for me was to do this totally unprepared- as any man in the street might."

"You want to know my secret? I don't hurry, I don't run very far at one time-only a mile or so, and then I walk for a while. Then I run some more and walk again. It takes the whole bloody day. But I get there."

This sounds much like the behaviour of migratory animals who somehow manage to cover huge distances without running out of fuel. Exactly how this is achieved is uncertain, although the mechanism of teleoanticipation has been proposed. In this model, knowledge of the destination or the endpoint of exercise is used in conjunction with feedback on physiological status to regulate work to ensure avoidance of premature exhaustion and failure to reach the destination.

Such a strategy seems fine if it doesn't matter how long it takes to get to the destination. But what if you need to get there quickly? Speed is obviously of crucial importance to predators and their prey. If the predator is not fast enough, they go hungry, whereas motivation is no issue for the prey. From the point of view of the predator there is a point after which it may become counterproductive to continue a hunt-it's not worth killing yourself for the sake of a meal when there is always likely to be another chance. I recall reading about cheetah's hunting gazelle. Apparently, the chase is always abandoned on achievement of the same core temperature. Presumably if they carry on beyond this point, they risk doing themselves serious damage. The gazelle doesn't have the same option, however. They either get eaten or risk a slow death because of overexerting themselves.

Humans are a bit more complicated though, because for some reason unique amongst animal species [as far as we know] they feel the need to train cover specific distances in specific times, or else in the fastest time possible. The possible explanation please is to be found in this paper by Zig St Clair Gibson (https://pubmed.ncbi.nlm.nih.gov/28478704/). In simple terms, humans need to maintain physiological homeostasis to survive, something we were all taught at secondary school. But there is also the concept of psychological homeostasis. For some reason, to maintain this, people need to achieve certain objectives or goals. For some people, the need to achieve these goals is stronger than for others. Personally, I always felt a very strong 'need' to run a sub four-minute smile [I failed] I trained very hard for a long period of time in this ultimately futile pursuit. My daughter on the other hand, is probably far more sensible than me and shows no desire to push

herself to achieve any such goals. She is perfectly happy walking, cycling, dancing and playing rounders, but displays no interest in beating anybody or anything. Now, it is possible to imagine how these two approaches to life play out. While my desire to achieve specific goals (which I may not ultimate have had the physical 'tools' to achieve anyway) led to frequent exhaustion injury, vomiting beside the running track, sore muscles and periods of overtraining, my daughter is unlikely to experience sport in the same way and will probably have a long enjoyable, non-competitive and healthy relationship with physical activity.

In considering these issues, what strikes me is the completely arbitrary nature of the goal I had set myself – 1 mile in 4 minutes. It sounds nice, but what is 1 mile? A quick look at Wikipedia (I know, I know…) tells me the English mile is derived from the Roman mile which itself consisted of 5000 Roman feet. The English later standardised the mile at 8 furlongs (or 5280 English feet) in 1593. The rationale for this all sounds as clear as mud, but ultimately it seems as though the distance I was aiming to cover in a certain time had something to do with the shoe size of Roman Legionaries. At this point someone could say that English units of measurement are ridiculous, and the metric system is far more sensible. I'm inclined to agree, although then I discover that a metre is defined as a length equal to 1650763.63 wavelengths of the orange-red emission line in the electromagnetic spectrum of the Krypton -86 atom in a vacuum! So, the commonly accepted 'fastest human on earth' is actually the quickest to cover 165076363 wavelengths etc. This doesn't sound quite as catchy as 100m. Don't get me started on the 26 miles 385 yards of the marathon either, which just happened to be the distance from the Queens bedroom window to the track finish line in the 1908 Olympic stadium.

If the distances that have become standard seem completely arbitrary, then so does the system we use to measure time taken to cover them – 24 hours in a day, 60 minutes in an hour and 60 seconds in a minute. This seems to be the result of the fact that the ancient Babylonians made their astronomical calculations in the sexagesimal (base 60) system, and this has stuck. Surely a decimal system for time too would make life much easier, but we are where we are and it's not going to change now.

