# Lothar Altmeyer: Clinic notes

# The Discus Throw

The discus throw is best suited for very tall athletes with long arms.

**Christoph Harting**, Olympic Champion 2016, is 6ft 9in tall and has an arm span of over 7 ft.

The discus technique can be structured as follows:
(1) double support starting phase
(2) single support starting phase
(3) supportless phase
(4) single support delivery phase
(5) double support delivery phase.

1. The double support starting phase begins with the check of the backward swing and ends when the swinging foot leaves the surface of the circle.
The body weight is shifted from the right (swinging) leg to the left (pivot) leg.
It is important that the primary rotation of the trunk is produced from the rotatory action of the (right) swinging leg, which is lifted from the ground after the weight of the body has been shifted to the left leg.

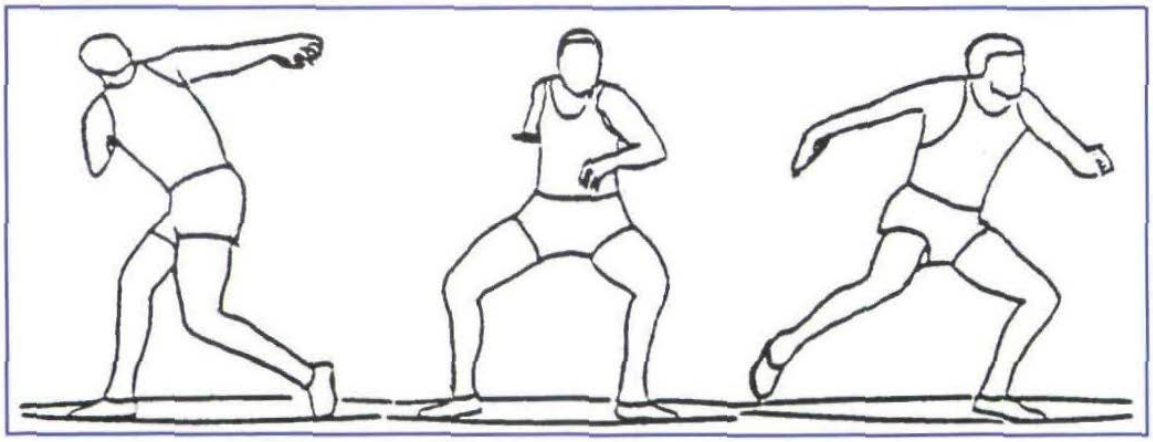


Figure 7: Double support starting movement in three phases, with accentuated V formation of *the feet in the bridge position*

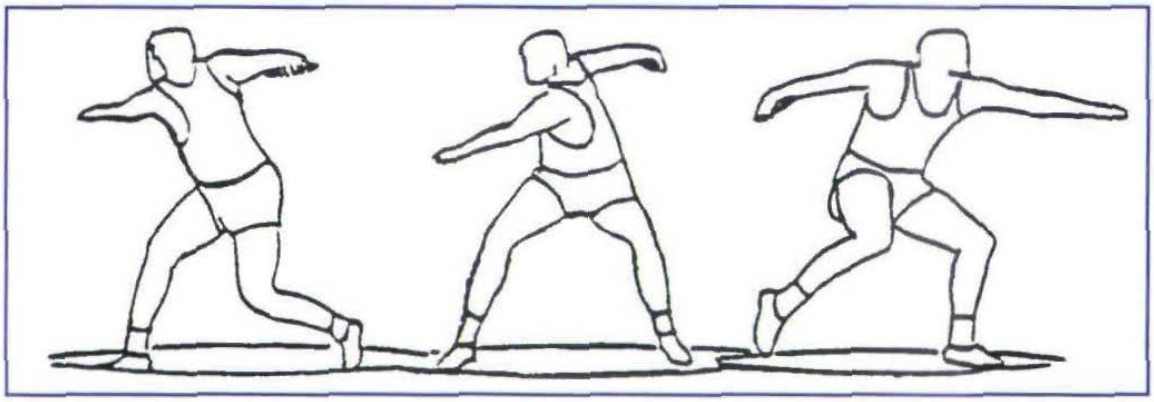


Figure 8: **Double support starting position, in three phases** (variation B, without specific V formation of the feet)

