Throwing, Striking, and Kicking Skills

Skill highlights

1. In high-velocity throwing and striking skills, there is a rapid acceleration of the athlete's body segments, beginning with those in contact with the earth. This whiplike, or flail-like sequence progresses upward from the legs to the hips, from hips to chest, and culminates in the tremendous velocity of the striking or throwing arm. To achieve the greatest possible velocity, it is important that antagonist muscle groups are completely relaxed.
2. Kicking skills differ from throwing and striking skills in that the last and fastest moving links in the whiplike sequence are the athlete's lower leg and kicking foot. The progressive acceleration of body segments in kicking skills is similar to that of throwing and striking skills.
3. Each movement pattern in throwing, striking, and kicking skills contains a preparatory action commonly called a windup or backswing. A windup provides additional distance over which force is applied. It also prestretches the athlete's muscles ready for their explosive recoil. Relaxation and flexibility help to produce an optimal windup.

SPOTLIGHT ON . . .

Javelin Throw

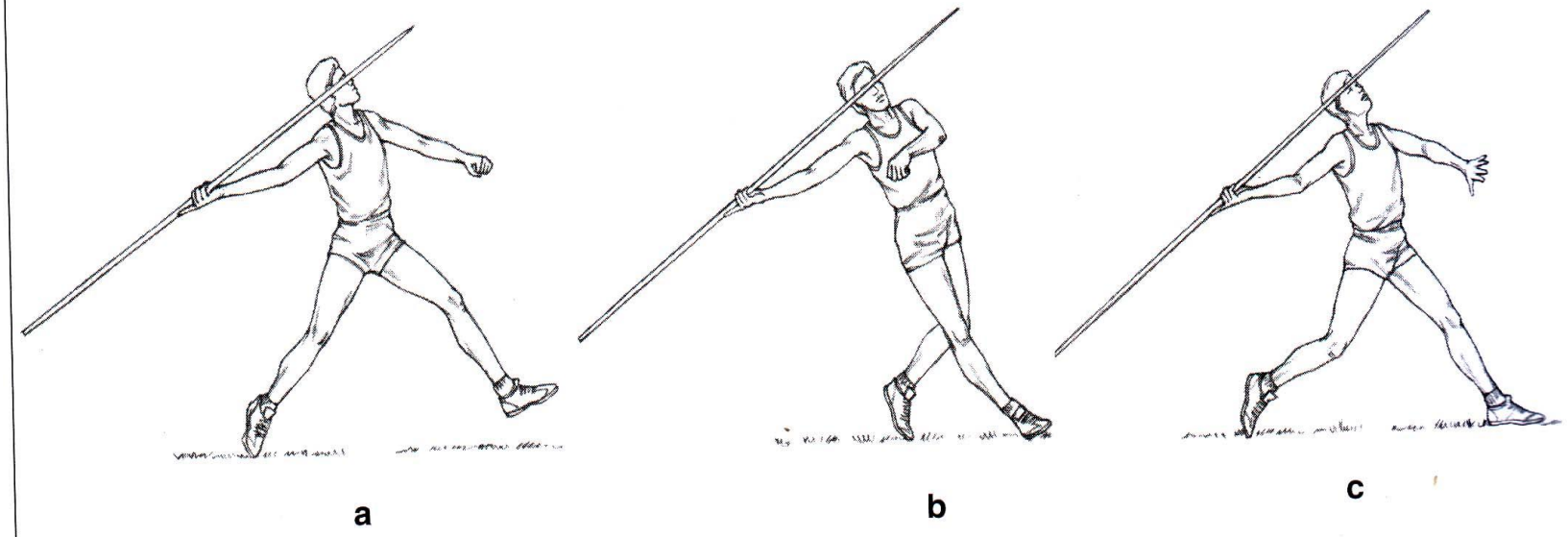
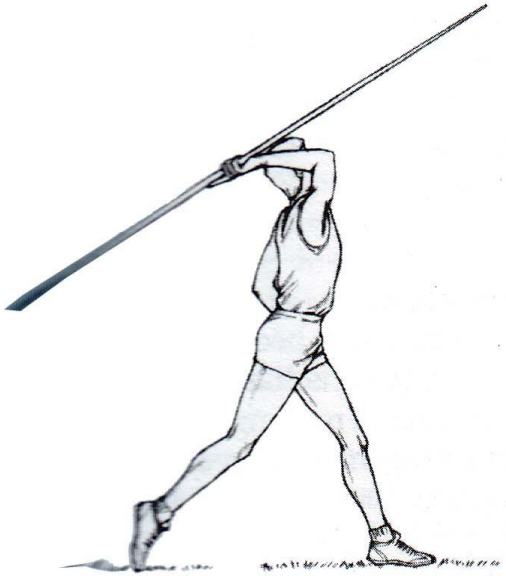


Fig. 9.4. Javelin throw.



