TECHNICAL CONSIDERATIONS FOR THE 100M HURDLES
Thanks & Appreciation

Vince Anderson, Texas A&M
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Unfortunately, like in many other endeavors, we too often cling to what we know rather than constantly examine and evaluate what we are doing to get the results we are achieving. This all important self-evaluation enables us to selectively discard ineffective practices and replace them with better ones.

Gary Winckler
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PRESENTATION OVERVIEW

- Anatomy of Movement
  - Muscle function
  - Leg Stiffness
  - Reflexes

- Approach
  - Penultimate Step
  - Take-Off Step

- Intra-Hurdle Sprinting: Adapted Sprinting
ANATOMY OF MOVEMENT: MONO-Articulating & BI-Articulating Muscles

Mono-articulating Muscles

*Gluteus Maximus
*Tensor Fascia Latae
Short head of Bicep Femoris
Vastus Muscles
Adductors
Soleus

Bi-articulating Muscles:

Psoas Major
Hamstrings (Bicep Femoris, Semimembranosus, Semitendinosus)
Rectus Femoris
Gracilis
Gastrocnemius
MONO-Articulating Muscle Function

• Stability and leverage
• Force & work generators
• Lose tension in quick movements

BI-Articulating Muscle Function

• Contribute significantly to high speed movements.
• Transfer energy from mono-articulating muscles.
  • Transfer of energy while resisting moments across adjacent joints (isometric function).
• Saves energy by allowing concentric work to be done at one end eccentric at another.
ANATOMY OF MOVEMENT: MONO-Articulating & BI-Articulating Muscles
PELVIS & HIP

Force generators

Force amplifiers
• Spinal Engine

Oscillation & orientation allow for force/energy absorption and distribution.

Pelvis stability (not rigidity) is paramount for optimum translation of elastic energy into force/movement.
PELVIC GIRDLE, SPINAL ENGINE & SPRINTING

• Elastic energy stored in the pelvis
• Stumble reflex + Cross extensor reflex = “Scissoring”
• Bending of the hip & knee of the trailing leg strengthens extension in the other hip & knee, and vice-versa.
LEG STIFFNESS

Hip/Pelvis
- Stabilize the pelvis
- Pelvis stability is paramount for optimum translation of elastic energy into force/movement

Knee
- Transfer of energy
- Direct forces from both ankle and hip

Ankle
- Main determinant when knee angle is more obtuse
LEG STIFFNESS & SPRINTING

• Force around knee and ankle determines how much of the force generated by the hip is exerted on the ground.
• Up to 6.5m/s leg stiffness is influenced mostly by changes in the knee.
• Weak ankles forget about it!
• Reusing kinetic & potential energy
REFLEXES... a rapid, predictable motor response to a stimulus

INNATE... present from birth
- Cross extensor reflex
  - Extension of one leg as the other is flexed
- Stumble reflex
  - Accelerated grounding of front leg results in accelerated recovery leg

AQUIRED... learned over time, and typically more complex
- Learned motor patterns enhanced by repetition

NOTE: The distinction between innate and acquired is not always absolute and some reflexes can be modified/enhanced by repetition, or inhibited if the situation so requires. (not withdrawing from a pain signal because it may cause more bodily harm...)
REFLEXES... a rapid, predictable motor response to a stimulus
HURDLES: Navigating the ground

Approach
Penultimate Step
Take Off Step
Intra-Hurdle Sprinting
APPROACH

Early establishment of essential posture and positions

- Shin angles, rise & pelvic orientation
- Optimal concentric (thrust) work early → effect eccentric work late

Optimum rhythm (individual)

At step 4 the athlete have reached approx. 75% of peak velocity.
APPROACH
PENULTIMATE STEP

Steers the take-off foot/leg
Contact to stay in natural rhythm of the approach

MAJOR OBJECTIVE:
• Transfer energy developed in the approach
• Minimize or eliminate loss in leg stiffness (ankle/knee) and subsequent lowering of COM.
• Provides energy to the take-off step (extension reflex & stumble) via pelvic musculature
TAKE-OFF STEP

Minimize losses in horizontal velocity.
Minimize increases in vertical velocity
Establish flight path of COM
Set up effective touch down and subsequent step.
TAKE-OFF STEP

Stepping down from above
- Vertical shins angles late in swing phase
- Pretension in lower leg
- Preserve leg stiffness
- Optimize elastic response

Stumble reflex
- Rapid grounding of take (swing) leg
- Rapid recovery of lead (trailing) leg
- Reducing duration of ground contact of penultimate step and subsequent flight time
- Shin of recovery leg relative parallel to ground

Leg Stiffness at take-off depends on:
- Joint torsional stiffness
- Leg orientation relative to the ground
- Speed of contact
PENULTIMATE & TAKE-OFF STEP: Skill Development

Mats placed at the desired spot for the penultimate and take-off steps.

Points of emphasis (cueing):

• Athlete is to step “down” and not merely step “on” the mats.
• “Running up stairs”
• Optimizing hip height on take off step
TAKE-OFF STEP: Skill Development
TAKE-OFF STEP: Skill Development
PENULTIMATE & TAKE-OFF STEP: Skill Development

Stumble reflex – facilitate “scissoring” into take off step.

Mat placed at desired spot for penultimate steps.

Cueing:

• Athlete is to step “down” and not merely step “on” the mats.

• Aggressively and deliberately “drumming” the hands to facilitate quicker recovery of trailing leg.
PENULTIMATE & TAKE-OFF STEP: Skill Development
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INTRA-HURDLE SPRINTING

“Adapted sprinting”
Application of sound sprint concepts

- Pelvic orientation
- Rapid transition from support → flight → support
- Higher COM = greater leg stiffness

Elite hurdlers achieve sprint times of 0.64 to 0.74 between TD and TO

Makes up approx. 50% of race is on the ground between H1 & H10
INTRA-HURDLE SPRINTING
INTRA-HURDLE SPRINTING
INTRA-HURDLE SPRINTING (Developmental?)
INTRA-HURDLE SPRINT: Skill Development

Oscillating Dribbles
INTRA-HURDLE SPRINT: SKILL DEVELOPMENT

Hurdle Dribbles
INTRA-HURDLE SPRINT: SKILL DEVELOPMENT

Hurdle Dribbles
INTRA-HURDLE SPRINT: SKILL DEVELOPMENT

DRUM
INTRA-HURDLE SPRINT SKILL DEVELOPMENT:
Speed Dribbles
INTRA-HURDLE SPRINT SKILL DEVELOPMENT:
Speed Hurdle Dribbles
CRITERIA FOR OPTIMUM PERFORMANCE

• Speed to H1 take-off is between 2.19-2.23s
  • Correlation between speed into H1 and final time

• Reach peak velocity between H1 – H4 (mean velocity is reached between H3-H4)

• Maintain velocity until H6-H8
  • i.e., staying with in 0.01 of fastest RU.

• The range of hurdle clearance between 0.23-0.28s
Unfortunately, like in many other endeavors, we too often cling to what we know rather than constantly examine and evaluate what we are doing to get the results we are achieving. This all important self-evaluation enables us to selectively discard ineffective practices and replace them with better ones.

Gary Winckler
Thank you for listening...