2. The optimal time of lifting the foot of the swinging leg from the ground depends from the way it is moved. If you favor a ‘narrow’ movement of a bent swinging leg the lifting from the ground should be delayed. If you prefer a wide swinging movement with an almost straight swinging leg you must lift it earlier. The latter variation appears to be more effective because an extended leg has a greater moment of inertia than a bent leg. So it is possible to produce an effective rotational impulse about the longitudinal axis of the body by a correspondingly powerful pull at the pelvis. The wide swinging, extended leg facilitates a synchronous shift of the centre of gravity (CG) to the centre of the circle. This makes possible a fluent change of support from left to right with a very short flight time and a shortened translation path of the CG.
By bending or moving the swinging leg toward the turning leg, the angular velocity can be effectively increased at the beginning of and during the support-less phase. At the start of the rotation, the free arm is used in a horizontal and extended way in order to reduce the angular velocity. During the subsequent support-less phase the arm is bent and moved in again towards the trunk. So the extended arm has rather a steering function; it ‘controls’ the optimal angular velocity during each phase of the turn.
A combination of the use of the extended leg and extended arm at the beginning of the single support starting phase and the subsequent bending of the respective extremities at the end of the starting phase seem to be most effective. During the single support starting phase, the discus ‘follows’ the thrower, which means that the throwing arm and shoulder should be deliberately held back during the starting phase, instead of leading the movement. Thus, the ‘trailed’ discus travels through its first low point behind the thrower as it passes the bisector of the circle.

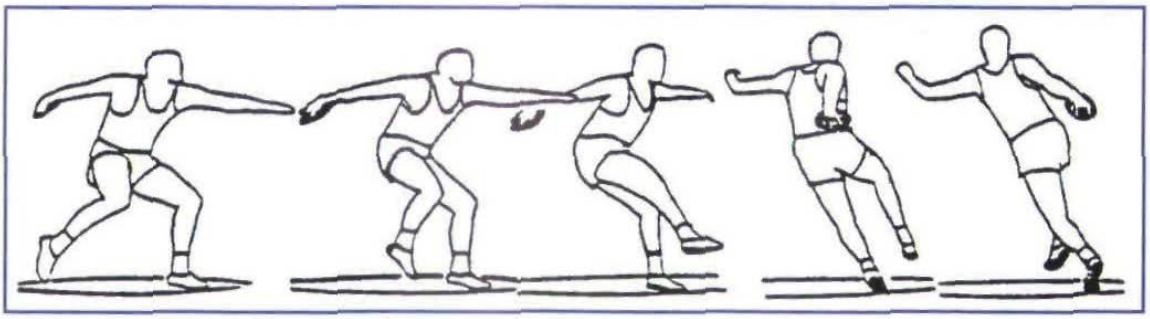


Figure 11: Single support starting phase with combined use of extended free arm and swinging leg
As compared to the Sylvester technique, the swinging leg passes the turning leg at a closer distance, and the foot is moved in a flatter way (see phases 4 and 5).

3. The main function of the flight phase is to effect the change of support from the left to the right leg. Although it is possible to perform this translation even with no loss of ground contact, this inevitably leads to a considerable reduction in the force of the primarily horizontal push-off of the left leg. The ‘no support’ phase, which is characterized by a flight time of 60ms to 80ms and a distance of 0.8m covered by the discus, is the shortest of all five phases, in both space and time. The obvious aim is to go through the flight phase as quickly as possible.