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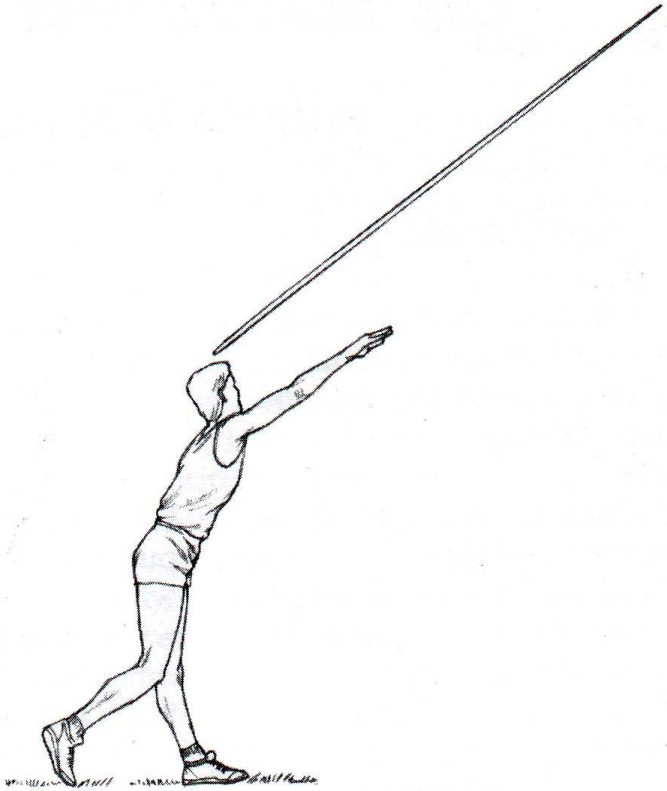

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Javelin Throw

Technique	Mechanics
1. A run-up toward the direction of throw leads into a wide powerful throwing stance. The run-up is relaxed and increases in velocity. The athlete accelerates during the first two thirds of the approach. This leads into the final one third of the throw, which includes the withdrawal of the javelin and the final throwing motion.	1. A run-up builds momentum and generates enough velocity to carry the athlete through the throwing stance and into the follow-through. Too much velocity in the early part of the run-up may cause the athlete either to slow down during the throwing actions, or conversely not allow enough time in the throwing stance to apply an optimal amount of force to the javelin. Efficient use of a run-up can increase the distance thrown by 90 to 100 ft compared with a standing throw.
2. Before entering the throwing stance, the athlete's shoulder girdle is rotated away from the direction of throw, and the throwing arm is taken back to arm's length (see Figure 9.4a). By use of one or more crossover steps, the lower body moves forward under the torso so the athlete's body is angled backward away from the direction of throw (see Figure 9.4, a-b).	2. The purpose of the rotation of the shoulder girdle coupled with the extension of the throwing arm is to prepare the athlete for the application of force over the largest possible distance and time frame. The backward body lean makes this distance and time frame even greater.

Javelin Throw

Technique	Mechanics
3. The athlete steps into the throwing stance with the leg on the opposite side of the body to the throwing arm. This step is considerably larger than those prior (see Figure 9.4c).	3. Stepping forward with the opposing foot sets up a large base of support for the application of force. This allows the athlete's hips and shoulders to be rotated away from the direction of throw.
4. The athlete's body is tilted backward and the center of gravity lowered over a partially flexed rear leg. The rear leg is flexed at the knee and angled 45 degrees from the direction of throw.	4. Flexing the rear leg stretches the leg muscles in preparation for their explosive rotary thrust toward the direction of throw. This rotary motion is the first stage in the athlete's whiplash action that starts from the athlete's base and progresses up to the throwing arm.
5. The rear leg is vigorously rotated toward the direction of throw. This action thrusts the hips in the same direction (See Figure 9.4, c-d). The muscles joining the hips to the torso stretch and contract explosively.	5. More massive, slower moving parts of the body shift forward into the throw while lighter body segments (e.g., the throwing arm) complete their backward extension. This motion stretches the muscles in the abdomen, chest, and shoulders ready for their explosive contraction during later phases of the throw.
6. The athlete's torso rotates and pulls the shoulders and the throwing arm toward the direction of throw. Opposing muscle groups	6. Each of the athlete's body segments, from the legs through to the shoulders and throwing arm, sequentially accelerate. This sequence sets up a flail-like

