No speed limits

by Frank W. Dick

NSA © by IAAF
11:2-3; 23-27, 1996

The author draws upon his wide experience of coaching and advising athletes and games players to show how 'speed' can be interpreted in many different ways, according to the demands of the specific sporting activity concerned, and how what are commonly recognised as endurance activities often contain a good element of speed and, likewise, how 'speed' events often have a good measure of endurance. The demands of a sport should, therefore, take this into account.

A description is given of several areas in which special ways of training for speed can enhance an athlete's performance and of the factors upon which the development of this specific quality of speed is dependent.

Several top-class sportsmen and women are cited, as examples of how the natural characteristics of their sport influenced the type of speed required and the methods used to acquire it.

Photo: Scuola dello Sport

Frank W. Dick O.B.E. is President of the European Athletics Coaches Association. He was Director of Coaching for the British Athletic Federation from 1979 to 1994. He is now a free lance consultant working with several top athletes of different sports.

Whilst it may be useful, at a very general level, to describe some sports as "speed sports" and others as "endurance sports" or "strength sports" and so on, the fact is that no sport is purely one or another of these descriptions. The basis of such classification is probably the notion of what constitutes the main determining factor for achievement in this or that sport. This, however, can create a false picture of the demands of a sport and of what the athlete needs to gain those fine advantages required to make a winning difference. I believe that this is very much the case when considering the place of speed in the preparation plan.

Let me take two examples to underline this point. I guess you would agree that any sport which can last over 6 hours and 40 minutes of physical activity must be an endurance sport. But that was the length of the Becker-McEnroe Davis Cup match in 1987 – and I'd suggest that speed is a determining factor from time to time throughout the "endurance sport". Then there is speed skating as opposed to figure skating. But is speed not a determining factor in figure skating? Certainly speed is a major consideration in executing triples rather than doubles in jumps – even if it is rotational rather than linear velocity.

Perhaps the problem is our concept of what speed is. It is a broader concept than metres/sec of linear speed, be it in sprinting, rowing, cycling, skating, skiing, swimming or whatever, and it is much more than the release/launch speed of implements, speed of serve etc. It must embrace speed of response, be that to a starting pistol, to the attack of an opponent, to a crisis and so on. It must also embrace speed of decision making and correct option selection in solving a problem set by an opponent, whilst simultaneously setting one for that opponent – whether an individual or a team. It is as much about reducing the timescale for the opposition to make decisions, choose options and perform techniques as it is about performing those functions more quickly oneself. Thus, imposing a stressor to interfere with the opposition's game plan and technical effectiveness is as much related to challenging

their speed as it is to increasing the timescale for your own strategies, tactics and techniques. It is, indeed, all of those things and more. I believe that, in the final analysis, this rather more expansive concept leads to the conclusion that speed is, more often than not, what constitutes the winning difference.

So, how can we approach the development of an athlete's speed to make it more effective in his/her arena?

There are seven areas in sports performance where training will enhance speed:

1) Reaction to a signal

- The sprinter's reaction to the gun.
- The goalkeeper's reaction in saving a penalty.
- The receiving tennis player's reaction to return a serve.

2) Capacity to accelerate

- The tactical speed change of the middle distance athlete.
- The soccer player gaining a metre over an opponent in 20 metres.
- The cyclist breaking away from the leading group to steal a late race advantage.

3) Capacity to adjust balance rapidly

- Passing the ball in soccer and then moving to support the player now with it.
- Making a tackle in rugby and then moving to support or attack in 2nd or 3rd phase play.
- Returning a ball in tennis and then anticipating the opponent's response options and moving to reduce them.

4) Achievement of maximum speed

- Maintaining technical efficiency at the athlete's sprinting speed limit in hurdling.
- International time scales vs. club timescales in delivering techniques and tactics.
- Maintaining pedal pressure when the bike is at maximum downhill speed.

