

# SPEED TRAINING—AN AID TO JUMPING AND VAULTING

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by David Lease, Scotland

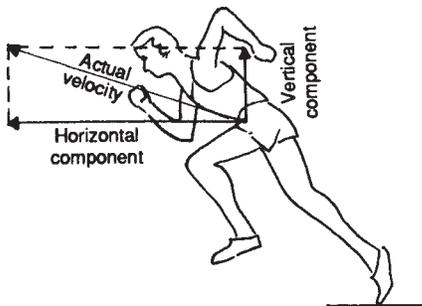
*In this offering Scottish national coach Lease outlines means of speed development and the application of speed to the approach in the horizontal and vertical jumps. A basic primer particularly valuable for the prep coach. This article originally appeared in the June, 1989 issue of the British journal Athletics Weekly.*

Jumpers and vaulters wish to extend their flight by distance, height or time.

The extent of the flight depends on the creation of two forces:

- a) The vertical, upward force.
- b) The horizontal, forward force.

The angle at which the jumper takes off is critical to how far he flies. This angle depends on how much of each force is present at takeoff.



If we can increase either of these two forces we can improve the extent of the flight, but to improve the distance of the flight we must:

- a) have the correct angle of takeoff
- b) increase the horizontal force.

However, with increased speed a problem arises for athletes. More stress will be placed on the yielding muscles at takeoff. If the muscles of the takeoff leg and lower trunk cannot accept this extra stress the takeoff will be at best inefficient and at worst the leg will collapse. Also, the faster one runs the more difficult it becomes to add the necessary vertical component. This is why a high jumper's runup is much slower than a long jumper's. The runup must therefore be performed at optimum speed but that optimum speed should be as

near flat-out as possible.

Speed is only of value if it can be used.

To summarize:

- 1) We need to improve speed (horizontal velocity).
- 2) We need to improve jumping ability (vertical velocity).
- 3) We need to improve yielding strength (elastic strength) to accept and redirect the forces.

If we manage these and increase the effectiveness of the takeoff it will present our performer with a second problem. He will be given more time in the air. If the old skill timing is used it will disorient him—over rotate for example—disastrous for the high jumper, gymnast and long jumper.

So:

- 4) Skill improvement or skill changes dictate the rate at which the new takeoff and runup can be introduced.

## IMPROVING HORIZONTAL VELOCITY

To improve forward speed into takeoff all we need to do is run faster. . . but we may be running as fast as we can! Can we improve, and if so how? Running is a natural activity and one we have practiced daily since the age of two but no one runs to the best of his ability, naturally. The individual running action is often one of compromise.

Few people run very fast because:

- a) They rarely practice running really fast.
- b) If they run, the surface on which they do rarely allows for really fast sprinting.
- c) Forces are often misdirected—splayed feet, knocked knees.
- d) Forces are often absorbed into a weak trunk.
- e) Muscles generating the forces are not as strong as

they might be.

f) etc., etc., etc.

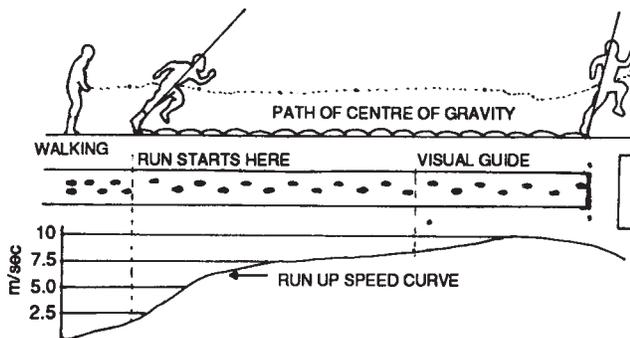
It is not difficult to improve someone's sprinting if they are prepared to train correctly.

We improve sprinting speed by either:

- 1) increasing the frequency, or
- 2) increasing the stride length,  
but preferably both!

This can be done by improving one or all of the following factors:

- 1) SKILL of sprinting
- 2) STRENGTH of the muscles involved in sprinting
- 3) SPEED of movements
- 4) SUPPLENESS of joints.



## THE SKILL OF SPRINTING

Two mechanical principles are important to enlighten us as to the best running technique. (Not style! Everyone implements the correct technique with their own physique and talents. That is, style and individuality is vital.)

Running is a series of takeoffs requiring horizontal and vertical forces.

At the beginning the sprinter is still.

Only forward velocity is required (he certainly does not wish to go up in the air!).

This means the center of gravity must be well in front of the feet (the points of contact through which the forces will be transmitted).

The performer must lean well forward at the start.

This also demonstrates that sprinting is a PUSHING activity.

As the runner gets faster, forward velocity accumulates to a point where the athlete would fall on his face. Balance is critical and the vertical component becomes more important to produce the correct takeoff angle. The running posture has to become more upright.