Javelin Throw

Technique	Mechanics
are relaxed. As the shoulders are pulled forward, the muscles of the shoulders stretch and then contract vigorously. A relaxed throwing arm follows the shoulder with a flail-like action. The athlete's body tilts sideways away from the throwing arm. The free arm rotates backward to help pull the chest and throwing arm around and into the throw (see Figure 9.4, c-d).	whip-cracking action that progressively builds and ends in the tremendous velocity of the throwing arm. A sideways inclination of the athlete's body allows for greater height of release. The free arm is pulled backward to help rotate the athlete's torso around the long axis of the body. Rotation of the torso makes a contribution in pulling the throwing arm at high velocity into the throw.
7. As the athlete's throwing arm is pulled forward, the upper arm and elbow lead with the throwing hand and javelin trailing well behind. Flexion occurs at the elbow of the throwing arm (see Figure 9.4d).	7. Flexing the throwing arm at the elbow serves two purposes: (1) It helps the athlete to become even more whiplike, and (2) the elbow acts like the axle of a wheel with the throwing hand rotating around at its rim. This wheel-axle arrangement increases the velocity of the throwing hand and the javelin.

8. The athlete thrusts forward toward the direction of throw. The torso moves forward beyond the supporting leg, which has been straightened (see Figure 9.4e).	8. Forcefully driving the body as far as possible toward the direction of throw extends the application of force to the javelin over the longest possible distance and time period.
9. The athlete uses a follow-through to complete the throw (see Figure 9.4e).	9. The follow-through applies force to the javelin for as long as possible. After the javelin has left the athlete's hand, the follow-through allows for safe dissipation of momentum from the athlete's body.
10. The angle of release of the javelin varies according to the throwing ability of the athlete, the type of javelin used, and environmental conditions at the time of throwing.	10. A javelin is dramatically affected by lift and drag forces. The trajectory angle and the position of the javelin at release relative to environmental conditions, such as head- and tailwinds, all determine the flight path and the distance that the javelin follows.