5) Capacity to maintain maximum speed

- Extending duration beyond 10 metres (0.83 for men and 0.94 for women) once maximum speed is achieved in a 100 metres race (Christie).
- Ball handling at maximum sprint speed while pressurised by the opposing players.
- Continuous pressure rhythm play – accepting pressure to inflict pain.
- Holding peak concentration at maximum speed of 270-330 km per hour and maintaining pressure/control in contesting the lead, whilst lapping other cars in Formula 1.

6) Capacity to limit the effect of endurance factors on speed

- Anaerobic efficiency in the 400 metres home straight.
- Anaerobic efficiency in the physical sections of Formula 1 circuits, as the race unwinds and where HR never falls below 180 beats/min for approximately 90 minutes.
- Anaerobic efficiency in long rallies in the 5th set at Roland Garross.

7) Capacity to choose correct action options

- Deciding when, where and how to overtake in a race.
- Deciding which player can use the ball best for the team and how to give him/her the ball.
- Deciding how to return a ball and create a problem for the opponent at the same time.

As with all learning, technical development is a continuing process over time measured in years, not days. Carefully guided learning will produce technical speed development well beyond previously accepted "age limits". For example, Christie and Ottey are providing lifetime best performances in their mid thirties. Formerly, athletes were believed to reach their peak in their mid twenties. More and more performers, in an increasing number of sports, are "speed maturing" later into their 30's.

Development of speed is dependent on several factors, the main ones being:

1) *Innervation* – The fundamental capacity to move limbs at maximum velocity
2) *Elasticity* – Using the elastic properties of the musculo-tendinous apparatus
3) *Biochemistry* – alactic anaerobic energy pathway
4) *Muscle relaxability* – Capacity to relax muscle and allow stretch
5) *Willpower* – Capacity to concentrate on maximum voluntary effort
6) *Action Acceptor* – Capacity to make a rapid selection of the appropriate action from relevant cues and the technical competence to perform that action
7) *Environment* – Those aspects of environment which facilitate or promote speed of performance of a technique or techniques.

Training for speed development

Clearly, the content of the training programme must reflect relevant training theory. The main considerations are:

1) Training load intensity

Having learned and developed a sound technique, it is then practised at various intensities within 75% and 100% of maximum speed. Maximum speed may be improved by "obliging" the performer to break through his/her speed barrier. Invariably this compromises the synchronization of limb/component movements within the overall technical "model". The coach, therefore, must establish an ebb and flow of intensity from unit to unit while developing speed. This allows the performer to re-establish technical stability at a comfortable speed, then to push it beyond 100% to go for new frontiers – then return to what is comfortable – then go for the current 100% – then return – and so on.

2) Training load volume

Repetition is the mother of learning; so the more we can practise new levels of speed, the greater the probability of getting quicker. But this means that the performer must have a foundation of strength, endurance and, of course, technical stability to perform repetitions of relevant quality in numbers. Practising quality repetitions demands this – and, in addition, demands very careful design of training units. This means the right decisions on intensity (% of maximum speed), volume (numbers of reps and sets, duration of stimulus in terms of distance or time) and recovery (sufficient to guarantee target quality in every repetition).

3) Training load density

Repetitions of the quality needed for speed development require that the performer comes to each repetition able to take advantage of the supercompensatory phase of the training stimulus.

This means starting the next repetition recovered from the immediate and early residual effect of the previous effort, but with all systems sufficiently aroused to produce maximum effort. Given that performers remain warm, recovery periods should be 4 to 6 minutes. However, in the interest of sport specificity, this may vary substantially – from intervals appropriate for the high intensity activity of a game such as rugby, to breaks between games in tennis, or team rotations in ice hockey, or between trials in track and field jumps/throws disciplines.

So what does this all mean in practice?

On an occasion such as this, talking as a coach to coaches, I would like now to share my personal experience of working on the speed development of performers in different sports, together with some personal observations. This should serve as a useful vehicle to relate theory, practice and perspective.

1) Back to the future

One of the most common oversights in coaching is to recognize a problem, to know the priorities required to solve it, but fail to prepare the athlete sufficiently to perform the practices effectively. We have to take time to go back in order to go forward.