Regardless of how we have come to have our current systems of measurement for distance and time, it's clear they have nothing to do with human physiology. Therefore, when an athlete sets a goal such as to run a mile in 4 minutes or a marathon in 2 hours, there seems no logical basis for these goals other than that they sound nice 'round numbers' (assuming of course you are counting in base 10). Let's imagine however that ancient Romans or medieval Englishmen had slightly smaller feet. This would make the 'mile' slightly shorter than it currently is. I wonder if I would now be a sub-4-minute miler, or if I would still be just missing out because I had created some kind of mental 'barrier' in my mind. When aiming for his sub-4-minute mile, Roger Bannister worked out what was required to achieve this and did just enough to get his goal. If Romans had slightly bigger feet and he needed to run something like a 3m55s using our current systems of measurement to break the 'barrier', would he still have done it as a result of reassessing what was required?

There are clearly no ways of answering these questions, but I do wonder if current world record performances would be the same in terms of absolute performance if different decisions regarding how to measure distance and time had been made a few thousand years ago.

4. The problem with data

Not only are the numbers we 'chase' rather arbitrary in nature, I would argue that many people have become far too reliant on data to inform decisions recording what they should be doing in their running.

Sport and exercise scientists, as well as athletes and coaches, routinely collect a wide range of physiological and performance data to assist the decision-making process informing the design and monitoring of physical training programmes. Although a vast array of affordable laboratory-based and wearable technology is now available to collect this data, ultimately users must still interpret its meaning and decide how to act upon it. Given the complexity of the factors determining human performance, this is clearly no simple task. In this short opinion piece, I argue that in many circumstances, the decision-making process may be best served by focusing on overall "gestalt" sensations (a phenomenon whereby the mind integrates multiple sources of perceptual information to produce an overall summary), rather than being concerned with isolated variables. Through use of such an approach, it is acknowledged that in complex systems the characteristics of the whole system are often greater than the sum of its parts.

So, assuming we want to collect data on something during training, what should be collected? The obvious answer to this is the various markers of "external load." So, things such as how far or long (volume), how fast or heavy (intensity), and details of interval sessions, etc. These are very simple to calculate and provide an accurate picture of what work has actually been done. However, in isolation these metrics clearly do not provide the full picture - the goal of training is not to go as far or fast as possible, but to provoke an adaptive response. This depends not on the external load as much as on the degree of physiological stress imposed by the session, or the "internal load." It is easy to see how the two can become disassociated. A 16 km run completed by a well-trained athlete in 60 minutes with a howling tail wind would be expected to produce a lower degree of physiological stress than doing the same run in 70 minutes in the opposite direction. To give us some indication of the more important internal load, we need some way of measuring the degree of physiological stress experienced, and also the acute response to this exercise stress. There are now lots of relatively cheap ways of doing this, and commonly used methods include assessment of heart rate, heart rate variability, blood lactate, blood glucose and more. Elite level athletes may have access to more sophisticated technology allowing monitoring of endocrine and inflammatory markers amongst other things. However, despite the availability of this technology, my suggestions as to the most useful data to collect would relate to more subjective measures of internal load and its associated responses, such as ratings of perceived exertion (RPE), muscle soreness and psychological state (e.g. mood and motivation); data requiring no more than a pencil and paper to collect. Why?

