TECHNIQUE TRAINING IN POLE VAULT

Vitaly Petrov (Italy, Ukraine)

It was over 40 years ago that the IAAF formally approved the flexible fiberglass pole as an official implement. Since then, the record of 480 cm (metal pole) has grown up to 615 cm and, hopefully, it will continue to rise in the future.

At present a considerable amount of practical and theoretical information has been accumulated, thus making it possible to impartially judge the peculiarities and patterns in fiberglass pole-vaulting techniques. Opinions regarding various vaulting aspects can differ, however, physical and mechanical principles of the vault are irrefutable.

The system of 2 pendulums changing in length (with the pole as the 1st pendulum, and the vaulter as the 2nd) is the mechanical basis of the pole vaulting technique. The angular velocity of each pendulum is to a certain extent controlled by the distance from the pole vaulter's centroidal axis to the axis of rotation around the hand and the shoulder-girdle. In the meantime a technical pattern of pole vaulting has been formed. It is based upon biomechanical laws, yet, due to differences in physique, physical fitness, psychological concentration abilities, and coordination skills, certain deviations from this pattern occur, which can be referred to as an individual approach in the implementation of the pattern.

If we divide the pole vault into its different phases, it will help us to examine the nuances of the modern pole vaulting pattern:

the pole hold and carry
approach (beginning and middle part)
pole drop and plant
push and penetration
shoulders' drive down and swing (of the body)
turn over onto the shoulders with the body stretching out along the pole
turn and crossing over a bar (style depends on the performance of previous phases).

HOW TO HOLD AND CARRY THE POLE

In order to reach the maximum controlled velocity during the approach and to naturally proceed to the hang on the pole with subsequent muscle effort shift, to transfer from the hang to overturn on the pole, it is first of all necessary to free oneself from the retarding effect of the pole on the pole-vaulter. To a considerable extent it can be improved by the correct pole hold and width of the hold, i.e. the distance between the hands. A modern technique pattern in pole suggests the grip at the distance of 60-70 cm (distance measured from the thumb of the left hand to the thumb of the right hand).

The width of the grip varies from one athlete to another and depends on the athlete's height and length of his arms, strength of the arms and mobility in the shoulder and especially in the wrist joints.

Narrow Grip

Disadvantages:

1. causes a great degree of tension in the arm and shoulder muscles and, consequently, limits the freedom of their movements

drives the center of gravity forward, thus decreasing the inclination of the athlete's body forward and forcing him to hold the pole in the higher position for a longer time (distorting the smoothness in the process of lowering the pole for planting)
complicates the planting technique (rigidity of the right shoulder and right hand)
shortens the shoulders' movement forward after penetration, jerking of the shoulders thus making the pelvis (centroidal axis) to outstrip the shoulders
reduces the loading of the pole with the right hand
delays and reduces the power of the shoulders' stoppage for the subsequent turnover
Advantages:

beginning of the run-up is more standardized and high
left hand pushes the pole from a higher position
Wide Grip
Disadvantages:

1. carries the center of gravity in the vaulter/pole system forward (early acceleration right from the first steps of the run-up)

blocks the shoulders' movement in the middle part of the approach
hampers the lowering and planting of the pole (it is rather a lateral flip than a planting)
the lower grip of the left hand blocks the vaulter's momentum in the push which results in the delay in penetration and hampers the turn.
Taking due consideration of all the advantages and disadvantages of the various grips, each coach establishes the most convenient width for a given vaulter. In my work with Sergei Bubka I had to change the width 3 times, and the optimum grip was established only in winter of 1991. The grip of the pole during the approach is one of the most important details in a modern vaulter's technical gear.

Acceleration
Acceleration is the ability to reach the maximum of controllable speed within a certain distance.

An important feature of the acceleration is its increment value and the ability to keep a certain speed on a certain running distance.

Acceleration as an element of the pole vault has its own components which are interrelated and which determine the vaulter's activity during acceleration. Any changes or disturbances in any of the components will retard the speed and efficiency of the acceleration. The length of the top vaulters' run-up is on the average about 42-46 m, with 18-20 strides. This length of the run-up provides for the implementation of an athlete's running abilities and allows for a smooth acceleration.

The 1st part of the approach takes place on a distance usually covered in 4 to 6 strides; it is here that the athlete lays the foundation of the approach:

set up of a single system: vaulter/ pole

evolving pattern of the first strides
run-up rhythm (acceleration), length and rate of the strides.
Maximum speed, its rationality towards the end of the run-up are established and depend on the correctly performed first strides.

It is necessary to stress here that the position of the pole and the vaulter/pole system influence the length and pace in the beginning of the acceleration.

Low pole carry in the beginning forces the vaulter to make the first strides more rapid which will result in a fast acceleration, rigidity of the movements and tying-up of the muscles.

Excessively high pole carry in the beginning will make the first strides longer and result in the up-and-down swing of the system's center of gravity, thus also affecting the smoothness of the approach. In the beginning of the first part the vaulter keeps the pole at 65-75 degrees to the horizon, and by the end, with smooth acceleration he will bring it to 50-60 degrees.

