Speed, technique and statistics in the women's Triple Jump

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The author highlights the major steps in the development of the Triple Jump. He then examines data obtained from the performances of the top four women jumpers at the 1990 TAC USA National Championships. Making particular reference to the importance of horizontal and vertical velocity, he provides a basic look at the biomotor abilities required for the Triple Jump. He concludes by discussing the implications of this data for present-day technique.

1 Introduction

The athletics world has only very recently begun to consider the women's Triple Jump as a bona fide World Championship and Olympic event. The time for a technical evaluation of this event is long overdue; and it must be stressed that such an evaluation can only be achieved by studying the performances of women. Their jumps will reveal different strengths and weaknesses from those of men; and so, while it is often educational to make the usual comparisons of male with female, it is not necessarily always appropriate.

However, any overview of the event requires a brief resumé of its history; of the athletes, championships, styles and attitudes which have shaped its evolution. This study will therefore highlight the major steps in the development of the Triple Jump. It will then examine data obtained from the performances of the top four women jumpers at the 1990 TAC USA National Championships, with particular reference to the importance of horizontal and vertical velocity; and conclude by discussing the implications of this data for present-day technique.

2 A brief history

The present-day Triple Jump developed as a result of continuous adaptations by pioneers of multiple jump events. The exact date of birth of today's 'hop, step and jump' competition is unclear, but the first off-
cially recognized IAAF World Record was set by the American Daniel F. Ahearn, who jumped 15.52m at New York's Celtic Park in May 1911.

Many athletes then experimented with and refined the accepted technique of the event, expressing in individual ways the strength and speed required. Among the great names that emerged during this evolution was that of Adhemar de Silva (BRA), who won 2 Olympic golds in 1952 and 1956, and set 3 World Records. However, it was not until a sprinter named Józef Schmidt (POL) set a World Record of 17.03m at the Polish National Championships in 1960 that the athletics world began to appreciate the importance of speed on the runway, now an integral part of the discipline.

A quite different approach from Schmidt's emphasis on speed was the reliance on great leg strength and power known as 'the Russian technique', exhibited in particular by Viktor Saneyev (URS). This power, complemented by a double-arm shift, helped him to raise the World Record to 17.44m in 1972 and ranked him first in the world from 1968 to 1976.

In a similar way, throughout the 1980s and the early 1990s, we have enjoyed the performances of top-class jumpers memorable for their characteristic strengths: Willie Banks (USA), with his great 'bounding' ability; Mike Conley (USA), whose sprinting speed has taken him round the 200 metres in 20.20 sec.; and Khristo Markov (BUL), with his power and unique style.

3 Horizontal and vertical velocity in the women's Triple Jump - a short statistical analysis

The relative novelty of the women's event means that the development of technique is less advanced than that of the men, and therefore more difficult to chart. There are still comparatively few statistics available on women triple jumpers. However, a study of data obtained from the performances of the top four women jumpers at the 1990 TAC USA National Championships provides some insight into these athletes' individual strengths and weaknesses and gives an overview of the state of development of the women's Triple Jump.

The following analysis is based on data from the hop phase, including preparation for take-off at the board, flight, and preparation for take-off into the step phase. The dynamics of the hop phase give an impression of the basic biomotor abilities required for success in the Triple Jump. Particular emphasis is placed on the importance of horizontal and vertical velocity.

**CM**: Centre of Mass

**V\text{TO}\text{(L.H.S)}**: horizontal velocity of CM at the instant of take-off (last stride of approach run, hop phase, step phase).

**V\text{TD}\text{(H.S)}**: horizontal velocity of CM at the instant of touchdown (hop phase, step phase).

**\alpha\text{(H.S)}**: the angle at take-off (angle of projection), determined by the relation of the horizontal and vertical velocity of CM at the instant of take-off (hop phase, step phase).

**DEPF**: 'effective distance', or the distance from the actual point of take-off, regardless of its relation to the board, to the first mark made in the sand, regardless of any subsequent marks.

**V\text{TO}\text{(L.H.S)}**: vertical velocity of CM at take-off (last stride of approach, hop, step).

**V\text{TD}\text{(L.H.S)}**: vertical velocity of CM at touchdown (last stride of approach, hop step).

**V\text{(H.S)}**: change of vertical velocity between touchdown and take-off into next phase.
Optimal distance in the hop phase is a result of optimal horizontal velocity in the last few strides and an optimal angle of take-off. Most male triple jumpers show a horizontal velocity of 10.04-10.46 m/sec. in the last 4-6 strides prior to take-off. The lowest velocity recorded by the women was 8.56 m/sec., and the highest 9.52 m/sec. (see Table 1).