You, I and everything else in biology are complex systems and we operate within various environments, each of which also represents a complex system. Essentially, a complex system is one that displays properties that cannot be predicted based on knowledge of its components. These properties are generated by the interactions between the various components of the system, meaning that examination of the various components in isolation cannot explain the behaviour of the system as a whole, which is therefore considered an "emergent" phenomenon. It is the issue of these interactions that presents a problem when trying to decide what to monitor relating to internal load and physiological strain. Consider what happens if you try to predict the path of the balls on a billiard table if someone was to strike them hard with a cue ball: "If you know a set of basic parameters concerning the ball at rest, you can compute the resistance of the table (quite elementary), and can gauge the strength of the impact, then it is rather easy to predict what would

happen at the first hit. The second impact becomes more complicated, but possible; you need to be more careful about your knowledge of the initial states, and more precision is called for. The problem is that to correctly compute the ninth impact, you need to take into account the gravitational pull of someone standing next to the table. And to compute the fifty-sixth impact, every single elementary particle of the universe needs to be present in your assumptions!" (Taleb, 2007, p. 178). So, considering the difficulty in predicting the behaviour of balls hitting each other, consider how much more difficult it is to predict the behaviour of an individual consisting of billions of interacting cells. What this means is that if you want to be confident you are monitoring the relevant data you have to monitor everything. Of course, this is impossible, and we must also consider the possibility that there are crucial variables we have not yet discovered or appreciated the importance of. This is before we even get to the issue of understanding how the numerous components interact with each other. To paraphrase Donald Rumsfeld speaking at a 2002 news briefing - there are the known knowns, the known unknowns, but most importantly of all are the unknown unknowns. In summary so far then, prediction in complex systems is exceptionally difficult, or even impossible, because of availability of incomplete information, large numbers of interacting variables combined with inability to measure them and likely measurement error. Even small errors in measurement of some variable may have dramatic impacts on predictions for the system as a whole. All of this means that measurement of only a handful of biological or performance markers is unlikely to give us the full picture with regards to how an individual is responding or is likely to respond to any training intervention.

At this point somebody might say, "But by recording lots of data I can track progress and identify how things looked when things were going well," an argument that basically says you can see trends in the data. Imagine that you monitor any variable you can measure (variable x) and you notice over a period of a few weeks or months that as x decreases your ability to run a given distance quickly also improves. The obvious conclusion is that x is correlated with performance and is therefore worth measuring. However, you may also have fallen foul of the "Turkey Problem". Taleb (2007) talks of a turkey who for the first 50 days of his life associates the arrival of humans with the delivery of food, and therefore draws the conclusion that the humans have his well-being at heart. On day 51 though the turkey gets a nasty surprise! Substitute "well-being" and "days" with for example, "performance" and "training volume" and you can see how similar errors may be made in interpreting training data. The other issue you have is that by collecting data over a relatively short timeframe you may miss out on the true pattern generating process - what looks linear may in reality only represent a small part of an oscillating pattern over the longer term.

If, as I argue, you cannot rationally decide what best to do based on measurement of isolated physiological variables, what can you do? In any situation where you have incomplete knowledge of options and likely outcomes (or a "large world" environment) then you need to rely on *heuristics*. Heuristics are a method of decision-making that ignore much of the available data and allow humans to solve problems without relying on complex statistical analysis. Crucially, heuristics have been shown to allow individuals to make better quality decisions in complex environments. At the most basic level, heuristics are little more than "rules of thumb." What rules of thumb should be used then? In my opinion, if the athlete isn't motivated to train on a particular day, then this tells me something isn't quite right "under the bonnet." I don't necessarily need to know exactly what but I can fall back on the old adage of "if in doubt, don't." Similarly, if an athlete has delayed onset of muscle soreness (DOMS), I do not need to know the exact levels of Creatine Kinase in the blood to know they are not yet recovered from previous training. My preference then is to focus on the overall experience of the athlete, admittedly based on the assumption that this is reflective of physiological status. Surely this is preferable to making training decisions based on incomplete and not fully understood data?

5, Learn to trust your intuition

If you are not going to use large volumes physiological data to inform decisions about what training you should be doing, what should you use instead? My suggestion is that you learn to trust your intuition.

