IMPROVING THE PENULTIMATE STEP IN THE JUMPING EVENTS

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This offering, by Arizona Assistant Women's Coach and past TF contributor Myers, focuses on the crucial last two steps in the jumping events, and the use of sound as a valuable coaching toot in evaluating the jumper's penultimate and takeoff steps. This article also appeared in the Sept. 1989 issue of the 1AAFjournal, New Studies in Athletics.

1. Introduction

It is unbelievable to me how many really good sprinters and amazing leapers there are. Yet there are relatively few good "jumpers".

Looking at the world rankings in the sprints, it is easily seen that there is incredible depth of performance in both the men's and women's sprints. In the jumping events however, performances fall off more steeply. Looking to our local gyms in the United States, you will see an abundance of talented vertical leapers, but this has not been translated to an abundance of good jumpers on our athletics teams.

How is it that so many athletes who would seem to have the prerequisites to become world class performers in the long jump, triple jump or high jump never make it?

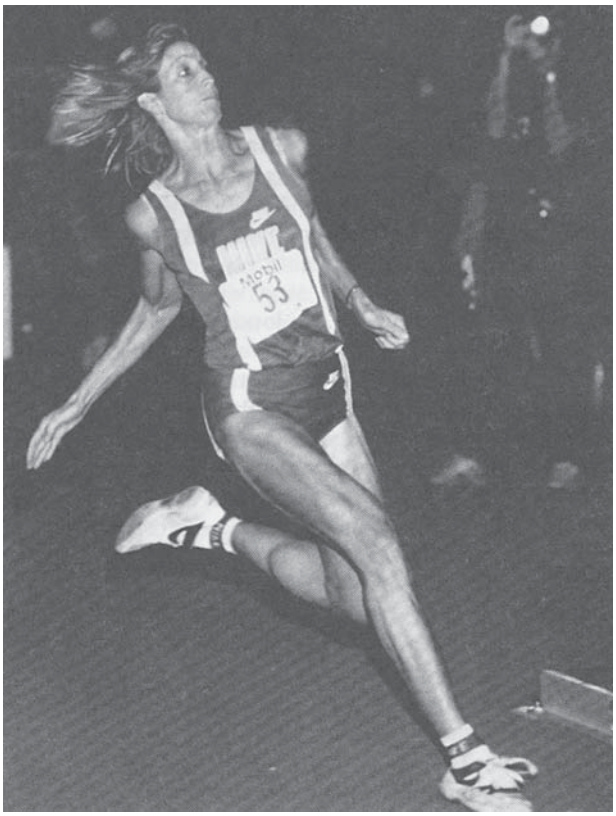
My feeling is that poor take-off technique is an important factor in this situation. Every season I see countless jumpers, from the beginners to sub-elite (training ages of 1 to 6), with poor take-off mechanisms. In my opinion, the penultimate step is the key to take-off technique and one of the least understood aspects in the jumping events. I believe that we, as coaches, could do a better job with the talent available by gaining a better understanding of the final two steps in the jumping events.

The purpose of this article is to assist coaches with their understanding of the mechanics of the take-off and penultimate steps in the jumping events and to explain a simple yet practical method for the analysis of this phase of the event.

2. Analyzing the Take-off

The take-off in the jumping events is not easily analyzed with the human eye. Additionally, many coaches coach events other than the jumps and find it hard to see this complex movement. Even more important is the fact that a large number of youth athletes are coached by beginning level club or school coaches who do not have enough experience to accurately see and make judgments about the take-off in the jumps by watching.

I would surmise that most coaches do not have access to the expensive video equipment which would help them in this area. I would therefore like to propose that many coaches can utilize another sense in analyzing and teaching take-off technique. That sense is the sense of hearing.



VICTOR SAILER/AGENCE SHOT

Jan Wohlschlag about to take-off at the '89 TAC meet.

What I am saying is that correct and incorrect takeoff mechanics can be distinguished by sound. With a clear understanding of the mechanics and objectives of the takeoff, in particular the final steps, as well as a little practice and experience, a coach can be able to make valuable analyses of jumps. This ability can assist greatly in the teaching and improvement of take-off technique.

3. The Long Jump and Triple Jump

The primary goal of the take-off in long and triple jumps should be to maintain horizontal velocity (with less than 10% deceleration) while developing enough vertical velocity to take-off at an angle of 15-25 degrees.