Jon Tiriac invited me to help develop faster footwork for Boris Becker. I studied videos of his footwork and that of other present and past top players. A decision was made on movement patterns to be developed and specific exercises and routines for those patterns and for speed. Very quickly however, it was clear that a preliminary conditioning programme was required for the muscles which were synergists in specific movements, so that those special exercises could be used. This was done, and the objective was achieved.

2) Now and then

In the interactive sports, the worst thing a player can do is to perform a task and then become a spectator, although the game is still going on. For example, after a tackle the player is of no value to the team if he remains lying on the ground; or if, after playing a stroke on the tennis court, a player stands still, he leaves the opponent with a very generous set of options from which to choose a winning reply.

Players should, instead, develop a playing attitude where they do something now and prepare immediately for what to do next. This, I believe, is best achieved as follows:

(a) 'Now' – the development of individual techniques e.g. basic strokes, and then variants, techniques for giving the ball; techniques for taking the ball/tackling, etc.

(b) 'And' – the use of practices that require a series of tasks to be performed at speed, i.e. against the clock or opponent. The tasks should not require decision making, because the object is to establish the immediate move after a task, adding 'and' to 'now'.

(c) 'Then' – the development of quality in performing a second task under the pressure of tight timescales. This is like learning how to put a phrase or sentence together rather than randomly selecting words.

The key is (b) – Steffi Graff and Monica Seles demonstrate some of the best footwork in modern tennis. When a stroke is played, the feet are dancing immediately, ready to take the player where she needs to be. In my opinion, the best coaching in this respect is to be found in Spain, where a boxing coach works on footwork with several of their top ranked tennis players. Their mobility and style of play on clay reflect this.

In track and field, hurdlers must learn early to be active with the lead leg on running off the hurdle and use the trail leg action to promote this. Hurdlers must, then, in training have 10 metres to sprint beyond the "last" hurdle.

Soccer players must pass the ball and then move to receive it in a better position to use it effectively for the team. Rugby players must move immediately into a sprint after a tackle, in order to maintain a continuous influence on the game.

Drills and practices in competitive situations prepare players physically and mentally for this.

3) Solve and set

In games such as racket sports and combat sports, with each piece of play there is an extension of 'was and then'. The opponent sets a problem for the player to solve, and, in solving it, he/she must set one for the opponent and reduce the opponent's capacity to set a new one. Here, the player must think like a chess player, measuring this or that consequence of a particular move in response to the opponent. The assessment of consequence is based on the options open to the opponent and on the opponent's technical preferences and competence in those options. When you reflect on the speed at which such assessment and movement/action decisions are made, Boris Becker is quite right when he says "It's 90% anticipation". However, it's educated anticipation – a response rather than a reflex, and the player must have the 'Now and Then' approach before anticipation of the 'Then'!

4) Speed reading

Bobby Charlton, in his final two or three seasons, very seldom had to use sprinting speed beyond 10 metres, because he moved off the ball to prepare for his next involvement. In 1964, the Polish Fencing Master defeated each of the nation's Olympic gold medallists in an exhibition on their return from Tokyo.

Both of these men learned, through their years of experience, that, to reject false cues, it was quicker to apply "90% anticipation". Neither was as athletically fit and fast as their younger opponents, but they could read the game more quickly.

Fitness work, especially in the form of strength and speed combinations, is often used as a safety net to compensate for lack of game 'reading speed'. Future development will see very rapid improvements in individual and team sports, when athletic speed and 'speed reading' are developed simultaneously. I believe that modern technology, combined with the creativity, imagination and skill of coaches, will make this possible. For example, the interactive capacities of virtual reality make it possible to put players into situations where they have to 'solve and set', to think 'now and then' and to 'read at speed'. On top of this, players can be trained to visualise game crises and think through solutions by means of relevant sports psychology programmes.