When I was training seriously the only wearable technology available was a stopwatch. In those pre-GPS days, I would estimate the distance I'd run by using a London A-Z and a ruler. Despite these rudimentary monitoring methods, I seemed to learn to 'know' when I was in good shape. It's difficult to explain how I 'knew', but there was just a certain feeling in the legs and running seemed to 'flow'. It was these feelings that informed decision-making with regards to goal setting for upcoming races. Somehow, I was able to sense if I was in pb shape or not.

It's not just I who has experienced this phenomenon. In his autobiography, middle distance great Steve Ovett frequently talked of how he could intuitively interpret the signals his body was sending. At one point he says:

"I knew that if that session is achieved in a certain pattern, then it is a case of two plus two makes four… I know from how my body feels after that session that I am ready for a fast run. I can do a session through the woods without the benefit of a watch and still know that I am going well. Instinct… tells me I am in shape for something special"

And:

"I believe part of my talent is an intuitive feeling about when I am ready to race… I know from experience and a certain feeling that I am capable of running really well"

Also:

"For many of my races I make what really is a last-minute decision… I do not plan a month in advance: it is almost day to day with me. I have been out on a training run, felt good and got back home to ring round and search for a race."

This intuitive approach to training also seems relatively common. There are several examples, but my favourite two are 1988 Olympic 5000m and Multiple World cross country champion John Ngugi of Kenya, and multiple masters world record holder Derek Turnbull of New Zealand. Ngugi said that "when he felt like going fast, he did; and when he didn't feel like it, he didn't", whilst Turnbull claimed "I don't know about this aerobic business, I don't train. I just run — when I feel, where I feel, how I feel."

These anecdotes all sound very nice, but they also sound rather naïve. Surely a more rational 'scientific' approach would yield superior results? Just think of all the data on exercise it is now possible to collect to inform training and racing decisions. I'm not so sure. Think of the number of possible training sessions that can be devised as well as the number of ways in which they can be combined. Chess grand-master Gary Kasparov once said:

“The total number of possible different moves in a single game of chess is more than the number of seconds that have elapsed since the big bang created the Universe. Intuition is the defining quality of a great chess player.”

This makes perfect sense – imagine the computing power required to calculate the effects of all possible combinations of training sessions to try and work out what is optimal! However, even given the potential limitations of using a rational data driven approach, it can be hard to believe that basing decisions on whatever ‘feels’ right may be superior. I suspect that this is based on misunderstanding of how intuition is developed. It certainly isn’t just a case of doing whatever you fancy – it is far more subtle that that.

It seems as though intuition essentially relies on a process of pattern recognition and interpretation, a quality that can be developed if certain requirements are met. The most important is experience. This is not entirely surprising, as greater exposure to a situation provides more opportunities to recognise patterns that are important (or unimportant). The recognition of what is unimportant is probably at least as essential as what is important, especially in the context of potential data overload. This forms the basis for heuristic decision-making whereby an individual ignores most available data and focuses on a few key qualities of their environment to allow them to make ‘fast and frugal’, yet accurate, decisions. To go back to the earlier Steve Ovett quote (“I know **from experience** and a certain feeling that I am capable of running really well”), this was something he had picked up on. It is necessary to emphasise that when he wrote this, Ovett was an established senior athlete. Earlier in his career he required more specific coaching input from Harry Wilson. Another key factor, besides experience, contributing to high quality intuition is emotional intelligence (because emotion precedes cognition, facilitating more rapid decision-making). Emotional intelligence represents a set of skills and behaviours which can also be developed though experience and exposure to certain situations.

I am sure that some (most?!) readers will disagree and prefer a more data driven approach. However, those who prefer a more intuitive approach should be reassured that this is anything but simplistic and naïve, but rather a sophisticated approach to dealing with large volumes of complex data.

