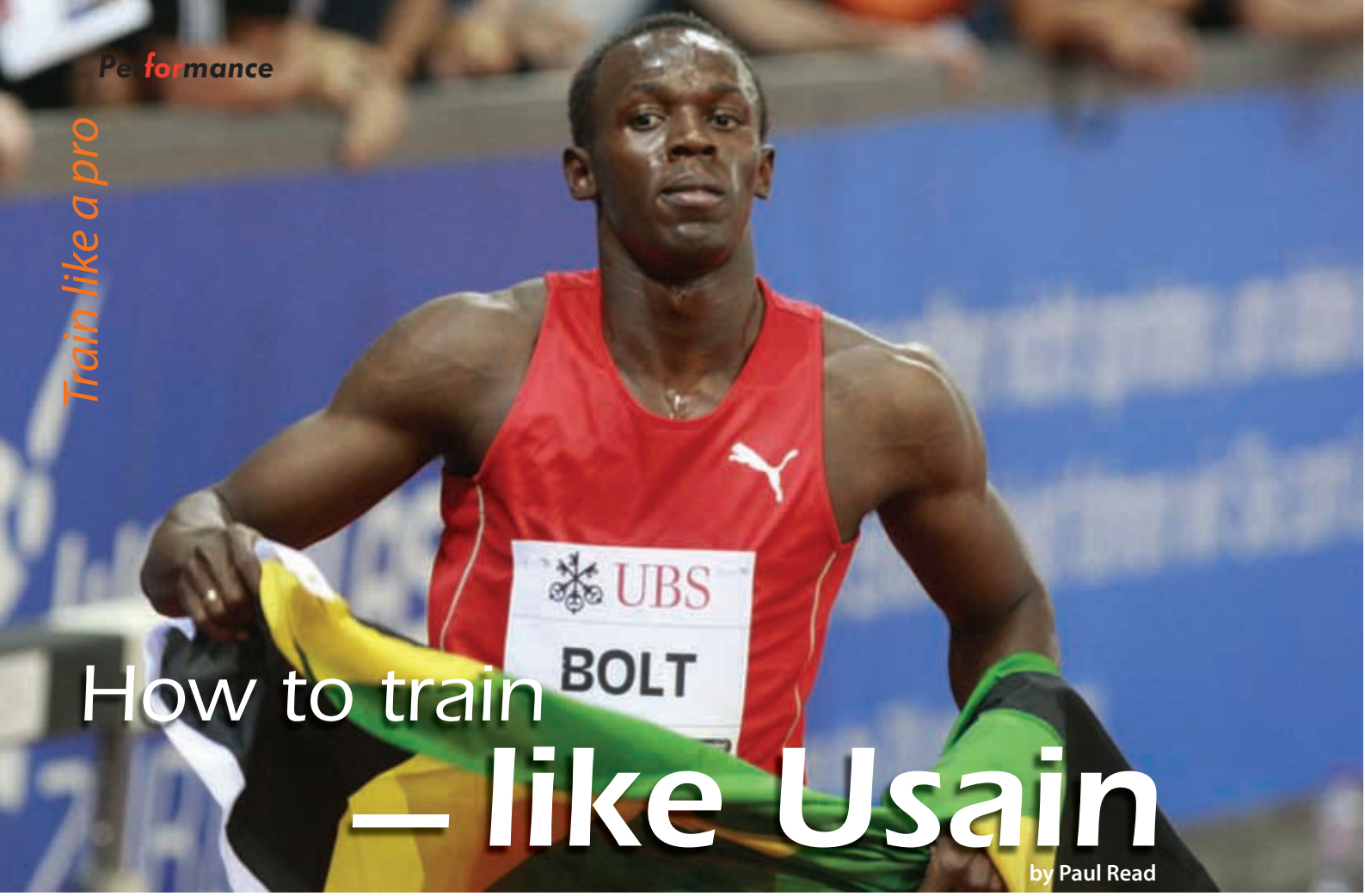


How to train – like Usain

by Paul Read

The 100-metre sprint is the premier event at the Olympics, and who would not be envious of the title, 'World's Fastest Man'? With the world record currently set at 9.58 seconds, this summer's London Olympic Games provided an opportunity for the world's best to battle it out for the much-coveted Gold medal.