4. The aim of the single support delivery phase is to develop torsion between the axes of the shoulder and pelvis. The free arm facilitates this by slowing down the rotation of the shoulder axis, while the pelvis continues to rotate.
The twist is supported by the left arm, which is deliberately held against the throwing direction and forms the ‘opposite pole’ of the turning extension movement of the right

leg in the throwing direction. It is important that the right leg, immediately after landing, performs a rotational movement, which is at first rather passive. The necessary rotational impulse has its origin primarily in the rotational start. However, immediately after the push-off of the pivoting foot from the back of the circle, this rotational impulse is continued and augmented by the contraction of the oblique trunk muscles. The fast and active positioning of the free (left) leg in the turning direction further increases the rotation of the lower extremities. The rotation of the trunk and throwing arm follows after these movements of the lower extremities.
In order to minimize the reduction of angular velocity through friction, a landing on the ball of the foot is essential and the sole of the right shoe should permit an easily executed pivoting movement. The use of the left arm to hold back the upper part of the body, while the lower part is rotating actively, is possibly still the most effective method of achieving a high pre-tension of the trunk. Furthermore, this method makes it possible to prevent the discus from running ahead during the single support phase.
Next there is a vigorous swinging or 'pulling' action of the arm diagonally upward, in an extended bent position. The free arm is immediately swung backwards and upwards towards the throwing direction.
The gradual increase of the velocity of the discus can be achieved only if the following preconditions are fulfilled:

- an attainment of a high angular velocity of the whole system, by means of
- an accentuated and dynamic leg action during the first single support starting phase.
- a delay of the trunk rotation during the flight phase and at the beginning of the first single
  support delivery phase
- an optimal landing position, with the longitudinal axis of the body leaning back against the throwing direction (the trunk first remains bent over the bent turning leg). The discus is trailed at, or slightly above, the height of the head at its second high point ('kept back and high').
- an active use of the free arm and free leg in the turning direction, while the throwing arm is deliberately (passively) 'held back' during the single support delivery phase.
- a good degree of flexibility and looseness at the throwing shoulder, so that the inertia of
  the trailed throwing arm / implement can be utilized by 'the pull' of the free arm. This prevents the discus from running ahead. At the same time, this leads both to the development of a high tension and also to such a great angular velocity, that centrifugal
  force keeps the discus on the widest path of acceleration, at the level of the second high
  point.
- an active turning thrust of the right leg, which causes the pelvis to run ahead and shift quickly in the throwing direction. This leads to an increase of tension in the trunk during the single support delivery phase and is an optimal preparation for the slinging movement.

This 'slinging movement' is the transition from the single support delivery phase, which lasts about l90ms and in which the discus covers a distance of 1.50m to the double support delivery phase.

5. Between 60 and 75% of the release velocity is produced in the double support delivery phase. Its duration is approximately 150ms. When the discus leaves the thrower's hand, you can have two feet, the front foot or no foot on the ground. It is not possible to say which technique is more successful.
Those throwers who opt for the 'jump delivery' stress the vertical acceleration component of the release velocity, which is only possible if there is very great explosive strength in the leg muscles, while those who prefer the double support put the emphasis rather on the rotational component. The optimal execution of this delivery variation also requires great leg strength.
The primary characteristic of the support delivery is a significant running ahead of the hips, with a corresponding trailing of the implement and a considerable twist of the body. The 'slinging movement' resulting from this, together with a preceding development of tension via the right hip, with the front leg serving as a prop, cannot be achieved to the same degree in the jump delivery because of the 'condensed' dynamics of this delivery technique.
The head must not run ahead of the throw but, during the whole release phase, must be kept at the anatomical 'zero position'.
Another important difference to note is the 'lifted delivery position,' with a vertical alignment of the longitudinal axis of the body, in the case of the jump delivery, as opposed to the slightly backward lean of the trunk in the case of the support delivery.
The main goals of the thrower are the maximization of the release velocity and the optimization of the delivery conditions.