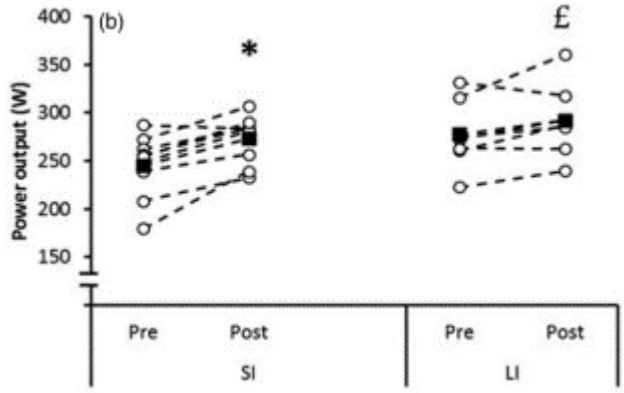
6. **Stop wasting your time searching for something that does not exist.**

I originally became interested in sport science because as an obsessive athlete I really wanted to know how I could run faster. Surely a thorough understanding of how the body works and adapts to exercise would allow me to 'work out' the optimal way to train? In essence I was working under the assumption that the 'recipe' was out there awaiting discovery. Now I am less convinced – in fact I'm pretty confident it's not.

In searching for the perfect training program, there are lots of things that need to be optimised. At the level of the individual session alone, consideration needs to be given to intensity, volume, recovery periods, time of day, nutritional status, mood, motivation, and probably a whole host of other factors. The magic of training doesn't exist solely in the details of a single session though, and how they are put together is likely more important. This means we need to consider overall periodisation strategies, recovery between and sequencing of sessions, rate of progression, and again a whole host of additional factors.

If I am looking for 'scientific' solutions to these issues I can look for two types of evidence – experimental studies or case studies of successful athletes (its interesting you never see case studies of unsuccessful athletes; maybe they are doing the same as the successful ones?).

Experimental studies can be very useful as they are able to demonstrate the superiority of one type of session over another. However, care must be exercised. Take the example of the results from this very nice study by Ronnestad et al demonstrating the apparent superiority of short over long interval training in improving aerobic power. Looking at the overall results there appears a clear 'win' for the short intervals. However, there are varying responses by individual participants. Take this figure showing pre- and post-intervention 5-min all out power output:



For the participant in the long interval (LI) group who started with the second highest power output, the intervention has been highly effective. However, for the athlete who started slightly above him it's been a disaster. So, the overall message to take from the study is that short intervals are 'probably' better for most people except for the few for whom they aren't. How do you know if you are one of the few? I have no idea! Try them and see what happens.

One other comment about this study – it was 10 weeks long and participants were highly trained. Will the apparent superiority of short intervals persist if the training is continued beyond 10 weeks? Would you get the same results in less well-trained participants? Dunno on both counts…

As for case studies or descriptive studies, these are my favourite papers to read, and I find them fascinating. They are very useful as they allow identification of common themes – if there is some common theme present in the training of all elite athletes then this is probably important. However, there are still issues to consider when interpreting these. Take some of the excellent studies describing the training performed by the great Kenyan athletes. All very interesting, but how applicable are they to the athletes I work with who are not Kenyan, are not born and raised at altitude, and have not been running 10km to and from school each day since the age of 6? Perhaps the foundations of the Kenyan success lie elsewhere and are not based in some perfect training programme? Just because Eliud Kipchoge benefits from a weekly long fast run, it does not necessarily follow that you or I will (or even Kipchoges' training partners). What may be of more interest from a training perspective is what these athletes did in the distant past to get them to the position where they can benefit from such training.

If we consider performance a biopsychosocial emergent phenomenon (as we should), then it is clear that science is limited in its ability to provide all the answers to the 'how should I train?' question (I always emphasise to my students just how hard sport science is – people are 'messy' and operate in messy environments). Trying to implement a truly evidence-based program is next to impossible – the best we can do is evidence 'informed'. There will always be a role for the subjective and the 'art' in coaching.