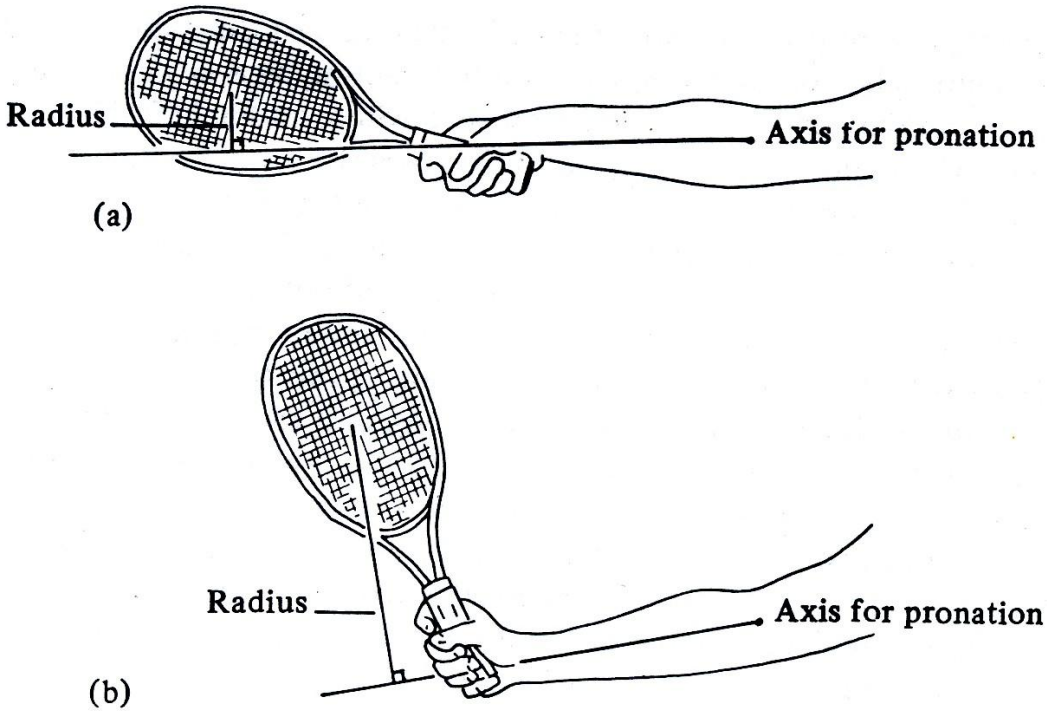


Figure 12-4. (a) Small radius "wheel" segment. (b) Large radius "wheel" segment, used in the wheel and axle mechanism of radio-ulnar pronation.

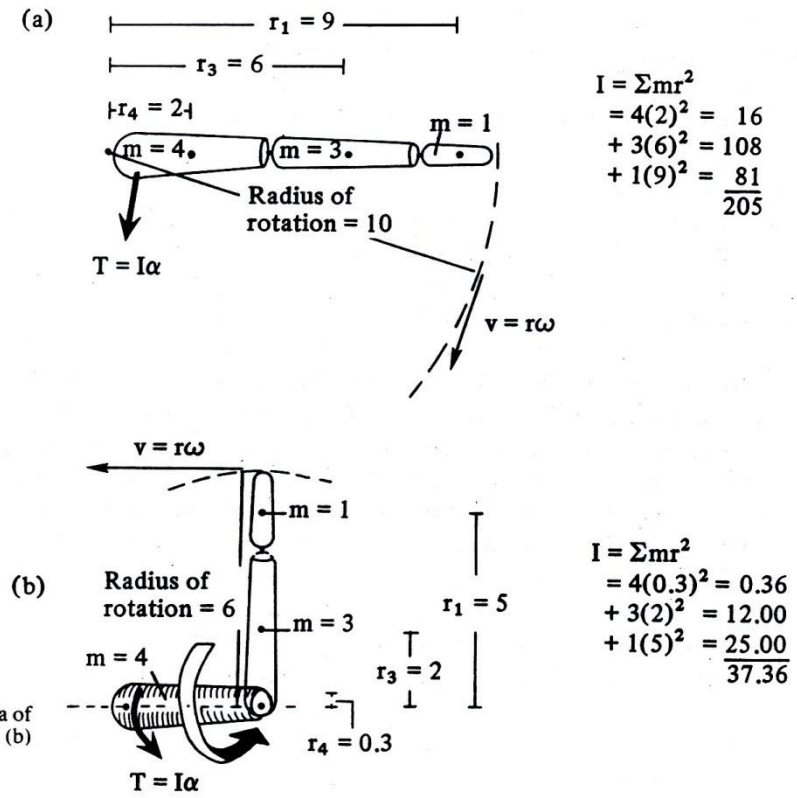


Figure 12-5. (a) The rotational inertia of a segment in a lever arrangement and (b) in a wheel-and-axle arrangement.