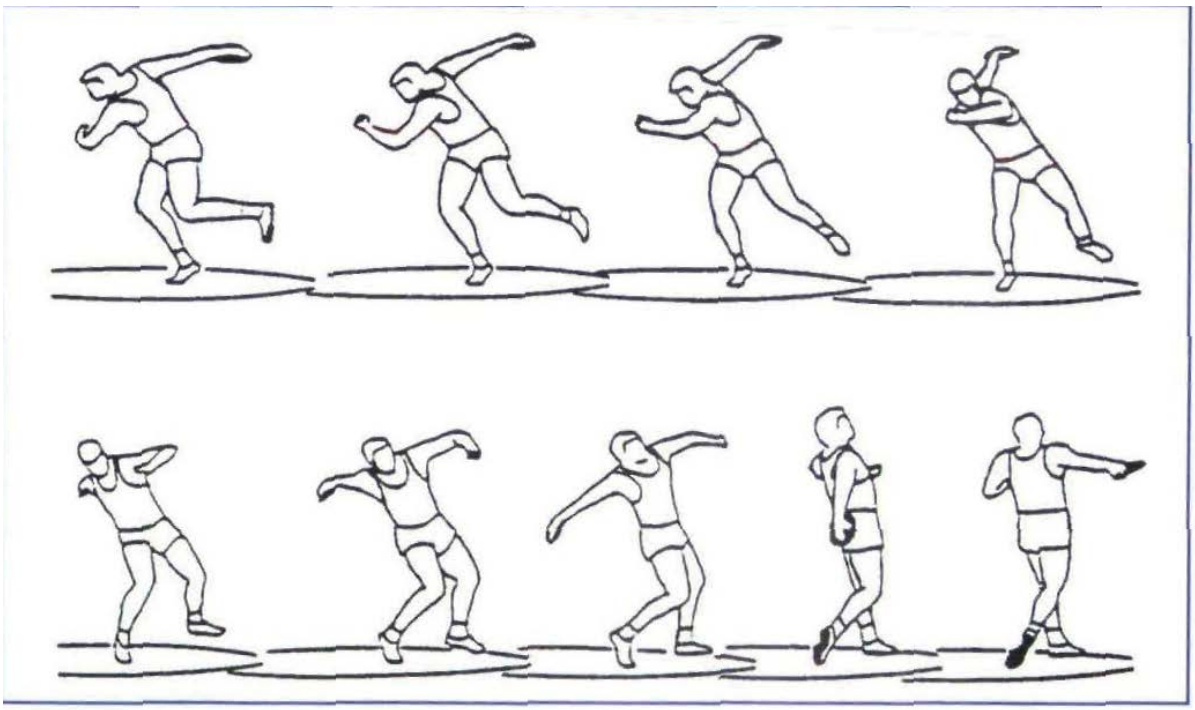
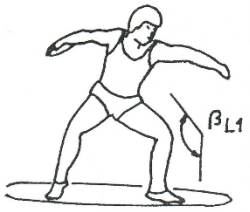
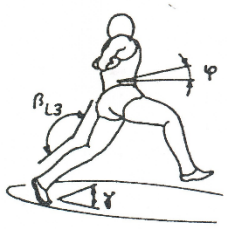
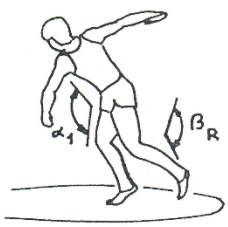


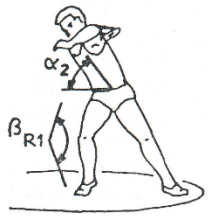
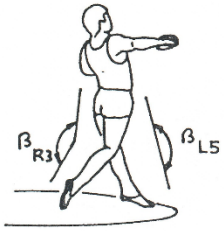
**Figure 18: A side/oblique view of a 68m throw, showing variation II of the free arm behaviour**
During the transition from phase 2 to phase 3, the free arm is first of all lifted and then actively rotated in the throwing direction, in the plane of the shoulder axis. As soon as the thrower reaches the frontal position, he blocks the left side of his body.

