Efficient baton exchange in the sprint relay
by Georges Maisetti

It is essential to consider relay racing as a team event. The regular, conscientious practice of the French relay team, initiated by Joseph Maigrot and continued by successive coaches up to the author's period in charge of the men's 4 x 100 metres team, has evoked at team spirit and camaraderie that has enabled the French to achieve great success in the last few years.

Statistics are given to show how the French team has consistently beaten other national relay teams, composed of faster runners but with a less effective baton exchange technique. The three commonly used methods of handing over the baton are explained and evaluated, and it is shown how the method selected by the French team is actually more effective in maintaining baton speed than the other methods.

The importance of co-ordinating the respective speeds of the incoming and outgoing runners is stressed and methods of achieving this objective are explained.

1 Introduction

When talking about the sprint relays in France, it is more exact to speak of 'tradition' and 'spirit', rather than 'school'.

In fact, for several decades, our sprinters have shown, paradoxically, that, within the individual sport of athletics, relay racing is a team sport. The explanation for this is that our athletes have always shown themselves willing to apply themselves regularly to group work.

The founder of this tradition was a great French coach, Joseph Maigrot, who was able to prove that, through hard work, we could compete with the best in the world.

Thus, the French relay team came third in the Mexico Olympics, with a time of 38.42sec, which was the European record until 1980. Coaches Vaussenat, Verzier and Louric followed the same path, with a place among the finalists in the 1972 Olympics, first in the European Championships in Rome in 1974 and the bronze medal in the 1980 Games at Moscow.

When I was appointed, in 1987, as the coach responsible for the men's relay, I, quite naturally, continued with the methods of my predecessors, to whom I pay tribute for the legacy which they passed on to us.

After a modest career in athletics, followed by a course leading to Professor of Physical and Sports education, I very soon turned towards coaching and remain an athletics fanatic.

Results of the men's 4x100 metres from 1988

- '86 Olympic Games (Seoul): bronze medal 38.40sec (national record);
- '89 World Cup (Barcelona): France represents Europe 38.47sec;
- '90 European Championships (Split): gold medal 37.79sec (world record);
- '91 World Championships (Tokyo): silver medal 37.87sec;
- '92 Olympic Games (Barcelona): semi-finalist (2 injured);
- '93 World Championships (Stuttgart): disqualification after winning the semi-final in 38.52sec;
- '94 European Championships (Helsinki): gold medal 38.57sec;
- '95 World Championships (Göteborg): elimination in the semi-final after injury to J.C. Trovabal.
2 Terminology

The 'hand-over' is the baton exchange from the giver (incoming runner) to the receiver (outgoing runner).

The different types of handover are (Figure 1):
- the up sweep technique;
- the down sweep technique;
- the push forward technique.

'Braking' describes the situation where the giver is forced to slow up in order to make the exchange, with a consequent loss of baton speed.

The check mark is a piece of 5cm x 40cm adhesive tape, which the receiver is allowed to place in his lane, to indicate when he should start his run.

3 Towards a good baton exchange

3.1 The criteria of an efficient relay race

- Since the baton must be carried throughout the race, it is the speed of the baton that counts. The best maintenance of speed, therefore, must be judged by the quality of the three exchanges.
- If the winning team is always the one that reaches the finishing line first, that does not necessarily mean that it has the best technique.
- One way to estimate the technical quality of a relay team is to calculate the biggest difference between the total of the best individual times during the season and the best time registered by the team.

Viewed from this angle (cf. Figure 2):
- The French team at Tokyo in 1991, although its time was not so good as that achieved in Split in 1990, nevertheless showed a better technique. This was confirmed on that day by their second place, only .037sec behind the USA team, which, according to the individual times, should have been 1.42sec faster.
- It is not wishful thinking to believe that the objective fixed for the Olympic Games at Barcelona (under 38.50sec) would have been reached, had it not been for our problems with injuries, especially since the technique of the team had improved still further.

3.2 The contribution of observation

The receiver, even if capable of an excellent getaway, and even if he actually utilises the full 25 to 26 metres at his disposal, will never be able to equal the speed of the incoming runner, who is moving at top speed and generally a good finisher at this level of performance (Figure 3).

Therefore, it can be taken for granted that there will be a difference of speed between the incoming and outgoing runners, to the advantage of the incoming runner.

This cannot be easily recognised by direct observation, because of the very subtle way in which the 'giver' generally adapts his speed to that of the 'receiver'.

For a complete assessment of the technical quality of the exchange, it is useful not only to evaluate the baton speed during the 30 metres zone but also to trace the speed of the giver during the final phase of his run (if possible from the time he reaches the checkmark up to the middle of the change-over zone), and that of the receiver at the moment he grips the baton, especially in the last 10 metres of the zone.

Thanks to video recording, we have been able to calculate the average speeds achieved by the giver and the receiver under these conditions, and we can confirm the apparently permanent existence of a distinct imbalance between the two.
Likewise, analysis of the behaviour of the receivers in the top teams at important competitions very often reveals either a get-away too late or less than all-out acceleration, or perhaps both at the same time – which increases considerably the risk of 'braking'.

### 3.3 The proposed modifications

We have just shown the impossibility of obtaining a perfect co-ordination of the speeds of the two athletes at the change-over.

The problem, therefore, is how to reduce the extent of this slowing-down (braking) of the giver, and the harmful effect it has on the speed of the baton.

The answer can be given in two parts:

1) **Technique**

   **The Receiver**

   - decides when to start off; by observing the progress of the incoming runner during the last few metres of his run and by estimating his finishing speed.
   - should take up an upright, balanced position – the 'waiting' position should be one which facilitates the fastest possible get-away. This involves a standing start position, with a lowering and forward lean of the trunk.
   - should get away like a sprinter coming out of the blocks. Cf. Figures 4 and 5.