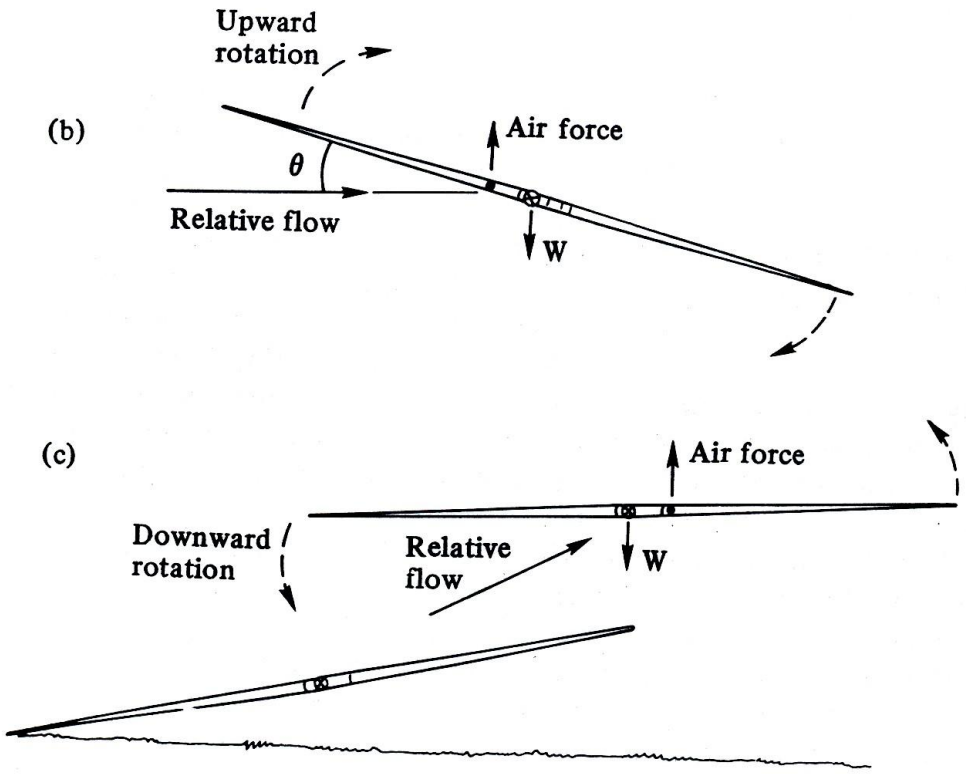
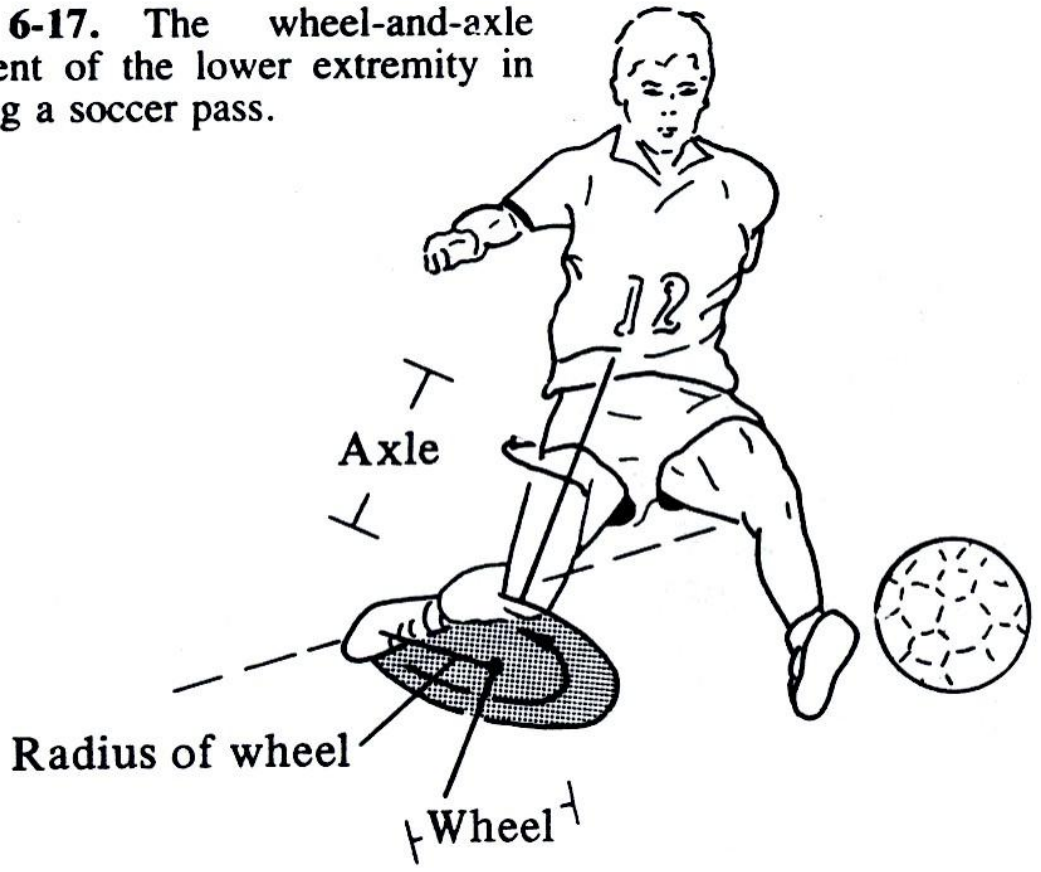


Figure 9-18. The torque produced on a discus and a javelin when the center of pressure and center of gravity do not coincide. The center of pressure is in front of the center of gravity in (a) and (b); the center of pressure is behind the center of gravity in (c).