7. **Don't just 'follow the herd'.**

If the perfect schedule is not out there waiting to be discovered, this would seem to make things difficult for us. OK, there is no magic recipe, but surely looking at what everyone else is doing will give us some clues as to the 'path' to follow? Maybe, maybe not…

Trends in training practices change frequently. In the distant past when I was young the mantra was 'quality over quantity', and the dominant training model was the 5-pace method as developed by Frank Horwill and advocated by Sebastian and Peter Coe. Rather than completing high volumes of work, this method centred on regular track sessions performed at paces corresponding to race speeds for various events, the rationale being that the under-distance sessions developed speed and the over-distance sessions developed endurance. The logic behind this method seemed impeccable, and there were no shortage of magazine articles explaining how to implement it. It was also not too difficult to find articles in the scientific literature demonstrating the apparent superiority of high-intensity training, thereby giving this method some legitimacy.

Interestingly, my early coach was not a big fan of this method, having himself been an active athlete in the 1960s and 70's when he had trained with some of the leading athletes of the day. In that era, volume was King and 100-mile weeks were the norm as inspired by the highly successful New Zealand coach Arthur Lydiard who had achieved great success with athletes from numerous countries. Several books on this method were published, and again these referred to scientific studies lending support to the method. Currently the pendulum seems to have swung back towards the high-volume approach, and in particular the importance of 'Zone 2' and 'polarised' training. Once more, it is no great challenge to find scientific literature supporting these approaches.

Despite these swings of the training pendulum, it is clear that performances continue to improve across the range of athletic events. This raises the question of whether or not these advances are primarily due to changes in training practices, or whether something else has been going on. Perhaps the specific details of training are not that important in the whole grand scheme of things provided that the key principles are adhered to?

Prescribing training is essentially a decision-making process, both in terms of the short-term (what should be done at the track tonight?), and the long term (how will we structure the upcoming year?). These are very complex decision to make involving consideration of numerous variables and many unknowns. When making complex decisions, humans will look for information to simplify that decision, and the most obvious source of information is what everyone else is doing. Abhijit Bannerjee developed a simple model of herd behaviour in a 1992 paper, whereby decision-makers looked at decisions made by previous decision-makers before making their own decision, based on the rationale that the other decision-makers had access to important information that they did not. This also sounds perfectly rational, but the result is that everybody ends up doing the same thing! In reality this is exactly what happens in a whole host of human and animal environments, as evidenced by collective behaviours apparent in fields as diverse as pedestrian movements, investing, voting intentions and, as we have previously argued, athletic pacing. I see no reason why this should not also be the case with regards to athletic training, and it is easy to see how things would unfold:

athlete is successful using method > articles are written about this method > other people start using this method based on the belief that the originators knew something they didn't > some of these people are also successful > more articles are written > etc etc

Hey presto! In no time at all, this new method has become the dominant practice and found its way into the coaching literature.

Now, if I was to adopt a new conditioning practice, I would want good evidence that it was likely to be effective. The easy way to find out what is the effective is to look at what the top athletes are doing – surely they would not be so successful if their training was 'wrong'? So, if I see (for example) that the best are training for 10 hours per week, mostly at low intensity, then the obvious conclusion is that I should do the same (see herd principle above). The problem comes though when you start to wonder how many athletes also train for 10 hours per week yet fail to achieve any success at all, or worse still fail to even make it to the start line due to illness or injury. No one writes books about sporting failures that nobody has heard of, but I would bet that the vast majority of athletes attempting to succeed at the top-level fail to do so, despite trying very hard and doing everything 'right'. It may be the case these athletes simply do not have the necessary 'talent' to succeed at the elite level and that they have still achieved their own personal potential. However, it is also possible that they may have succeeded had they trained differently and not simply followed the herd. Either way, the end result is that our understanding of what needs to be done to achieve success (at whatever level) is clouded by survivorship bias-we look to the survivors and ignore the collateral damage.

There are no easy solutions to these issues, but we should all wary of allowing herd behaviour and survivorship bias to weigh too heavily in our decision-making processes.