   **The Giver**

   The upsweep hand-over is recommended, since it fits in best with the natural movements of top speed running. It can, therefore, be carried out efficiently and with very little extraneous movement. By allowing the giver to be close to the receiver at the moment of exchange, it entails the minimum loss of speed.

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**Figure 2: Comparison of exchange data Split and Tokyo**

The table below shows the performance of the athletes in the exchange of the baton in Split and Tokyo.

<table>
<thead>
<tr>
<th>Name</th>
<th>Split 1990</th>
<th>Tokyo 1991</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morniere</td>
<td>10.19</td>
<td>10.28</td>
</tr>
<tr>
<td>Sanguoma</td>
<td>10.02</td>
<td>10.18</td>
</tr>
<tr>
<td>Troubal</td>
<td>10.30</td>
<td>10.29</td>
</tr>
<tr>
<td>Marie-Rose</td>
<td>10.19</td>
<td>10.37</td>
</tr>
<tr>
<td>Cason</td>
<td>10.05*</td>
<td></td>
</tr>
<tr>
<td>Burrell</td>
<td>9.88</td>
<td></td>
</tr>
<tr>
<td>Mitchell</td>
<td>9.91</td>
<td></td>
</tr>
<tr>
<td>Lewis</td>
<td>9.86</td>
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</tr>
</tbody>
</table>

**Figure 3: Acceleration distance for outgoing runner**

The distance of 25 to 26 metres actually usable is divided into three zones:

- **1m to 1.50m**
- **10m to 10m**
- **10m to 3.50m**

The acceleration zone is 10 metres, and the change-over zone is 20 metres.
Figure 4: Movement of outgoing runner

The down-sweep exchange, on the other hand, requires each runner to hold one arm in a horizontal position, with the result that there is some distance between the two and a consequent loss of extra speed.

The push forward exchange seems to lie between the two others and to be a little more efficient than the sweep-down technique.

2) Aims

Improvement of the baton exchange entails a certain element of calculated risk, which is evidenced by the sharpened sense of anticipation of both receiver and giver.

The receiver fixes his attention exclusively on the incoming runner. His ability to assess the situation, helped by his upright, balanced posture, gives him great confidence. He can thus dare to anticipate and start his action sufficiently in advance to give him time to achieve a complete, ample and rhythmic 'downward-forward' movement.

The giver must force himself not to slow down instinctively during the last part of his run, as he approaches the receiver.

The exchange may then be envisaged in two ways:

- The giver calls out to the receiver to reach back with the baton, sees the hand and passes over the baton. In this case, the receiver will take several strides without the use one of his arms, which will, therefore, cause him to lose speed. Keeping one arm motionless for only two strides can be considered as an excellent takeover.
- The giver calls out to the receiver and, at the same time, reaches out with the baton and runs with a 'fixed' arm for a few strides, before placing the baton in the hand of the receiver. In this case it is the giver who loses speed but, in this way, he does enable the receiver to use both his arms for a little longer and thus get better acceleration. The receiver can then run less than two strides with a 'fixed' arm.

4 Conclusion

With the world record for the 4 x 100 metres relay now very close to 37.00sec, this team event can at last be considered a real speciality.

In our opinion, the paths leading to this conclusion are:

- A technical approach to the event which will lead to much more risk taking by the relay runners. This will manifest itself by systematic
Table 1

<table>
<thead>
<tr>
<th>Checkmark</th>
<th>Accel 0m</th>
<th>Entry 10m</th>
<th>Midpoint 20m</th>
<th>Exit 30m</th>
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<tr>
<td></td>
<td>11.59 m/s</td>
<td>11.24 m/s</td>
<td>10.00 m/s</td>
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<td>10.87 m/s</td>
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<td>x 26m</td>
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<td></td>
<td></td>
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<td>x 26m</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>10.85 m/s</td>
<td>9.40 m/s</td>
<td>x 17m</td>
</tr>
<tr>
<td>LEWIS</td>
<td></td>
<td></td>
<td>9.62 m/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9.62 m/s</td>
<td></td>
</tr>
</tbody>
</table>

All speeds are average.

* Approximative average speed not measured (Lewis's check mark distance not known).

* Time taken from lift of receiver's rear foot.

x Place of exchange.

Figure 6: Comparison of exchange data Split and Tokyo, French team

- Change-overs in the second half of the zone (which is not yet the general case).
- The introduction of proper team preparation, which will undoubtedly bring about a change of habits and mentality. In this regard, we would like to take the opportunity to say that 'relay team spirit' can exist and that it plays a major role in the search for perfection in relay running, even though it is impossible to evaluate its exact importance.
- A greater number of relay competitions in the athletic calendar.

REFERENCES:

Discussions with Joseph Maigrot.
The Relays; Entraineur 80 AEFA FFA

LORIE, M.:  
Le relais 4x100 m (Congrès Européen des Entraineurs: Venice 17-20/3/81); in Revue AEFA FFA (2ème trimestre 81)

OBERSTE, W.; WIEMEYER, J.:  
The regulation of manual aiming movements using the example of baton passing in the 4x100 metres relay. New studies in Athletics, no. 1, March 1991
MACH, G.: The 4x100 metres relay with the push-forward pass. New studies in Athletics, no. 1, March 1991

Les courses de vitesse et de haies. Entraineur Fédéral ed. 94
AEFA FFA

Marc Blane and Bruny Surin. Photo: Allsport / Stu Forster