Figure 6-17. The wheel-and-axle arrangement of the lower extremity in performing a soccer pass.



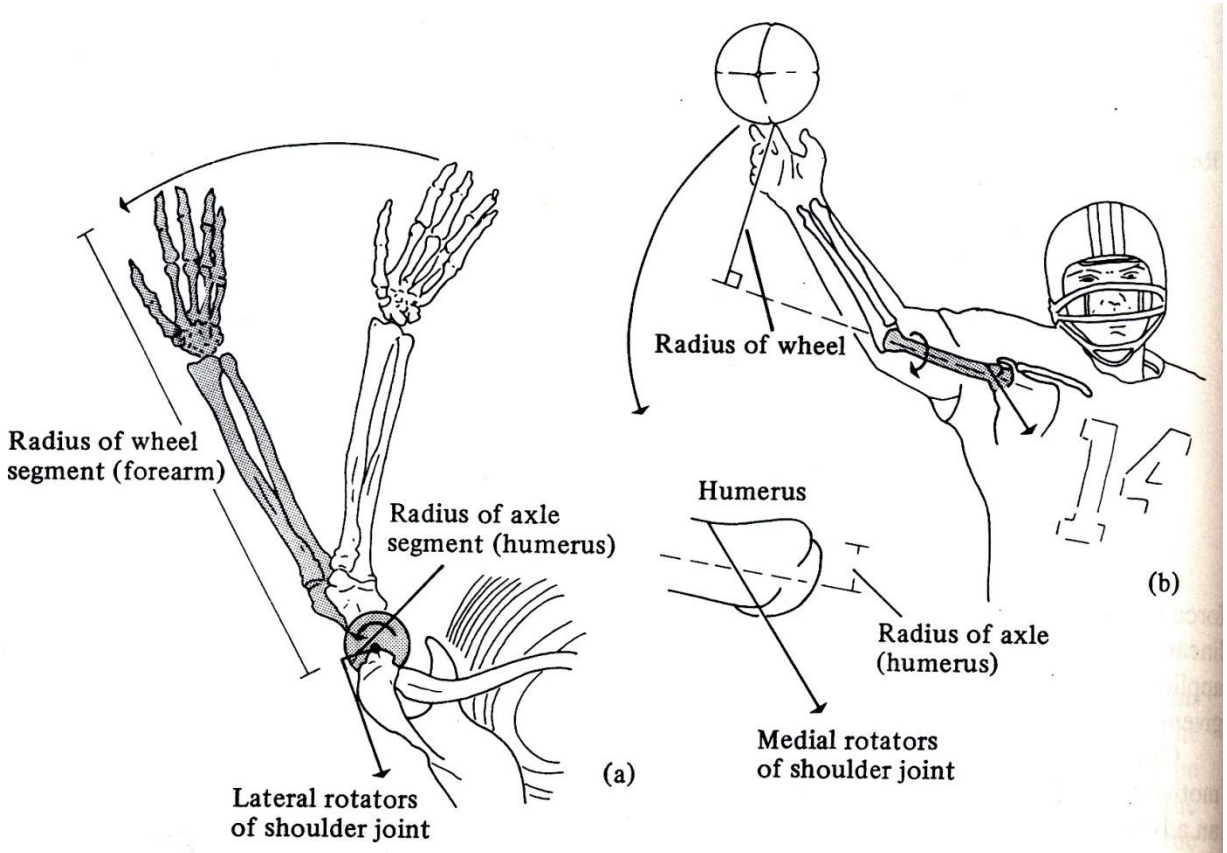


Figure 5-24. (a) Cross section of the humerus, showing the wheel-and-axle arrangement of the external rotators of the shoulder joint. (b) The humerus and forearm acting like a wheel and axle as a player throws a football pass.

