Factors that Affect Performance in the Horizontal Jumps

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How do we improve the performance of individual athletes?

Coaches

Problem

What
Experiments

How
Model

Why
Solution

Modify

Researchers
Horizontal Jumps: Series of Phases

Mechanical Objective:
Horizontally accelerate
More upright

Maintain Posture
Maintain Horizontal Velocity
Generate Vertical Velocity
Take-off behind board

4 steps out
Prepare Take-off

Performance outcome measured in Olympic competition

The output of one phase becomes the input of the next phase
Landing Phase: *maximize distance*
Flight Phase: *control of body during flight*

**For Coaches:** Cause-effect concepts ("why")

**For Athletes:** Mechanical Objective ("what is the goal?")
Take-off Phase: *generate vertical velocity*
*maintain horizontal velocity*

**For Coaches:** Cause-effect concepts ("why")

**For Athletes:** Mechanical Objective ("what is the goal?")
Jump Preparation: *maintain horizontal velocity*

For Coaches: Cause-effect concepts ("why")

For Athletes: Mechanical Objective ("what is the goal?")
Run-up: consistent position relative to scratch line
controllable horizontal velocity

For Coaches: Cause-effect concepts (“why”)

For Athletes: Mechanical Objective (“what is the goal?”)
Acceleration Phase: *generate horizontal velocity*

**For Coaches:** Cause-effect concepts ("why")

**For Athletes:** Mechanical Objective ("what is the goal?")
Factors that affect force generation during contact

Factors that affect control of body trajectory during flight
Tools for Coaches: to understand cause effect and evaluate outcomes

PC Users: Kinovea (free) http://www.kinovea.org/
Tools for Coaches: to understand cause effect and evaluate outcomes
Flight Phase Analysis: Projectile Motion Analyzer https://dornsife.usc.edu/labs/biomech/best-practices/

Input: Take-off Horizontal (Vx) & Vertical Velocity (Vy)

Output: Flight Trajectory of Center of Mass

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To estimate Jump Distance measured in competition:
add horizontal position of CM in front of box at departure (last contact with box) = a1
add horizontal position of CM behind feet at time of contact with sand (initial contact with sand) = a2

Measured Jump Distance = Horizontal Displacement of CM during flight = a1 + a2

Change in CM during flight
Horizontal Displacement of CM during flight
### Evaluation:

**Areas of Excellence:** Runway Management?  Contact Phase Control?  Conversion?  *Jump at Speed?*  Flight Phase Control?

**Areas of Needing Improvement:**

- Daily Dozen (Pre-habilitation/movement integrity)?
- Core stability: (strengthen/fatigue resistance/abs on!)
- Joint Control: throughout range of motion?
- *Jump at Speed?*
- Positions/Configurations?
- Transitions (error)?

**Body Preparation Progression:**

- Capabilities
- Movement Skills
- Jump Skills
- Progression: Challenge/Recovery

**Other?**
Prepare to compete

Clarity of purpose
What is the goal of this phase?

Little things done well add up

Simplify!: Develop an engaged CORE
You get what you practice

Develop a team around the team:
Balance:
Challenge with Recovery

Sleep, Refueling, Mindfulness, Physical Preparation
Motor Control, Biomechanics, Sports Medicine

Every foot contact is an opportunity to speed up, slow down, or maintain speed

Personalized plans for improvement:
More than one way to improve jump