Can cross-country running be considered an athletics event in its own right?

by Renato Canova

Since many very good distance track athletes are unable to perform equally well over the country, it would seem that cross country racing requires some abilities over and above those needed for success on the track. The author describes a research project to find answers to several questions regarding this phenomenon, such as: Can cross country racing be regarded as a specific athletic event, or do the quite great differences in the type of course and weather conditions make each race a separate event? Similarly, is there such a thing as a specialist cross country runner or rather are there several types of successful cross country runners, depending on the conditions of the courses? Are any possible differences between successful track and cross country runners due to genetic factors and how may they respond to training? What part does the environment play in the development of successful cross country runners? The research was carried out using Kenyan distance runners and the conclusions reached were that: (1) success in cross country running is due largely to genetic factors; (2) environment and social conditions are also important influences - the Kenyans were used to running at varied pace and terrain over long distances from a very early age; (3) the basic difference between track running and cross country lies in the different types of load placed on the muscular systems - sharp variations over the country and a "constant" load on the track; (4) cross country running is an art while track running is a science.

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(Translated from the original Italian by Alessandra Lombardi.)

1 Introduction

The patent superiority of Kenyan runners, who have dominated cross-country World Championships for the last fifteen years, as well as the consistent victories of African, in particular Kenyan, athletes in different Grand Prix events, prompted us to undertake a methodological research aimed at answering a number of queries; namely:

a) Can cross-country running be considered an athletics event having a specific identity like track events or the marathon, or does each race provide the opportunity to express different aptitudes depending on the type of course and on the weather conditions?
b) Are high level performances in cross-country races conditioned by the same prerequisites as performances in track events or road races?
c) Will different athletes who achieve similar performances in track or road races achieve similar performances also in cross-country race?
d) Is it possible to identify a "cross-country specialist" or is an athlete's specialization confined to a given type of course, in that the same level of performance may not be achieved on a different course?
e) How many of the possible differences are connected to genetic factors and how do these respond to training?
f) Lastly, how important is environment in determining the psychological and physiological differences between cross-country specialists and track or road specialists?

The investigation we carried out enabled us to find answers to some of these issues; they will certainly not cover all the range of possibilities, but will provide the basis on which to develop a scientific and methodological research.

2 What is a cross-country race?

From the point of view of technique, cross-country running does not have a specific identity. Differences between the type of course - fast courses, courses on more or less uneven or on flat
The obvious answer is that each race is an event unto itself and requires very specific qualities and aptitudes.

Practical experience has taught us to distinguish "heavy ground" specialists from athletes who excel on dry courses. In the same way, some track event specialists are at ease on the track but do not enter cross-country races when the course is known to be rough. Gebreselassie, for instance, certainly one of the world's best middle distance runners, stopped participating in the cross-country World Championships after a few negative experiences, because his excellent qualities do not correspond to those required for this type of race.

**3 Do high level performances in cross-country races depend on the same prerequisites that condition performances in track or road races?**

The qualities that a 10,000m specialist must possess, and try to enhance through training, may be summarized as follows:

- high aerobic power with high VO₂max;
- great sense of rhythm during intense effort;
- long term concentration capacity despite fatigue;
- high specific MAX LASS (Maximum Lactate Steady State);
- biomechanical efficiency at the constant competition pace;
- highly developed tactical sense, so as to be able to "read" the structure of the race.

All these qualities are essential also in cross-country running but they are not sufficient to guarantee high level performances. Other capacities are also extremely important; the capacity to vary the muscular tension in accordance with the changes in rhythm, to be alternatively aggressive and completely relaxed, to acquire and exploit an "internal sensitivity" associated with the entity of the effort (in track races, rhythm is a measurable entity) and, lastly, the capacity to react instinctively, without necessarily following a preordained scheme.

It is therefore certain that athletes who achieve high level results in cross-country races are likely to achieve similar performances in track or road races, but the contrary is not true.

**4 Will different athletes who achieve similar performances in track or road races achieve similar performances also in cross-country races?**

Apart from fairly insignificant differences in the construction material, all tracks used for athletics events are substantially identical. Therefore, athletes who are capable of high level results can achieve them anywhere.

On the contrary, the running surface of cross-country races varies considerably and it is, therefore, necessary to identify the aptitudes that are necessary to achieve high level performances in totally different situations.