In the long jump, the center of mass is lowered slightly (about a 7% deviation for men and 4% for women from sprinting), as the touchdown of the penultimate step is slightly heel first (not on the ball of the foot like top speed sprinting). The ankle should be at a 90 degree angle to the shin. The step should be slightly longer, almost flat and pulling (with the hamstrings and glutes) so that the take-off foot is grounded as soon as possible. Both of the last two steps should be grounded while they are coming back toward the body, not reaching out, which will negate forward velocity.

The last two steps should be quicker than the preceding ones, therefore, an increase in rhythm should occur. The increase in stride frequency occurs as the last step is shortened almost 10% less than the penultimate step.

If executed correctly, the body is slightly lowered on the penultimate and is on the rise (at 15-25 degrees) through the take-off. All this should occur with a goal of less than a 10% loss of horizontal velocity (according to Hay, 1988, the average loss is 14%).

An easy tip-off to a poor execution of the last two steps is loud foot contacts with the runway. This indicates a braking action instead of maintenance of velocity. Conversely, if the athlete is just running through without getting any conversion of horizontal to vertical, there will be the sound of normal sprinting.

A correct penultimate step will yield a resonant sound, a median between the loud contacts and regular sprinting, followed by a quickened take-off step which sounds more like a regular sprint step.

The real factor here is the rhythm of the sound of the last two steps. Correct penultimate and take-off steps will yield a distinct increase in the speed of the sound of the last two steps. It is this increase in rhythm that a jumper must have in order to accommodate the correct take-off mechanics. With no increase in rhythm in the last two steps, a correct take-off is virtually impossible.

4. The High jump

The main difference in the take-off of the high jump i that the body lowers more to precipitate a takeoff angle of 45-55 degrees. (There should be more ankle, knee and hip flexion).

In the high jump, much of the same mechanics apply as in the other jumping events. The athlete should be as fast as possible through the penultimate and take-off strides. Since vertical velocity at take-off here is the top priority, both arms must be used to attain impulse. So while the penultimate step is pulling back rapidly, both arms are pulling back behind the body, about hip level, much like a swimming stroke.

Since the main goal is vertical velocity rather than horizontal, the take-off leg is used more like a pole vault pole. The earlier it is planted, the smoother the conversion from horizontal to vertical. To realize this early plant, the key again is a quick, flat, pulling, penultimate step which does not drag the ground as it drives off into the take-off.

The penultimate step usually includes deeper knee joint flexion in the high jump compared to the long jump. Because of this increased negative vertical velocity, the sound is again a resonant sound due to a heel first, but almost flat footed, ground contact. Again, too much deceleration will yield a loud, blocking sound caused by an overly long penultimate step.

Where many younger athletes get into trouble is an overly long take-off step. This severely hinders conversion of horizontal velocity to vertical velocity. This also detracts from the stretch-reflex activity of the take-off leg which aids in developing peak vertical velocity.

5. Conclusion

While at first you may not be able to distinguish the difference between the sound of correct and incorrect penultimate steps and take-offs, with a minimum of practice hearing can become as practical as seeing (as many blind people will attest). By learning to use your sense of hearing for this purpose you will be gaining an additional coaching tool.

With a better understanding of the mechanics of the penultimate step and take-off, and by using the feedback provided by sound, it is possible to systematically teach athletes better take-off technique. I feel we can have many more proficient jumpers at every level in the athletics ranks and many coaches of potentially brilliant athletes can be spared the agony of seeing their athletes stagnate instead of improve.

REFERENCES

Dapena Jesus. *Biomechanical Analysis of the Fosbury Flop.* TAC funded Biomechanics Research, 1988.

Doherty J. Kenneth. *Track and Field Omnibook,* Los Altos, CA: Track & Field News, 1985.

Hay, James. *Practical Findings from Recent Research on the Horizontal Jumps.* TAC funded Biomechanics Findings Summarized, 1988.

Nixdorf E., Bruggemann P. *Biomechanical Analysis of the Long jump—II World Championships in Athletics—Rome 1987.* London; International Amateur Athletic Federation, 1988.

Ritzdorf W., Conrad A. *Biomechanical Analysis of the High lump—II World Championships—Rome 1987,*

Susanka P., Jurdik M., Koukal J., Kratky P., Velebil V. *Biomechanical Analysis of the Triple Jump—II World Championships in Athletics—Rome 1987,* London; International Amateur Athletic Federation, 1988.