So it is with the runup for a vault or jump.

Because each push of the foot contact is slightly to the side of the body (off center) it creates rotation in the body. This in itself is not too important because

each stride balances the last (or should, and that must be checked!).

To each action there is an equal and opposite reaction. To each change of rotation there is a reaction and an opposite rotation takes place in the upper body. Once again these forces balance and are not important in themselves.

However, the muscles of the trunk are massive and slow moving compared to those of the limbs. If the reaction to the leg action is left to the trunk muscles it can hinder the running speed. The arms are fast moving especially if bent where the lever is kept short. The arms should absorb as much of the reaction as possible.

It can be argued that the first part to move when an athlete leaves the blocks is the hands. Therefore the arms lead the legs on a correct arm action and the legs will follow. They become the reaction.

To summarize:

- 1) Arms dictate the running rate.
- 2) Arms can dictate stride length (to some extent).
- 3) The trunk should remain as still as reasonable.

To develop the correct technique of running, athletes break the movement into "bits". They then attempt to absorb the correct action into the whole.

## DRILLS FOR POSTURE AND CORRECT ACTION

Running at 75%-80% of full speed (800-meter speed) Run 40-60 meters.

### 1) *Run Tall*

Coaching points: The runner should feel he is hanging from a string attached to the crown of the head. Totally relaxed—especially neck and shoulders. Try to run above the ground—totally stretched up!

### 2) *Low Shoulders and Right-Angle Arms*

As drill (1) but add: Relax and lower the shoulders. Spread the back wide. Move the arms backwards and forwards. Elbows at about right angles. Elbow to shoulder height at the back balanced by hand-to-shoulder height at the front.

### 3) *Pushing*

As drill (1) and (2) run upright but add: Push the ground away with the legs, flicking fully with the feet. It is essential to lean forward a little.

### 4) *Strike the Ground*

As drill (1) and (2) run upright but add: Attack the ground with the feet—bring knees higher. Strike rate will increase and running will become faster.

For jumpers it is wise to add a fifth but rather artificial drill.

### 5) *High Knees*

As drill (1) and (2) but—move forward at walking pace, running with exaggerated high knee action at least to right angle.



**Leroy Burrell, 9.94 sprinter and 27-5½ long jumper.**

Do not lean back.

These sprinting drills should initially be a training session of their own. Eventually they become part of the warmup.

Ultimately each drill should be so integrated into the whole running action that no one drill is recognizable as being practiced.

However, each drill represents a part of the runup:

- Drills 1 and 2 are part of all aspects but,
- Drill 3 is extensively used in the first phase.
- Drill 4 is extensively used in the middle phase.
- Drill 5 is extensively used in the final few steps into takeoff.

The running action needs to be practiced at a faster and faster rate, gradually building speed through each run, through the session and through the year. It will be necessary to return frequently to the practices at 75%80% effort to review improvements especially as the performer develops physically.

## STRENGTH

The fastest runners are born rather than made. The reason is the composition of their muscles.

Sprinters are made of fast-moving muscle—white fibers.

Endurance runners are made of muscle which efficiently uses oxygen—red fibers.

However we are fortunate:

- a) Both these types of fibers can be strengthened.
- b) There are other types of fibers that can be trained to behave as either white or red.
- c) Strength can be vastly improved simply by improving the efficiency of the nervous system. (If the body is stressed new nerve-muscle connections grow. As a result strength is increased by improved coordination.)

It is important to appreciate that the response of the body to stress is very specific. If you train the muscle for endurance the new parts that grow will be good for endurance! Don't ask Allan Wells to run a marathon or Liz McColgan to run 100 meters and be good at them.

In jumping or vaulting runups we are looking for an improvement in white muscle fiber and the nervous connection to them. The exercises must therefore reflect this.

Strength can be gained by training in three different ways:

- 1) Increasing the number of repetitions of an exercise. Repeating the same number of repetitions but decrease the time.
- 3) Repeating the same number of repetitions but increase the weight lifted.

It must be remembered each method will have a different effect, which may be critical. e.g., jumpers and gymnasts do not wish to put on too much weight (gymnasts and pole vaulters especially in the legs). Therefore we need a method that will produce maximum power in the legs, but will put on the least amount of weight!

Strength requirements of a jumper:

- 1) Strong stable trunk
- 2) Powerful limbs (power strength x speed)
- 3) Elastically strong limbs
- 4) Yielding strength for takeoff (and landing—triple jumper and gymnast)
- 5) Strength through the specific running and takeoff action.

### 1) A strong stable trunk

Areas to be strengthened are:

- a) muscles of the spine
- b) muscles of the stomach
- c) rotational muscles of the trunk
- d) where the spine joins the pelvis
- e) where the spine joins the shoulders.

These muscles all protect vulnerable parts of the body. To load these parts with heavy weights, especially in young and growing performers, can be damaging. Initially the exercises should use body weight only and stress increased by gradually adding repetitions and eventually more sets of repetitions. (Strength

Endurance).