It is preferable to launch into acceleration the single solid vaulter/pole system while controlling it through the left hand. Various changes in the rate of the movements, pole position, irregular running often occur as a result of the vaulter's attempts to start run with various jumps, imitating the start in long jump and triple jump). All of this gives rise to so many irregularities and errors that sometimes it is hard to understand the reason for the movements.

There are other ways of starting the run – 4 to 6 measured walking steps taken to the starting mark, with the pole held in the same position as for the acceleration run, which is uniform in its acceleration similar to high jumpers who start the run-up with strides. Thus their transition from walking to running is inconspicuous and natural.

Concentration before the vault, a desire to vault and confidence that this very vault will be the best are often the decisive factors for successful performance.

If the top of the pole is held a little to the left (from the run-up line), the left hand will be positioned in a more comfortable and elevated position, and the whole vaulter/pole system will become more compact (without shifting forward or to the right).

During the whole run, including the pole drop, the left hand is held high enough and on the same level (chest level).

The left hand provides the direction and the bearing point around which the drop and the plant take place. If this is the case, then during the run it must remain motionless, positioned higher than the left elbow at all times.

Any motions of the hand (forward, backward, down or sideways) will break the single vaulter/pole system.

The right hand which plays the major part in the drop and plant, through the support of the left hand, during the run moves more than the left one. In the various parts of the run its work, position and strength of the grip are different.

The second part of the run takes place on a stretch covered in 8 to 10 strides. The main task here is to achieve 90-95 per cent of the maximum speed. The pole is carried here at about 45/60 degrees angle. In the end of the 2nd part the athlete reaches the maximum stride length. Acceleration here is sustained by the slight movement of the shoulders, synchronizing the work of the upper part of the body with the work of the legs, without, however, moving the pole in any direction. If in the beginning of the run the main effort is made at the push from behind, in the middle part, as the speed increases, the athlete is stretching and switches over to the active "drawing through" of the hips forward, accompanied by the active counter movement forward of the swinging leg which is bent to the maximum.

The whole foot is placed on the ground with a bias for an instantaneous roll (active placement); the shock absorption phase will increase if the foot is placed starting with the toe.

Pole Drop

This final 3rd part of the run is characterized by the increased rate of the run while the length of the stride remains the same, thus achieving the maximum speed of the run-up. The length of the strides is a little shorter as compared to sprint, the body is straightened. The length of the strides should not change abruptly. The 2nd last step is longer than the last one by 10-20 cm (optional).

This part in covered in 6 strides and equals to 17,0 – 17,5 m (shown by top athletes of the world) if measured from the back of the box.

The key to the correct vaulting technique lies in practically all the movements of the drop and push part of the run-up – both for the beginners and for more advanced vaulters.

Without changing the running pace and running position, 6 to 5 strides before the push, the vaulter begins the drop. This is done with the help of pulling and rotation (initial) of the right hand.

During the next two run-up strides (4-3 steps) the vaulter's attention is focused on the slight thrust of the hips forward without losing control over the shoulders, maintaining their leading role in the run-up.

While the right hand is being pulled, the right elbow is gradually drawn behind the back, thus making it possible during the last two run-up steps to lift the right hand with the pole up to the right shoulder.

The left hand remains at the same level as 6 steps before the push; while slightly moving ahead, it controls the height and advancement of the pole. Two steps before the push, the pole is a little higher – 10-15 cm above the vaulter's center of gravity.

All these movements cannot be considered as a static position; the vaulter has already begun the drop 4 steps back, and here the pole simply crosses its horizontal line.

The drop must not be abrupt (if the vaulter was not late in initiating it), it must fall within the rhythm of the last strides.

When making the last two steps of the drop, the vaulter should not "lose" the pole by stretching the left arm forward (as if looking for support, the box). All the movements during the drop take place while the left hand is kept over the left elbow. During the last 6 strides, and especially during the last 3 steps, the vaulter must keep the abdominal muscles tight without breaking the line of his advancement; this will help him to drive the shoulders back even before the drop. A very important detail of the drop that will save him from squatting at the penultimate step, is riding the pole over the head before the vaulter arrives at the vertical position of the right leg. If he does it on time, then the right foot will take an active step on the late, beginning to accelerate to pole for the plant. The most dangerous moment during the drop is an early touch of the box when the transition is made from the right to the take-off foot.

Take-off and penetration
The efficiency of this phase depends on the vaulter's skill in the drop/take-off junction, on whether he is able to begin the push before the pole is set against the box. The pole must be smoothly transferred to the plant position when the vertical take-off plane is crossed. The technically correct movement demonstrates the right acceleration of the pole by the moment the vaulter reaches the vertical take-off plane.

The left arm is not trying to bend the pole; it plants it firmly towards the bar and then transfers the effort to the right hand, so that the pole is bent by the impact of the vaulter's speed and mass. The vaulter, alert to the resilience of the pole, must perform all the subsequent actions on the pole as on a rigid support.