The first quality that needs to be investigated is the elastic reactivity of muscle fibres. As we know reactivity can be invoked when there is a firm support. On a very hard surface, the amortization phase of the running stride, the subsequent loading phase and then the elastic response are totally dependent on the athlete's muscle fibres, since the running surface absorbs little or no energy at all. This situation favours athletes with high elasticity and allows them to enhance technical efficiency, reduce energy cost and so maintain high speeds for longer periods. When the running surface is elastic, for instance in the case of indoor tracks built on raised panels, the amortization phase is longer, the reactive response is delayed and its intensity reduced. Efficiency is not reduced, however, because the surface itself returns the stored elastic energy, thus creating a rebound effect on the touch down foot. Depending on the material used for the track, the rebound effect will more than compensate for the energy absorbed.

The situation is very different when, as is often the case in cross-country races, the running sur-
face absorbs energy but is not reactive. The foot sinks into the soft, muddy surface and elastic strength, both from the athlete's reactivity and the soil's rebound effect, becomes ineffective. In the case of most middle distance runners, a high muscle reactivity corresponds to a low general strength level, because the elastic component of the muscle is more developed than the contractile component. Consequently, the better class athletes tend to be handicapped, as opposed to athletes having greater strength and less elasticity - those who use a "low", almost "pulling", action, induced by the biceps femoris rather than by the extensor muscles of the ankle.

Competition results provide indications as regards the specialization of cross-country runners to the type of running surface. Muddy surface specialists have considerable muscular strength and low elasticity and reactivity levels; athletes who prefer a dry, rough course can cope with frequent changes of rhythm and phases of high neuro-muscular intensity, while those who achieve better results in extreme weather conditions can easily tolerate very low temperatures and have an excellent thermoregulation capacity.

Apart from the observation of competition results, we carried out a number of experiments and obtained results that provide consistent indications.

5 Which are the main physiological parameters that distinguish an athlete's aptitudes in relation to the type of course?

When we visited Kenya towards the end of 1998, we attended a 5km cross-country race in which the time difference between the winner and the athlete who placed fourth was over 50 seconds.

All the athletes were following a training programme prepared by us and were in similar physical condition. The group was homogeneous - all steeplechase specialists with a personal best ranging from 8:05 to 8:08min. They trained together and the monitoring of their work-outs indicated analogous levels.

We decided to investigate the situation more accurately and in January 1999, during another trip to Kenya, we asked these athletes to follow a specific training programme on a dirt track, using a heart rate monitor.

The programme consisted of 15x400 metre repetitions, in an average time of 66sec (65 to 67sec), with a 200 metre interval in an average time of 43.7sec (41.4 to 46.3sec), for a total of 9km in a time of 27:26min. The four recordings were inconclusive in that they were practically identical, both during intense effort and during recovery. The only variation was in the maximum pulse rate, which ranged from 168 to 176.

Four days later (the physical condition of the athletes can be considered similar), we repeated the exercise on open ground - dirt roads and fields, with a number of uphill and downhill stretches. The surface was always dry and hard. The athletes ran together and were asked to perform 15 variations, each lasting 60 seconds, at the intensity measured on the track, with a recovery of 45 seconds at sustained rhythm.

The recorded graphs showed quite significant differences: in one case the second graph did not differ from the one obtained in the previous exercise on the track while, in another, it appeared as a continuous line, as if the exercise had been carried out at a constant speed.

Figure 1 (next page) shows the graph produced by the first athlete, Figure 2, that of the second athlete, who was not able to continue the exercise after the eleventh variation.

These differences indicated that, when the exercise was carried out on a flat, uniform surface such as the track (albeit only a dirt track), entity of the effort and recovery capacity were identical in all the athletes. When the exercise was carried out on open ground, the response of the athletes differed because the external factor had a different effect on their respective "internal loads".

In order to establish the physiological features that could determine such differences, we investigated two parameters:

• the ability to express, over a long period, a sufficiently constant level of strength in relation to the entity of the effort;
• enduring elastic reactive strength.

We tested the first item by asking the athletes to perform a 7km uphill run in a time of 24:46 minutes, wearing a heart rate meter. The only datum we observed, for which we cannot yet provide an univocal interpretation, is that the athletes who achieved the two best performances in cross-country races had the highest heart rate and, more importantly, also showed the greatest difference between the heart rate measured after the first 6 minutes and that measured at the end of the exercise.

The four graphs (Figures 3-6) are here presented, following the order in which the athletes finished the cross-country race:

Figure 3 (P.K. - winner);
Figure 4 (J.K. - second);
Figure 5 (C.K. - third);
Figure 6 (E.B. - fourth).
We investigated the second feature one month later, when the athletes came to compete in Italy. The same four athletes were asked to perform a simple exercise on the "Bosco platform": free hops for 5 consecutive minutes.

This is not the exercise normally used to test the various aspects of strength. We believe, however, that the analysis of the relation between touchdown and flight times of a protracted action is sufficient to provide indications of "elastic strength endurance". This is probably the element that has the greatest influence on the reduction of energy costs in running.

