Long vs. Triple Jumping

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The Athlete:

- Often the same individual competes in both events.
- In point of fact:
  - The most important factor in the Long Jump is linear velocity or speed at take-off.
  - The most important factor in the Triple Jump is strength, coordination, and mental toughness.

The Physics

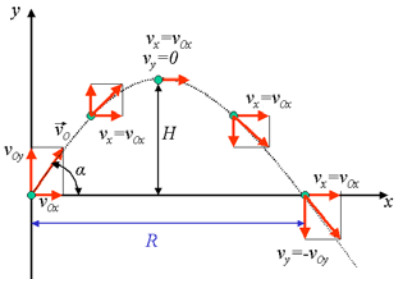
- The athlete in both events becomes a projectile governed by the laws of physics.
- What happens to a projectile once it is launched?
- Assuming acceleration is constant, motion can be described by three formulas:

$$Vf = Vi + at$$
$$d = Vit + \tfrac{1}{2}at^2$$
$$Vf^2 = Vi^2 + 2ad$$

Vf = final velocity
Vi = initial velocity
a = acceleration
t = time
d = distance

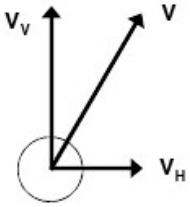
- *These formulae are used to describe vertical and horizontal motion*

Important Characteristics of Projectile Motion



- Center of mass (CM) of projectile will travel in a parabolic path - regardless of the motion of the individual body segments.
- Vertical velocity at the peak of the projectile's flight will be exactly zero.
- Horizontal velocity is constant (ignoring air resistance)

Importance of Speed, Angle & Height at Release



- *Speed of release*: most important
  - Increases in V_H increase distance.
  - Increases in V_V increase time of flight.
- *Height of release*

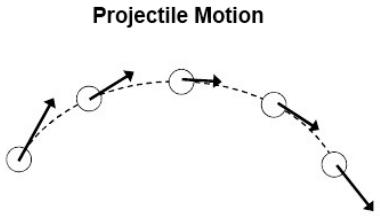
  - Increases time of flight
  - V_H and V_V remain same
- *Angle of release*
  - Affects ratio of horizontal and vertical velocities.
- Overall, effect is minimal since increases in one are offset by decreases in the other.

Optimum Angle of Release

- If the height of takeoff is equal to the height of landing, the optimum angle of release is always 45 degrees.
- If the height of takeoff is greater than the height of landing, the optimum angle is always less than 45 deg.
- For any given height of release, increasing the speed of release results in an optimum angle which approaches 45 degrees.
- For any given speed of release, increasing the height of release results in a decrease in the optimum angle.

Projectile Motion in the Long jump

- Center of Mass (CM) of the long jumper will travel in a parabolic path – regardless of the motion of the individuals body segments.



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Long Jump

- Relative height > 0
  – Optimum angle will be less than 45 degrees
  – When considering the speed at take-off, the optimal angle should be about 42-43 degrees
  – However, in reality the angle of takeoff is about 15-25 degrees
- This is the "Range" Equation

$$R = \frac{v^2 \sin\theta \cos\theta + v\cos\theta\sqrt{(v\sin\theta)^2 + 2gh}}{g}$$

- For the long and triple jump "h = 0", since the athlete is jumping off an even runway. Therefore the *simplified* equation for Range is

$$R = \frac{v^2 \sin\theta \cos\theta + v \cos\theta}{g}$$

- Notice that R is proportional to v^2
- Therefore, velocity is the most important component
- Jumpers can achieve 43 degrees at takeoff but have to slow down in order to do so!

Effect of Velocity on the Long jump

- Moving at 10 m/s at take-off :
  - foot not on ground long enough to generate a large takeoff angle
  - the jumpers goal is to maintain speed and contend with a low takeoff angle
- Velocity is the most important factor in the gaining distance in the Long Jump.

The Long Jump Landing

- Newton's 3rd Law of Motion: *"For every action there is an equal and opposite reaction."*
- Drive the head and chest down and pull the arms through with straight arms.
- This brings the legs and thighs up toward the torso, allowing the legs to stay up and follow through on the projectile path as long as possible.
- When the heels finally touch the sand, the jumper should "pull with the heels and let their legs fold up and slide out on one hip" thus, adding to Total Time (Tt) in the air and maximizing flight time.

Jump Variables

Variable	Values for actual jump	Speed @ T.O. > 5%	Angle of T.O. > 5%	Ht. @ T.O >5%
Speed @ T.O.	8.90 m/s	9.35 m/s	8/90 m/s	8.90 m/s
Angle of T.O.	20	20	21	20
Rel. Ht @ T.O.	0.45m	0.45m	0.45m	0.47m
Horizontal Range	6.23m	6.77m	6.39m	6.27m
Change in Horizontal Range	---	0.54m	0.16m	0.04m
"D" of jump	7.00m	7.54m	7.16m	7.04m

Velocity is the most important factor!!!

SPEED RULES!

Hitch vs. Hang

Hitch

- Exaggerated running in the air to counter forward rotation at take-off.
- Long levers are important.
- Teaching drill for one and half hitch kick.

Hang

- Exaggerated running in the air to counter forward rotation at take-off.
- Long levers are important.
- Teaching drill for hang technique.

Long vs. Triple Jumping

- Two separate events which require differing skill sets.
- Coached and taught using different skill drills.
- Greatest emphasis in coaching is dependent upon the athlete's nature.
- Triple jumpers: tougher mentally, focus more on strength development.
- Develop the philosophy that the triple jump is just that, three jumps vs. one jump
- The Triple Jump is a "throw down" event; whoever establishes the mark puts it out there with the concept that it is going to be challenged. Never count the triple jumper out until they have taken their 6th attempt.

The Triple Jump

1. Hop
2. Step
3. Jump

Dominant Skill = Strength

- Conserve speed through each phase!
- Each phase must be marked by an "active landing" in order to conserve speed.
- Goal is to increase vertical height (Vh) to a greater extent in each phase.
- HOP is relatively low in Vh.
- STEP phase will lose some velocity making it easier to achieve Vh in this phase.
- The JUMP phase is a total commitment to projecting the flight path to maximum.
- "Hang" technique is the technique of choice during the Jump phase.

Goals

- Maintain speed through each phase.
- Each phase reaches a greater height.
- Use single arm action at take-off
- Double arm action through step/jump
- Hang technique on jump phase
- Elevate the legs to maintain flight path as long as possible.

HOP Drills

- Single Leg Bounding

STEP Drills

- Short approach, short hop, exaggerate step

JUMP Drills

- Execute Hang Jump technique off the end of the runway

Plyometric Drills to Improve TJ Skills

- Standing Triple Jump
- Alternate bounding
- Combination bounding
- Single leg bounding
- Speed bounding
- Execute short approach H-H-S-J
- Execute short approach H-S-H-S-J