8. Fartlek

As is probably clear by now, I have spent a lot of thinking and reading about training for endurance events. Initially as a very motivated competitive middle-distance runner aiming to maximise my ability, and latterly in an attempt to find a way in which I can get my body into a state whereby even making the start line of some low-key club events would be tremendous. For my first few years in the sport, I had a coach to do all the thinking for me, but ever since going to University I have effectively been self-coached (initially with advice from a couple of other athletes / coaches whose opinions I respected). During this time, I have experimented with many different forms of training, some of which produced better results than others. However, despite this practical experience and my 'research', I can honestly say that I don't know what method of training produces the best results for myself, let alone what would be most appropriate for anybody else who were to ask me for training advice. Having said this I do know what definitely doesn't work for ME – daily intervals, high mileage, or trying to train on a LCHF diet have all produced catastrophic results requiring substantial recovery time (but… others have achieved great success using these methods). To complicate matters, the training that seems to produce good results differed at different points of my 'career'. This makes sense as to continue to provoke further adaptations, the stimulus needs to be continually changed i.e. those who train the same remain the same!

So – 'what training should I do for best results?' seems an almost impossible question to answer. This would be the case at both the level of the individual session (e.g. should I have 45' or 60' recovery between my 400m reps tonight? 10 or 12 reps? (why do people always use nice round number for reps and recoveries? I've never heard of anyone doing 9x550m with 32' recovery)), and at the level of the season / career. Given that the human body is so complex and in turn operates in an even more complex environment, then the responses to any training stimulus may be wildly unpredictable, so trying to write an annual plan may appear questionable, especially if applied generically to a large squad of athletes. At this point some people may well be thinking that any good plan is flexible and open to modification based on results and progress. This is a viewpoint with which I entirely agree. However, how are we able to tell if the initial 'plan' is most appropriate in the first place? Furthermore, what data is used to determine whether or not modification is required?

Given the complexity (and essentially educated 'guesswork') inherent in putting together a physical training schedule, I am inclined to consider that in many circumstances, the 'best' training for an individual is to simply do whatever they feel like, provided this leads to a sustainable .routine that is enjoyable. But – what if the athlete doesn't want to do anything sometimes?! So be it – I have personally never had a good training session or race when in a bad mood or not wanting to do anything. Going out and slogging away a few miles or running a few half-assed reps never goes well and only makes my mood worse. Such a spontaneous and unplanned training schedule is likely to be characterised by big random fluctuations in intensity and volume, but this is not necessarily a bad thing.

Actually executing a training schedule consisting of 'whatever you feel like' may be harder in practice than it sounds. However, the concept of Fartlek (Swedish for 'speed play') was introduced in the 1930's, and the more I think about it, the more it feels like the perfect method of conditioning for endurance athletes. (I use the term 'conditioning' because I acknowledge that in the serious high-performance athlete, other more specific forms of training are required – there is no way you break the world mile record without doing lots of running at the exact pace required and becoming very familiar with running hard continuously for the required duration).

Fartlek was originally performed in the forests of Scandinavia and was developed by the Swedish Olympic Coach Gosta Holmer who coached world mile record holders Gunder Haegg and Arne Andersson.

According to Holmer (cited in Temple 1980):

"Fartlek brings us back to the games of our childhood where nature decided that we should expose our inner organs to much effort, so that our bodies will develop….. The runner gets to learn his ability. He doesn't tie himself up on a certain task (such as a run of two English miles on the track, or three separate 220 yard sprints at a certain pace) but he is forced to explore. It is not the fixed course that makes a Professor out of a student, but the students spirit of exploration, his studies of other explorers and his friends with them. It is the same thing with an athlete. Fartlek is such a field of investigation. Fartlek is rich in contests. Richer for the athlete with a creative power and the ability of deciding where there is a limit for his strength. That is to say, the ability to decide for himself when the training is no longer improving him but destroying him instead".

