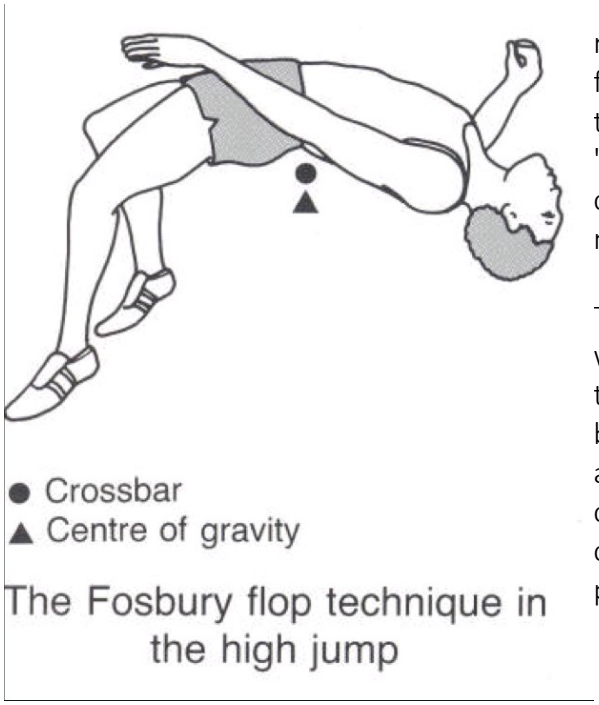
Bio-mechanical Analysis: High Jump

A high jump can be broken down into three phases: run-up, takeoff and flight.

At run-up, a preparatory phase for high jumpers run in curves to generate the right amount of angular momentum in order to perform in the air the rotations necessary for a proper bar clearance.

In the last two or three stride of of the run-up, the high jumper should lower the hips without losing a significant amount of speed, and this helps to lower the center of mass for start of the takeoff phase, the instant when the takeoff foot leave the ground. Before the takeoff, the hinge moment occurs. It's when part of a moving object stop creating a momentum transfer the center of mass from low to high resulting an upward momentum of the beginning of the flight phase. During the takeoff phase, the athlete produces angular momentum about a horizontal axis perpendicular to the final direction of the run-up.

After takeoff, the center of gravity follows a fixed path called a parabola. The parabola should reach the maximum possible peak height.



The Fosbury flop technique in the high jump

In a Fosbury FIop, the rotation consists of a "twist" (a rotation around the longitudinal axis of the body created from running on the curve forces body to rotate) which turns the back of the athlete toward the bar, and a "somersault" (a rotation around a transverse axis creating from the knee drive before take off) which makes the shoulders go down and the knees go up.

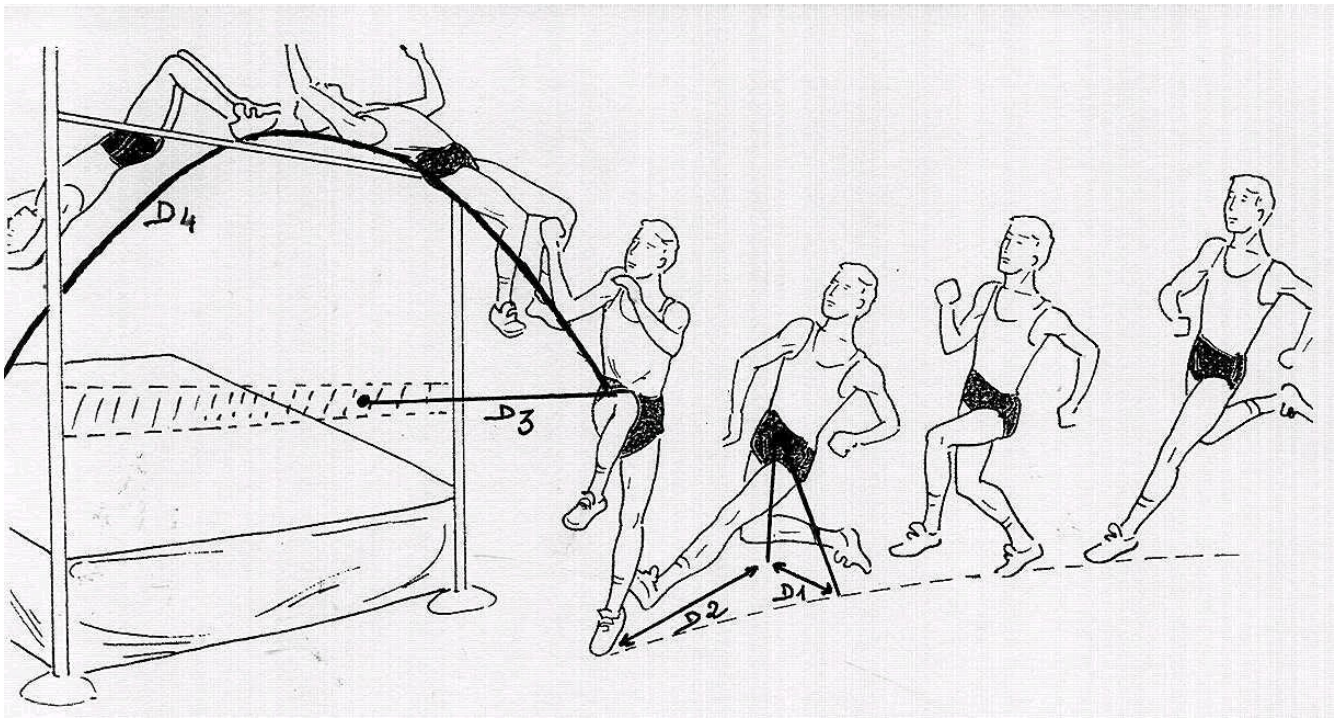
Two motions produces a twisting somersault rotation which leads to a face-up layout position at the peak of the jump. Combined with an arched configuration of the body, this position allows the athlete to clear a bar set at a height that is near the maximum height. Where the center of mass is below the body. This is result from the continuation of momentum through the previous phases.

tucking the chin

Tucking the chin is also important in the last phase. Good timing for tucking the chin helps the hips to drop and feet to rise to clear the bar.

The most frequent problems in the rotation of a Fosbury-flop high jump are due to insufficient amounts of somersault or twist rotation after takeoff. An insufficient amount of somersault rotation (sometimes misleadingly described as "stalling") makes it difficult for the legs to clear the bar; an insufficient amount of twist rotation produces a tilted position of the athlete at the peak of the jump, with the hip of the lead leg lower than the hip of the takeoff leg.

Ankle, knee, hip, shoulder and elbow joints have being used mostly throughout.
The planes the limbs are moving through are saggital and frontal. In the saggital plane there is flexion of the knee, extension of the hip, trunk, and cervical. In the frontal plane you have abduction of the arms. The muscles in the thigh, the quadriceps and hamstrings perform movement of knee joints while runing. At the hip, the gluteus maximus produces the movement of concentric hip extension assisted by the hamstring groups. Shoulder extensor muscle group help shoulder joints do a cicumduction before take off. The quadriceps muscle help the athlete push off the ground. Hamstring flex the knee, and during the high jump it restarts the leg turnover. While jumping, gastrocnemius muscle extend as the knee extensors from the knee make the ankle joint perform dorsiflexion then plantar flexion motion at sagittal plane. Retraction of chin to elevate hip and erector spinae muscles are used to generate force to get the body over the bar. Once the athlete's body is over the bar, they abduct their arms and then legs to slow their momentum.



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