We must take into account that, when it comes to a practical application in a long lasting exercise, only a very small percentage of elastic strength is, in fact, used — only about 13% in a marathon race, for example.
The result of this test turned out to be quite significant, since the values obtained perfectly reflected the order in which the athletes finished the race:

<table>
<thead>
<tr>
<th>athlete</th>
<th>tdt</th>
<th>ft</th>
<th>coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. K.</td>
<td>132sec</td>
<td>169sec</td>
<td>0.781</td>
</tr>
<tr>
<td>J. K.</td>
<td>141sec</td>
<td>159sec</td>
<td>0.886</td>
</tr>
<tr>
<td>C. K.</td>
<td>144sec</td>
<td>157sec</td>
<td>0.917</td>
</tr>
<tr>
<td>E. B.</td>
<td>151sec</td>
<td>149sec</td>
<td>1.013</td>
</tr>
</tbody>
</table>

(tdt = touchdown time, ft = flight time)

We can, therefore, corroborate that elastic strength endurance is essential in reducing energy consumption during a race, because it allows the athlete to optimize recovery whenever the muscles are relaxed.

Since fast cross-country races, those in which the surface is compact even though the course may be rough, require frequent variations of the intensity of muscular effort, athletes are here faced with a situation that is very different from the conditions of track events. In the latter, contraction and relaxation phases are, for the most part, cyclic, associated with the concept of effort distribution. In the case of cross-country races, these variations are random; they have a totally different significance, because the involvement of the athlete's recruitment capacity is more intense than in track events. Energy consumption is also higher and so is the need to recover in order to avoid excessive lactate levels.

This may also explain why some athletes, who are good cross-country runners at some point of their career, tend to lose this characteristic when they take up marathon racing. The technical
requirements of these two events are not compatible:

• The marathon runner needs to reduce energy consumption at competition speed, by achieving an agile, uniform and therefore, economical stride;

• The cross-country runner needs a very "nervous" action, better adapted to the ever changing stimuli presented by the structure of the course.

It is, therefore, clear that the characteristic features of a fast cross-country specialist depend, for the most part, on genetic factors; these will certainly respond to training, but this type of response to very particular situations requires very long adaptation periods.

The fact that these Kenyan athletes, who have identical backgrounds, who train together and have similar results in road races and in the steeplechase (the track event probably closest to a cross-country race), have such different values as regards elastic strength endurance, confirms the importance of genetic factors. Also, when all the qualities common to middle distance runners are at a similar level, elastic strength endurance can be identified as the basic feature that will influence the level of performance.

6 How important is environment in determining an athlete's future as a cross-country runner rather than as a track or road specialist?

The above considerations provide a partial explanation as to why one athlete is better than another in a certain type of cross-country race,
but not as to how this came to be (apart from genetic factors).

The supremacy of Kenyan athletes is not accidental. As children they undergo the absolutely natural and unconscious sort of training that is essential in creating the capacity to adapt to continuously changing stimuli (as is the case in cross-country races). This situation no longer exists in the more technologically advanced societies.

It has been widely documented that Kenyan children run a lot, never at a uniform, level pace, but for fun. This entails a succession of challenges over all possible distances and the accent is always on intensity. From the age of 6 to 14 years, they run 3, 6 or 10km to go to school every day and the same distance again to go back home. On the way they race against other children (from sprints to continuous runs of 3-4km), often more than one race. They run on all sorts of paths, roads and on grass and are, therefore, familiar with all types of surfaces and all types of inclines (uphill, downhill, hilly ground). In this way they develop an instinctive movement sensitivity and the capacity to solicit an intense effort in any situation. Kenyan runners have a highly developed relationship with their internal load; they understand and know how to monitor their level of fatigue.

This feature is not important for marathon runners, where the fatigue is less incisive, and where one needs to refer more to the entity of the energy consumption rather than to the intensity of the effort. In this case a Kenyan athlete, who is used to evaluating the power of his "engine", or his aerobic power, will have to be introduced to a new approach.

In the case of cross-country runners, this is the fundamental feature that allows the development and enhancement of specific aptitudes. Cross-country running is freedom, instinct, sensitivity. A good interpretation cannot be constrained into fixed schemes, both during the performance and during training. Cross-country is an art, whereas track events and the marathon are sciences.

This is why cross-country races are dominated by African athletes, and that is why the technologically advanced Western world is not likely to produce an athlete capable of challenging the runners from the African plateaux.

Extensive physical effort has become increasingly foreign to the European and North American mentality, while the African mentality is becoming ever more sophisticated, without losing its original instinctive nature. The Western world may win the occasional battle, but the war appears definitely lost.