(Abbreviated text from G. Tidow, New Studies in Athletics, 9/94)

## The Discus Throw

The following illustrations have been taken from HINZ, L.: Leichtathletik. Wurf und Stoss. Berlin 1991. Phases and descriptons have been changed.

| ILLUSTRATION | PHASE | DEMANDS | BIOMECHANICAL PARAMETERS |
|---|---|---|---|
|   | STARTING OF THE TURN<br><br>position<br><br>when left foot starts turning and knee is rectangular to throwing direction (picture from the rear) | - transfer of body weight onto left leg<br>- left foot works<br>- upper-body is held back by left arm | - knee-angle 130 - 140°<br><br>- left arm about 10° behind left thigh<br>- tension thigh area |
| | BALANCE POSITION<br><br>position<br><br>right foot leaves ground | - keep bent position | - angle left knee less 130° |
|   | SPRINT STRIDE<br><br>position<br><br>right leg passes left one<br><br>push-off of left foot | - "kick" of right leg<br><br>- flat push without full extension of the knee angle<br>- right thigh beyond horizontal<br>- left arm kept back conciously | - lower leg-angle 36 - 42°<br>- knee-angle ≈ 160°<br>- center of gravity moves forward up about 10° |
| | DRIVE ACROSS<br><br>position<br><br>left foot leaves ground | - right leg swings, then grounds under the body actively | |
|   | POWER POSITION<br><br>position<br><br>foot touches ground | - right foot touches at 11 - 1 o' clock on the ball<br><br>- upper-body bent over knee<br>- keep on rotating right foot | - knee angle 110 - 125°<br>- at the end of the phase 100 - 115°<br><br>- angle body - thigh 130° |

| ILLUSTRATION | PHASE | DEMANDS | BIOMECHANICAL PARAMETERS |
|---|---|---|---|
| | THROW | | |
| | position | | |
|   | left foot touches ground | - fast and solid planting of left foot<br>- upper-body above right leg<br>- discus can still be seen behind the body<br>- increase the torque<br>- turn - stretch impulse (foot-knee-hips-shoulder-arm) | - knee angle right 110°<br>- knee angle left 170°<br>- leaning backwards 45°<br>- summation of forces |
| | position | | |
|   | right knee faces throwing direction | - left leg bracing<br>- left knee stays behind perpendicular line | - left knee angle 170° |
|   | position | | |
| | throw | - explosive work of the legs<br>- release slightly beyond shoulder axis | - release angle 35 - 37° |

# KEY ELEMENTS OF THE DISCUS THROW

**WINDUP**

- relaxed swinging back of the discus ; throwing arm points at least in the direction of the throw and is held in shoulder height;

**THE TURN**

- start the turn with a movement of the left toe and lower your center of gravity
- build up tension between hip-axis and shoulder-axis
- active swinging movement of the right leg on a wide path around the left side
- coordination of left and right foot movement; fast and low forward

**LANDING ON RIGHT**

- active and balanced landing on right toe at 12 o'clock

**DELIVERY**

- right toe keeps rotating even before left leg lands; left leg is slightly bent and to the left
- right arm is held back as far as possible
- push right knee forward, then extend right leg against a braced left side
- hurl the discus around a fixed left side and release it shoulder high

**The discus**

The following suggestions are based on very personal experience. This is why we recommend:

0 general exercises to establish a sufficient level of agility

(equilibrium, balance, co-ordination, orientation, rhythm,..)

For this purpose other kinds of sports may be useful:

* skiing, skating, dancing, gymnastics, trampolin, games, ...

1 special exercises

balance: various kinds of rotation on the ball, slowly and controlled

turns: on the spot, forward turns with/without acceleration, turns with finish in various positions, ...

throws: with different implements (balls, shoes, etc)

discus: get used to the implement. Experience how the implement reacts on different movements (swings, rolling, spin, ..)

2 360° turns with delivery (with other implements)

Stand facing the front. Start turn with left foot forward. Put special emphasis on the rhythm (clap, shout). Finish without reverse in double-leg supported position (the right leg just helps balancing). Use different implements. Mind the danger of accidents.

Coach and athlete control final position!

3 360° turns with delivery (with discus)

same execution as the previous step.

Experience proved that this approach can be done well. For example the heavy fault of grounding the right heel in the power positon occurs far less than when beginning to teach the discus from the standing throw.

4 450° turns with delivery

Attention is paid now especially to the start and the balance position. The transfer of the bodyweight onto the left bent leg is important.

5 ... Advance to full turns (540°)

As soon as the basic technique is established all other known drills should be used to improve the skill level, for motivation and to let the athletes "play" with their movement.