Analysis: 100-metre sprint

- Elite sprinters display increased stride length and frequency (total strides: 41– 45).
- Ground contact times are very short – 0.22 in acceleration phase and 0.09 at maximum speed.
- Significant contributions come from powerful leg muscles.

The 100-metre distance is on average completed in 45 strides for elite athletes, with Usain Bolt's world-record-breaking run in 2009 totalling in astonishing 41 strides [1]. This article will focus on the exceptional characteristics that make elite sprinters (see Analysis below). Key factors include greater stride length and frequency, the application of higher initial ground forces in the acceleration phase of the race and a greater top speed.

Phases of the race

The execution of this race has three distinct phases: 1) acceleration, 2) maximum speed and 3) speed endurance. The specific requirements for each phase need to be reflected in training, as outlined above.

◆ *Phase 1: acceleration*

Acceleration is the ability to reach maximal speed in the shortest possible time, under control. During Usain Bolt's memorable 9.58-second performance in 2009, 73% of his maximal velocity was achieved after 10 metres, with maximum speed not reached until 60 metres [1]. Based on this, it is evident that developing optimal acceleration capabilities is essential. This involves high levels of strength relative to body mass, and high speed strength (defined under Phase 2, below). Both can be developed through appropriate strength training and application of speed strength exercises such as weightlifting and ballistics (explosive movements, eg, medicine ball training, sled pulls and wall drills – Figure 1). The key aspects of this phase are identified in Table 1.

Figure 1: Wall drill

Reps	Sets	Tempo	Rest
3–5	3–5	Explosive	3 minutes

- **Coaching points:**
  - Maintain a 45° lean.
  - Drive the foot explosively behind the base of support as you switch legs.
  - Ensure no heel contact.
  - Ensure 90° angle of the hip.
  - Maintain dorsiflex position (toe up) with the foot.
  - Progress to double and triple switches.

Table 1: Components of acceleration, with suggested exercises

Component / technical point	Suggested exercises
45° lean	Wall drill (Figure 1)
Increased ground contact time	Box jumps (see www.youtube.com/watch?v=cG8C3UM5Rsw)
Increased quadriceps activity	Squats, deadlifts, weightlifting
Greater propulsive force	Maximum strength training, weightlifting and ballistics

Table 2: Components of maximum speed, with suggested exercises

Component / technical point	Suggested exercises
Virtually erect (<5° forward lean)	High knees, A/B skips, high knee marches
Reduced ground contact times	Plyometrics – ankling, hurdle/depth jumps
Increased hip extensor activity (glutes/hamstrings)	Step-ups, deadlifts
Increased hamstring activity – eccentric stretch (to control flexion of the knee and hip)	Nordic exercises (Figure 2a), Romanian deadlifts (Figure 2b)

◆ *Phase 2: maximum speed*

This is the point where you can no longer accelerate – maximal velocity. Achieved by elite sprinters after approximately 60 metres, it involves a more upright body position and shorter ground contact times (0.09 seconds). Particularly significant here is the need for outstanding reactive strength, the ability to switch from an eccentric (muscle-lengthening) to a concentric (muscle-shortening) contraction efficiently without spending too long on the ground. Table 2 displays the key characteristics of maximum speed sprinting.

Components of sprinting speed

The ability to sprint effectively involves high levels of strength, speed strength and reactive strength. Specific training approaches for each are as follows:

◆ *Strength*

The ability to run at maximal speed requires high levels of force production. Notably, there is evidence that force applied to the ground is the most important determinant of running speed, with increased stride length resulting in a greater displacement of the athlete's body (both vertically and horizontally) [2].

◆ *Speed strength and power*

As a measure of ability to apply force with speed, speed strength is generally associated with two components: starting and explosive strength. High levels of strength are important, as stated above; however, if you are unable to apply force sufficiently fast, then performance in explosive events will be compromised.

◆ *Reactive strength developed through plyometrics*

As discussed above, the ground contact times in sprinting are extremely short. This suggests the need for high levels of reactive strength. A key method to develop this is plyometric training, which has been shown to reduce the energy cost of movement [4], with approximately 60% of mechanical energy recovered in economical sprinting [5]. This brings us naturally to the final phase of a sprint:

Remember … the hamstrings

A key preoccupation has long been the reduction of hamstring strains. The hamstrings function eccentrically to control hip flexion and knee extension during swing phase (as the leg drives up and extends forwards), and as hip extensors when the feet are on the ground. Peak stretch occurs late in the swing phase due to high levels of hip flexion, and this is when injuries are likely to occur. Increasing eccentric strength has been shown to assist with injury prevention [3]. Therefore, exercises such as Nordics and stiff-legged (Romanian) deadlifts should be considered essential. Additionally, this will address potential muscle imbalances brought about by overtraining the quads through squats, leg presses, and so on, and ultimately result in performance enhancement and further injury reductions.