This all sounds great on paper, but aside from a couple of Swedes in the 1940's has anybody else achieved anything on such an approach? It certainly seemed to work for 1960 Olympic 1500m Champion and former mile world record holder Herb Elliot who remained unbeaten over his entire career. Elliot was coached by Percy Cerrutty who stated that '*nothing must be dictated, fixed, or regimented' and 'high performance could only arise from spontaneous uninhibited expression'* (How to be a Champion, 1960). Similarly, former master's marathon world record holder Jack Foster of New Zealand said that he didn't 'train', but simply ran 3-22 miles each day depending on how he felt. If he didn't feel like running, he didn't or else did a few miles on the bike, and he just let the races take care of themselves.

This might all sound a bit haphazard, but is it really any less sophisticated than following some pre-determined schedule based on incomplete understanding of complex adaptive processes?

PS – a bugbear of mine. The original concept of fartlek was that it was spontaneous and not planned in advance. A session of something like 10x 1 minute on / 1 minute off is therefore not a fartlek session. It is an interval session that just happens to be performed somewhere other than the track. I suppose a 'true' fartlek session could end up consisting of something looking very similar to this, but it wouldn't be the result of preplanning.

9. So… how do you train?

Firstly, the principles outlined do far describe an *approach* to running, not a *method,* so this final section cannot be overly prescriptive.

First of all you will need to decide what types of session you need to do to make your preparation well rounded. There will be some debate as to what the requirements may be, but for arguments sake let's say that somewhere in the preparation of an endurance runner you need steady running (lots of it), long individual runs, 'tempo runs' (I am neutral as to the requirement for these, but if you think they are important – go ahead), VO_2 max intervals (if that's what you call them), short speed work, and rest. Middle distance runners will at some point probably need to include some race specific interval work too. Bear in mind that there are probably numerous ways to achieve similar adaptations (e.g. VO_2 max can be developed using either short or long intervals providing intensity and recovery is appropriate. You could probably get most of the way with fartlek).

Understand that your muscle have no idea what day of the week it is. Apart from reasons of convenience, it makes little sense to work on a 7-day repeating schedule. One of the 10 commandments is not "Thou shalt respect the Sabbath by doing your long run with the guys from the club". The trick is to apply further stress when you are ready for it. This requires very careful monitoring of your physical conditions. Monitor the usual suspects – subjective well-being / mood / sleep quality / morning HR / soreness. If you don't want to train on any given day, consider that perhaps you shouldn't.

If you do decide you are going to train, what do you do? Here is my suggestion – start off by running very easily for 15 minutes. If it feels rotten, turn around and run back home. If you feel good, then you have now had a decent warm up for the rest of the session. You can now choose. If you feel ok, continue with a standard 'bread and butter' run (e.g. 45 minutes to an hour). If you feel good, then you could either go long (90-120 minutes) or fast (tempo or intervals). Alternatively, the option of a spontaneous fartlek run is aways available too. Recognise that this may well lead to uneven clustering of similar sessions. So, you could do e.g. intervals 4 times in a 10 day period, but then not again for 3 weeks. At the end of the month, you have done the same number of interval sessions as someone who schedules one session a week. Is one necessarily superior to the other? Over a long time-frame, probably not.

How do you ensure progression in the training. An idea I have picked up from Brent Rushall's writings on swim training, is to simply encourage athletes to do as many repetitions as they are able in any given session. There is on important caveat however. The athlete needs to stop the session as soon as there is any deterioration in technique. This means the athlete is encouraged to challenge themselves whilst simultaneously reducing the likelihood of doing too much and overreaching. If the athlete is having a bad session and struggling, then it simply becomes a short session.

In a nutshell that's it. Certainly not the 'no idea' plan, but potentially a way of organising training in a manner that is individually optimal. All that's required is an understanding of what the training is trying to achieve, and honest assessment of your state on any given day (as well as some common sense – it would be moronic to cluster a bout of high volume / intensity work into the period shortly before a key race)