This is a comparatively wide range. However, a closer look reveals that the horizontal velocity recorded at the last stride for the top four jumps of the competition was over 9.00 m/sec. each time. For the top two jumps (effective distance 14.20m and 14.04m) it was 9.48 and 9.31 m/sec., respectively. The highest velocity, 9.52 m/sec., was recorded prior to that athlete's best actual distance of the competition, but this was not her best official distance due to the amount of take-off board unused.

It should be noted, however, that the fastest penultimate strides before take-off did not necessarily produce the longest flight distances in the hop phase. This may be due to the preparation for take-off; the angle of take-off; or, more problematically, to a lack of elastic strength.

Turning to Table 2 (on the following page), the vertical velocity at take-off and touchdown during the hop phase, and at take-off for the step, was recorded for each jumper.

Converting horizontal velocity into vertical velocity requires elastic strength. The higher the level of elastic strength, the better the athlete's chance of achieving an optimal take-off angle and take-off velocity (which is the combination of horizontal and vertical velocity). From the data available, we can draw the tentative conclusion that sprint work, to maximize the jumper's horizontal velocity, combined with strength training will promote optimal horizontal velocity, take-off angle and therefore vertical velocity.
4 Arm action - a choice of styles

Having discussed above the importance of both horizontal and vertical velocity to the Triple Jump, it is obvious that any individual choice of jumping technique must avoid compromising speed.

This is particularly true in relation to the arm action. The variety of possible styles of arm action will open up many avenues for further discussion when more information on the women’s Triple Jump becomes available.

The ideal arm action for the hop is a single arm or arm-and-a-half action. This allows the jumper to maintain the rhythm established during the approach run, and therefore to avoid compromising her body position prior to vertical impulse.

Moreover, the single arm or arm-and-a-half action does not cause a noticeable deceleration during the 3-4 strides prior to take-off. Its alternative, the double arm action, usually causes the jumper to decelerate prior to the plant of the take-off stride, compromising speed (horizontal velocity) in favour of power (vertical velocity) in order to gain a greater angle of take-off for the hop.

The double arm shift should be used only after the athlete has completed the take-off into the hop phase. This will enable her to obtain the correct body position prior to take-off into the step phase. It will also generate greater power, by co-ordinating the action of both arms with the step-take-
off leg. This may help to produce a greater negative foot speed prior to take-off into the step.

However, many elite men, and some elite women, use the single arm style throughout the jump. This seems to produce problems of balance during the flight phase, caused in many cases by a natural over-rotation of the torso and some lateral rotation (detrimental to arm control) during the flight phase of the hop.

The resultant deceleration in arm swing can affect the negative foot speed of the jumper in her preparation for take-off into the step phase, causing a decrease in horizontal velocity due to a greater ground contact time. Only a very accomplished technician, or a very strong individual like Khrislo Markov, can overcome the problems of over-rotation common to single arm jumpers while maintaining limb speed.

Development of both strength and technique, then, is necessary if the athlete is to overcome the rotational problems caused by the arm action during the hop and the step phase. It also plays a large part in the production of the powerful scissor motion which will generate the necessary negative foot speed for the maintenance of horizontal and vertical speed into the next phase.

5 Conclusion

In the women's Triple Jump, as in all events, consideration must be given to individual requirements when designing a training plan. However, it is evident from the data examined above that athletes must continue to refine their biomotor abilities, and specifically their speed and their elastic strength, if they are to develop an optimal technical model.

In developing their own individual style, for example in their choice of arm action, they must beware of compromising velocity, both horizontal and vertical, which has been shown to be of major importance to successful performances in the event. An optimal combination, then of speed and power must be the aim.

We have not yet seen the limitations of speed, absolute and elastic strength in the women's Triple Jump. The event is still
new, and few statistics are available for comparison and evaluation. Many of our best athletes have chosen to concentrate on other Olympic events, in which their natural speed and strength can be used more easily to obtain a place in an Olympic or World Championships team. As more of our top juniors and established athletes move into the event, it will make a great impact on the athletics world.