Figure 2a: Mid position for the Nordic exercise

Reps	Sets	Tempo	Rest
6–8	3–5	Slow (hold end position)	2 minutes

■ **Coaching points:**

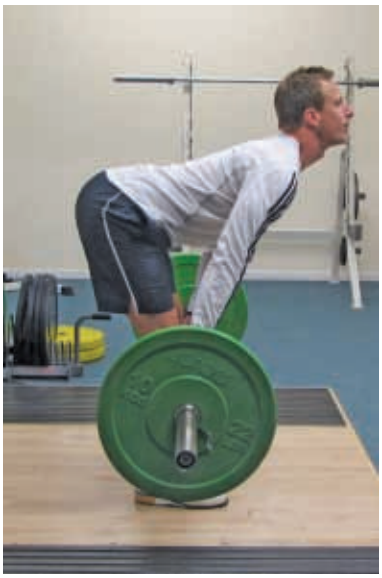
Maintain neutral spine.

Ensure the movement is initiated from the hips.

Do not flex the spine during the movement.

Figure 2b: End position for Romanian deadlift

Reps	Sets	Tempo	Rest
5	3–5	4–1–1–0	3 minutes



■ **Coaching points:**

Maintain neutral spine.

Ensure the movement is initiated from the hips.

Maintain a 5–10° knee bend.

Avoid bending knees further or flexing spine during movement.

Table 3: Suggested progressive model for fast stretch shortening cycle plyometric training [6]

	Phase 1 Eccentric jumping	Phase 2 Low-intensity fast plyometrics	Phase 3 Hurdle jumping	Phase 4 Depth jumping
Emphasis	Optimal landing technique	Short ground contact Legs like stiff springs Stay on balls of feet	Short ground contact Some degree of jump height	Short ground contact Maximum jump height
Sample exercises	Jump and stick Jump up to box	Ankling Single leg ankling Single leg jump and stick	Hurdle jumps	Depth jumps Multiple depth jumps

Table 4: Progressive model for developing hip power and knee/ankle stiffness [7]

Training goal	Hip power	Knee/ankle stiffness
Structural development	Nordics, Romanian deadlift, Split squat, Single leg deadlift	Eccentric single leg calf raise, Eccentric single leg leg press, Squats
Maximum strength	Deadlift, Hip thrust	Squat
Rate of force development (RFD)	Isometric hip thrust	Weightlifting – Jerks, Clean/snatch (power catch), Explosive step-up
Power	Hang clean/snatch, Heavy sled accelerations	Weightlifting, Squat jump, Heavy sled accelerations
Reactive strength	Hops/bounds and run drills, Light sled accelerations	Depth jump, Tuck jump, High hurdle hops, Skip patterns

◆ *Phase 3: speed endurance*

Through increases in stiffness of the ankle and knee, athletes use less muscular effort and are subsequently more economical in their running stride. Plyometric training and intensity should be progressively developed as suggested in the model outlined in Table 3. The use of technique drills for acceleration and speed development should also be considered, including wall drills, high knees and many forms of bounding.

Putting together a training plan

Based on the components of sprinting speed discussed above, the key physical qualities involve enhancing hip power and knee/ankle stiffness. Table 4 offers a suggested progressive model.

Sprinting is an explosive event requiring the development of a number of specific qualities such as maximal strength, reactive strength, power and rate of force development. These components should be incorporated as part of a periodised plan, implemented alongside technical and speed development work on the track. Methods and techniques in the toolbox of athletes to enhance performance include strength training, Olympic lifts and plyometrics.

A final note – training won't change your genetics!

Although the recommendations above will undoubtedly enhance your sprinting speed, unless you have superior genetics with a greater percentage of fast-twitch fibres (capable of more forceful/explosive contractions), that Olympic Gold may remain elusive. However, optimal application of strength, power and technique training can bring about an increase in fast-twitch fibres along with greater power and faster force production.

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