5) The Big Bang theory

In track and field sprinting over 60 to 100 metres, etc., the objective is sheer sprinting speed, with the technical models this implies. At maximum speed through to the finish, "control" signifies the sole objective of form at speed. At the end the athlete brings himself/herself to a stop in his/her own time. In field sports and other interactive sports involving sprinting speed, 'control' refers to a state of readiness to change direction or perform an additional task – giving, returning or receiving a ball etc. At the conclusion of most runs there is some sudden arresting of motion, through impact with another player or to complete a task before sprinting to perform another – and so on. This means that the basic sprinting model of running at full height, with full range of arms and leg action, is seldom relevant in the game itself. It is for this reason that there is little point in comparing track sprinting with sprinting in field games. A balance has to be struck, then, between development of a greater maximum speed, using orthodox sprint coaching methods, and relating running action to sport specific demands, where the centre of gravity is kept lower, strides are shorter, and where legs and arms may be involved in other skills on the move. That balance is better achieved in separating the period of 'pure sprinting' and 'sport specific sprinting' in the year plan. If not, there may be problems for the performer regarding both technique and the risk of injury. In reference to the latter, hamstrings are especially exposed to strain or even damage.

6) Think twice

The situation can and does arise where an established technique, and the biomechanics on which it is based, compromise further speed development and, therefore, the benefits it will produce. For example, in the triple jump, athletes who build their performance on a model which requires long foot contact time, to apply strength and transfer of momentum, eventually reach a performance barrier, which can be overcome only by developing greater elastic strength – and then only by small increments; or by changing the arm action and synchronization with the free thigh/striking leg. This initially regresses performance but then creates a platform for considerable improvement.

This calls for a very difficult kind of judgement from the coach, because the technical changes must be correct and the coach must be capable of instilling them successfully in the athlete. The performer may experience a motivation trough, and there may be considerable commercial pressure not to take sufficient time out to break down and then rebuild technique. In other words, there is a big risk – and you normally only have one shot to get it right – in what is really a short period of an athlete being at peak. You see, most of us start off coaching athletes in techniques which are considered best at that point in history. Our performers can then be well into their careers when the need for change becomes evident. If we want our players to be the best, however, the change is easy:

Take the risk of winning!

7) Perfection is always on the horizon

What made Ayrton Senna so different compared with other drivers, was that he was never satisfied with being faster than others. He wanted to be faster than himself. So, in qualifying, he would set the lap record – then proceed to drive to beat it, until he had several laps faster than any other driver. Most other drivers, if they achieved a lap record, would see if anyone else could beat it before trying to better the new target. Senna, then, used the qualifying stages to rehearse consistent and persistent pursuit of perfection – a perfection that he was defining himself. This allowed him to rehearse at maximum speed the qualities required for the race. This is a critical aspect of mental attitude. Just enough is not good enough to be the best. Performers must aim to go over speed's horizon. A lifetime best, a fastest ever performance, is not a terminus, it's a milestone. Performers must, then, constantly practise having a feel – a hunger – for speed. This can be pursued through activities ranging from simple reaction type games through to participation in other sports in which speed is a critical component.

8) Basic Instinct

The whole point of building practices which reflect 2, 3, 1, and 7 into training programmes is to make a range of patterns of play and a "speed attitude" instinctive. If it is not practised, it will not be instinctive. If it is not instinctive, the rhythm of the game will not test the opposition. In training, then, on a basis of work for 1, 5 and 6, and the general fitness programme required to maintain that rhythm for the duration of the contest, those practices are pursued and, if necessary, policed to the point where training sessions are approached with the physical and mental toughness required for the competition itself. No spectators are allowed on the field in competitions – none should be there in training!

It is quite clear that anyone in a sport involving running should be coached to run faster; the gain achieved is far more than that which comes through the development of other technical aspects. A well passed ball will cover the distance faster than Linford Christie – but his speed would take him to any point in the field quicker than any other player and so make him more likely to be able to influence play. I believe that time must be committed to the development of sprinting/running speed in every player, and to the fitness base required to use this time effectively. I also believe the same applies to other sports, whether on skates, skis, bicycles, wheelchairs, etc., and whether on or in water – but this is only a part of speed development. The total programme must embrace at least those several points raised here. Coaches must develop such programmes and take them to a 'now' where performers, individually and collectively in teams, produce a breathtaking rhythm of play to create new concepts of speed and an exciting future for achievement in sport.