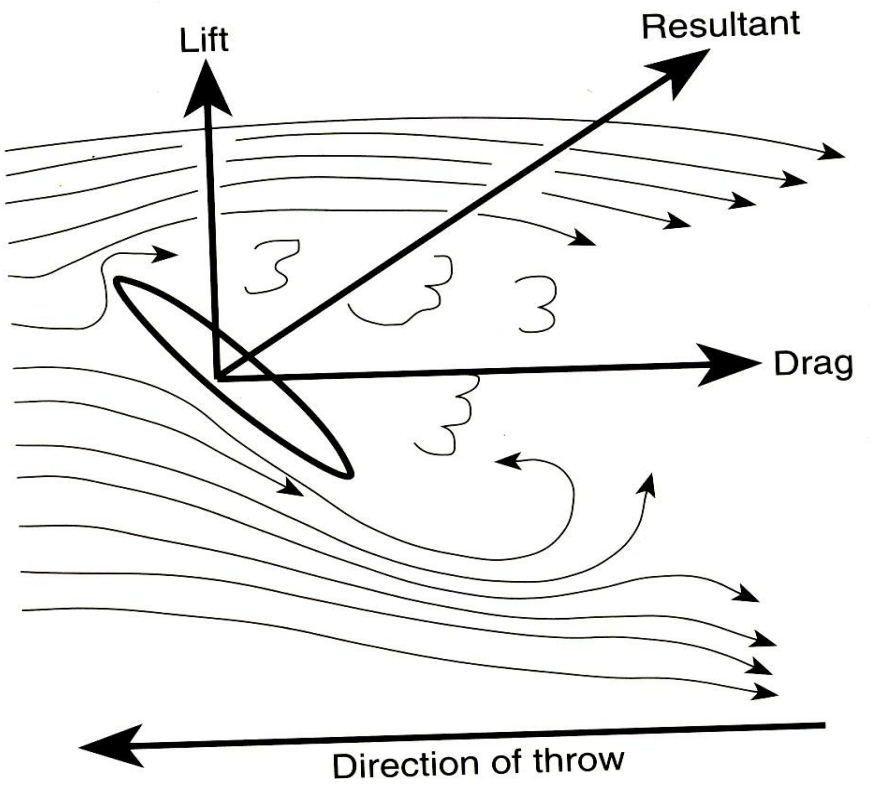


Fig. 6.13. Lift and drag forces combine to form a resultant force.

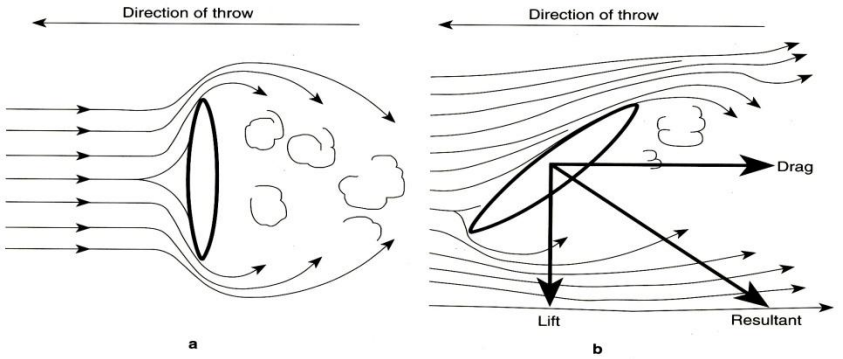


Fig. 6.14. (a) Discus thrown in this manner gets no lift. (b) Discus thrown with a negative angle of attack generates downward lift.

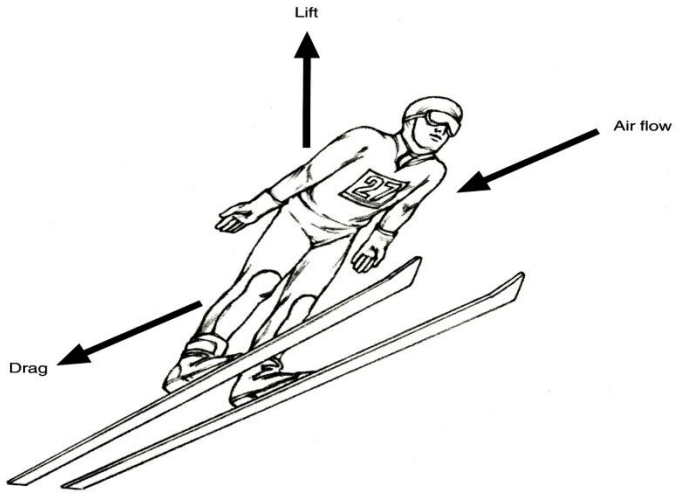


Fig. 6.15. Lift and drag in a ski jump.

Drag ： a force produced by the relative motion of an object or an athlete in afluid (e.g., water or air). The direction that drag force acts is in opposition to the motion of the object or athlete through the fluid

Lift ： The force acting on an object in a fluid, perpendicular to the fluid’s flow. Lift is not always upward; it can occur in any direction