Even adult Scottish sprinters use this system as a circuit.

The exercises are done smartly.

Press Ups —Shoulders—spine, back  
Chin Ups —Stomach, spine—pelvis, rotational  
Treadmill —Stomach, spine—pelvis, back  
1/2 Squat —Spine—pelvis, legs  
Speedball.

## 2) Powerful Limbs

It is important not to load the spine of young athletes. Strength work once again should be by bodyweight and increased repetitions. However, older competitors 16-18 can and should start working with weights.

Exercises are:

Leg press

Squats

Cleans

Jerk

Calf raises.

- a) Heavy weights, especially if lifted slowly, with few repetitions increase the bulk of each muscle fiber.
- b) Many repetitions of a lighter weight represent endurance. Muscle fibers increase minimally in size but blood is in great demand to bring oxygen, glucose and take away waste products. The body responds by growing new blood vessels and increasing the size of those already there.
- c) Fast-explosive weight exercises done for 6-8 seconds 5-6 repetitions demands the fibers work fast and together but make little demand on the circulation system. Muscle fiber size increases but less than (a) and much improvement is made by improvement to coordination and the interaction between nerves and muscle.
- d) Maximum bulk is achieved by lifting fairly heavy weights slowly. 5-8 repetitions taking perhaps 30 seconds. It is probably sensible to start the season using the first method and to increase the amount of muscle to some extent and then switch to (c) to improve power.

## 3) Elastically strong limbs

By this we mean limbs that can yield and return explosively.

Exercises:

- 1) Hopping left leg
- 2) Hopping right leg
- 3) Bounding

- 4) High skips
- 5) Long skips
- 6) High knees
- 7) Quick feet
- 8) Straight leg runs
- 9) Bunny jumps (not more than 900)

The value of this routine is that each part represents and strengthens a particular part of the running/jumping action.

Once again hopping and bounding (elastic strength) strengthens the muscle/nervous system. Massive muscle bulk is not a by-product. However, to regenerate nerve cells that have been stressed takes much longer than muscle and initially exercises of this nature should only be done once a week, rarely more than twice a week.

Play hopping and skipping games with children. Work over 15-20 meters, 2 sets for the adolescent, walk back recovery between exercises, 5 minutes rest between sets.

Work up to 30 meters with extra sets for the mature competitor. Try to minimize contacts-measure.

There are a whole variety of options.

## 4) Yielding Strength

For the very mature competitor depth jumping and box bounding can produce excellent results. However, yielding strength is being developed constantly by the exercises mentioned and from landings in gymnastics.

This may be adequate.

These exercises can be very stressful and very beneficial, although damaging if done badly.

## 5) Specific Running Strength

- a) 150-300-meter runs represent strength endurance, especially if many repetitions are done 90%-95% speed—400 meter speed. Very effective and some should be done, e.g., 3 x 3 x 150m, 4 x 2 x 200m.
- b) Short sprints at 98%-100% speed, 40-meter, 60-meter make great demands on power. 10-12 repetitions.
- c) Towing weights, e.g., a car tire, improves strength especially for the first part of the run as a forward lean is necessary. Running with a weighted jacket is also valuable over short distances.

## SPEED OF MOVEMENT

Exercises which put stress on the speed at which muscles contract are of value to sprinters. Such exercises we call speed drills and I offer a list produced by the Great Britain's women's senior sprint coach, Iain Robertson.

Other exercises which are arguably of value are:

- Running downhill (a very gentle slope 1-30)
- Sprinting with the wind
- Being towed by a piece of elastic.

### **PRACTICING THE RUNUP**

The whole must be brought together to ensure a smooth and natural-feeling runup. It should ensure that the athlete is ideally placed for peak performance at takeoff, moving as fast as is controllable but relaxed.

The coach should appreciate that the runup will consist of the following:

- |                          |                    |                          |
|--------------------------|--------------------|--------------------------|
| 1) first strides         | pushing            | exaggerated forward lean |
| 2) middle strides        | fast strike rate   | upright posture          |
| 3) exaggerated knee lift |                    |                          |
| 4) takeoff strides       | altered rhythm     | slight sinking of hips   |
|                          | (di daa—jumper     |                          |
|                          | di da daa—gymnast) |                          |
| 5) takeoff.              |                    |                          |

Each part should be practiced.

Each part should be practiced into the next.

The complete runup should be practiced.

Check marks may be necessary.

(Variations to runups usually take place in the first two steps.)

It may be necessary to practice starting with either foot.

Athletes view sprinting and runups as skill activities. This practice is as essential as the aerial part—more so to long jumpers, because their effectiveness eventually limits the success of the activity.

If you run at 28 feet per second a vault of 193" is possible.

If you run at 20 feet per second a vault of 133" is possible.