The primary purposes of the support-pushing part of the jump are as follows:

to perform the drop and plant with minimal losses in horizontal speed at the angle of 20-22º, i.e. at a tangent to the future swing on the pole;
maximum transfer of kinetic energy to the pole by means of the impact made by the "pivotal" junction.
Of great importance in pole vaulting is the depth of the body advancement forward during the take-off. With this in mind, even during the take-off the athlete must release the shoulder girdle from tension and drive his chest forward/upward, while at the same time taking off with the support leg and swinging with the free leg.

The quickness and depth of the take-off greatly influence the technique of all the next elements of the vault: the hang, swing and rock-back. Moreover, the performance of the take-off phase determines the rhythm of the subsequent parts of the vault.

The take-off point of the top pole vaulters of the world is somewhere within 420-440 cm from the back of the box. The taller vaulters take off at a distance of 410-420 cm, shorter ones do it at 430-440 cm.

Continued acceleration of the last 4 strides is an indication of good skills acquired in this part of the pole vault (pole drop/plant). The speed of Sergei Bubka shown in his best vaults continued to grow until the take-off, as follows:

4 strides before take-off: 9.5 m/sec

2 strides before take-off: 9.7 m/sec

before take-off: 9.9 m/sec.

Recommendations for the take-off phase:

Begin the pole acceleration for the "push" already from the swinging leg
Before the take-off leg contacts the ground the vaulter needs to create a maximum space between him and the pole. His arms must be stretched, the right (left) arm continues the line of his body, whereas the left (right) arm is at right angle the pole axis.
Before the vertical position the vaulter tries to increase this space to the maximum, whereas ever since, and during the whole movement from the take-off he must aim to "rush" as deep upward as possible, trying to reach the left elbow with his head.
The foot is placed for the take-off firmly with a quick roll-up on the ball of the foot.
The vaulter must pay more attention to the swing with the right (left) leg bent to a maximum in order to move the hips forward, trying to keep the shoulders in the front position, until the end of the hang.
Swing-up and rock-back
Having moved the chest and hips forward during the hang the vaulter begins to draw the shoulders back – mainly through the effort of the shoulder girdle muscles, thus switching the rotation axis from hands to shoulders.

Question: Is the drop of the swinging leg during the hang losing its importance?

Answer: At present the athletes and their coaches pay more attention to the quickness and the amplitude (depth) of the "drive" on the pole than to the external observance of the position. After the shoulder girdle muscles "switch on", the vaulter strongly swings his whole body upwards. The rotation axis goes through his shoulder girdle. In this case the swing on the pole is forceful and quick. The pole is bent to the maximum when the athlete's body takes a horizontal position to the ground, and the shins of the bent legs pass by the bent pole and are raised to the level of the head and shoulders. It is worth mentioning here that the arrest of the shoulders after the deep penetration ensures the drive of the hips upwards to the pole, through active unbending of the left arm, whereas the acceleration of the vaulter's hips drive upwards was built up by the turn of the shoulders back and down.

The turn over onto the shoulders and extension of the body along the pole
The turn must be done by simultaneous movements of the body parts: the legs go upward, and the shoulders drop down. The movement of the shoulders, or, to be more exact, their acceleration in the swing is a necessary element in vaulting with large grips and rigid poles. It is especially important to maintain the movement of the shoulders when the vaulter has unbent his legs (knees) and taken the "+" position – body and legs at right angle.

When the vaulter is unbending, the pole also has the highest speed of uncoiling upwards, therefore, the combination of the pole's carrying capacity and the athlete's unbending movement generates an accelerated thrust upwards, and by the end of the unbending movement the centroidal axis reaches the maximum vertical speed (Bubka's speed reached up to 6 m/s). An active turn over onto the shoulders should end when arms come in use in order to stretch the body along the pole. By this movement the vaulter maintains the speed of the body's thrust upwards. One of the vaulter's tasks during the pull up is keeping the body close to the pole. The closer are

the vaulter's and the pole's line during the pull up and turn, the longer is the acceleration upwards.

The turn and bar clearance

The pull and the turn are a continuous effort. There should not be any shortest delays in performing these elements. While trying to maintain the vertical speed, the vaulter begins to stretch the body and turn, using the take-off speed. The arms basically keep the body by the pole and maintain the speed.

In transit to the push the vaulter – apart from the turn left to the pole – uses the rotation of the pole in the bearing point. With their high upward speed, many great vaulters, after their right hand releases the pole, are still in the vertical position. The vaulter needs to keep the uniform motion of the body and by bending the knees thus increase the speed of rotation around the crossbar.

If the preliminary movements were performed correctly, the vaulter will be thrust up, and the bar clearance will be done in the most efficient style, the so-called "curved ascension".

Not all of the world's top vaulters have standardized motions during the bar clearance, but all of them are distinguished by the excellent "feeling of the bar" which allows them to perform the most efficient movements in order to avoid touching the bar.