Unifying Principles of Speed

Neuro-Biomechanics of Maximum Velocity Sprint Mechanics

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Speed Dynamics

Philosophy

Philosophy is the study of general and fundamental questions about existence, knowledge, values, reason, mind, and language.

Your personal Philosophy will largely determine your actions as a person and a coach

Sport Philosophy that has become increasingly more popular

Eight Primary Areas of Philosophy

1. **Ethics and Morals**
2. **Axiology (Values)**
3. **Metaphysics**
4. **Ontology**
5. **Cosmology**
6. **Aesthetics**
7. **Theology**
8. **Epistemology**

Epistemology (Relative Truth)

One of the areas in Philosophy that Deals with the Nature and Scope (Limitations) of Knowledge

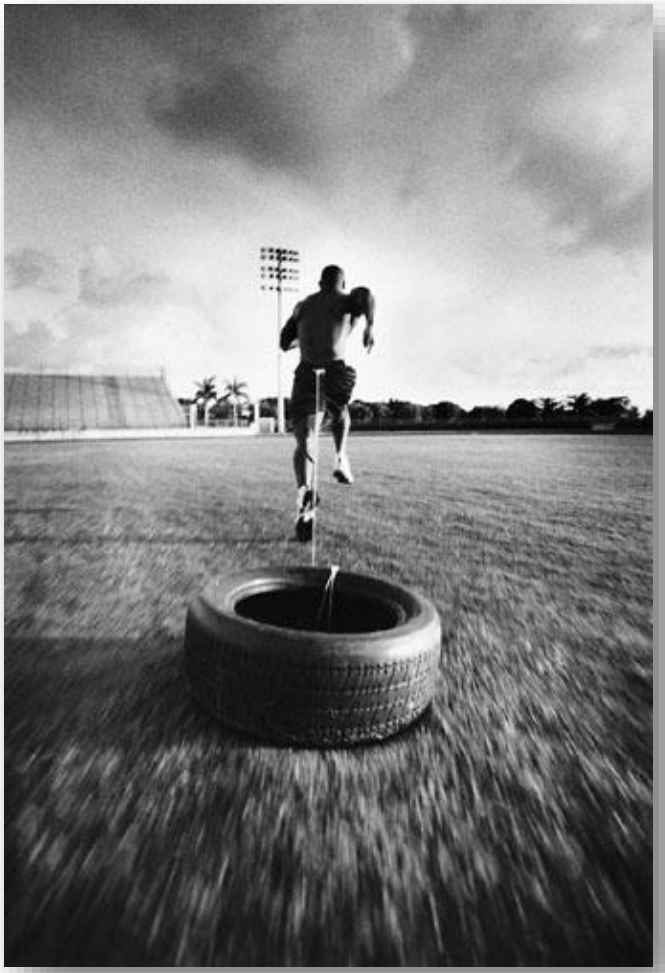
Implications of the Relativity of Truth

The theory of the nature and grounds of knowledge, especially with reference to its limit and validity

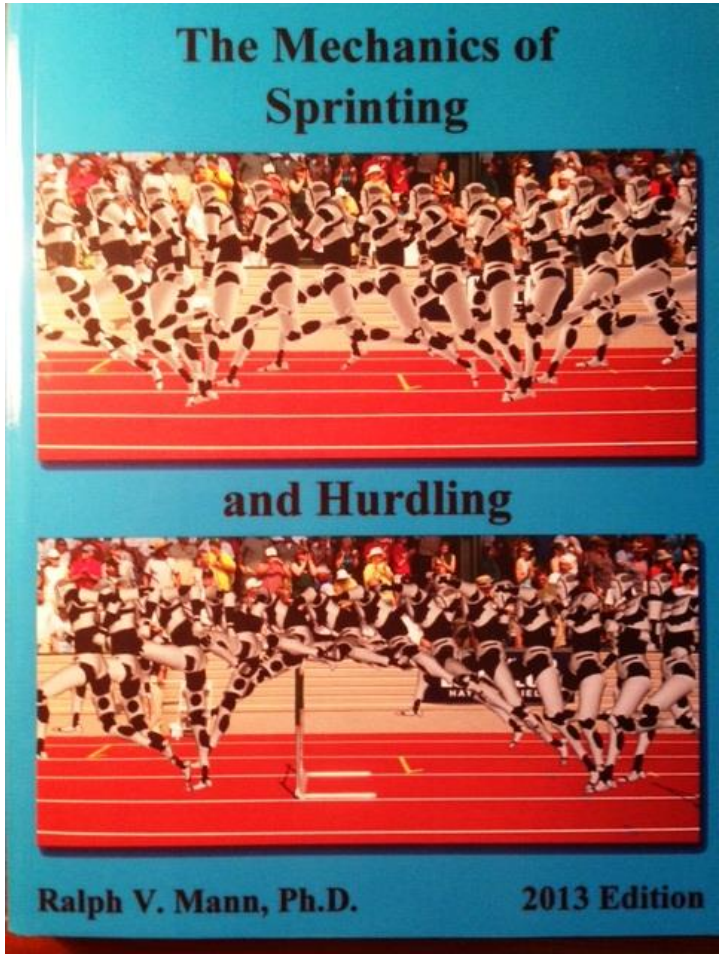
Reaction to “New Truth”

Adapted from Kubler-Ross Model

- Shock
- Disbelief
- Ridicule
- Denial
- Anger
- Sometimes Bargaining followed by Depression
- Acceptance



Latest Work by Dr Ralph Mann (2018)



Available from www.compusport.com

Athlete's Conceptual Model

The Athlete's Mission Statement

Reduce the Time Required to Apply the Necessary Force to the Ground by 0.005 Seconds

Reduce the Time Required to Recover the Leg Through the Full Range of Motion by 0.005 Seconds

Let's Do the Math!

The Athlete's Mission Statement

100-meters 50 steps = 0.50 sec

400-meters 200 steps = 2 sec

The Athlete's Daily Plan of Action

The Athlete's Goals: Accomplished in Four Ways

Produce a Greater Force

Produce the Force in Less Time

Produce the Force in the Proper Direction

Produce the Force Through Optimal ROM

Neuro-muscular Control

Recruitment Strategies to Enhance Speed

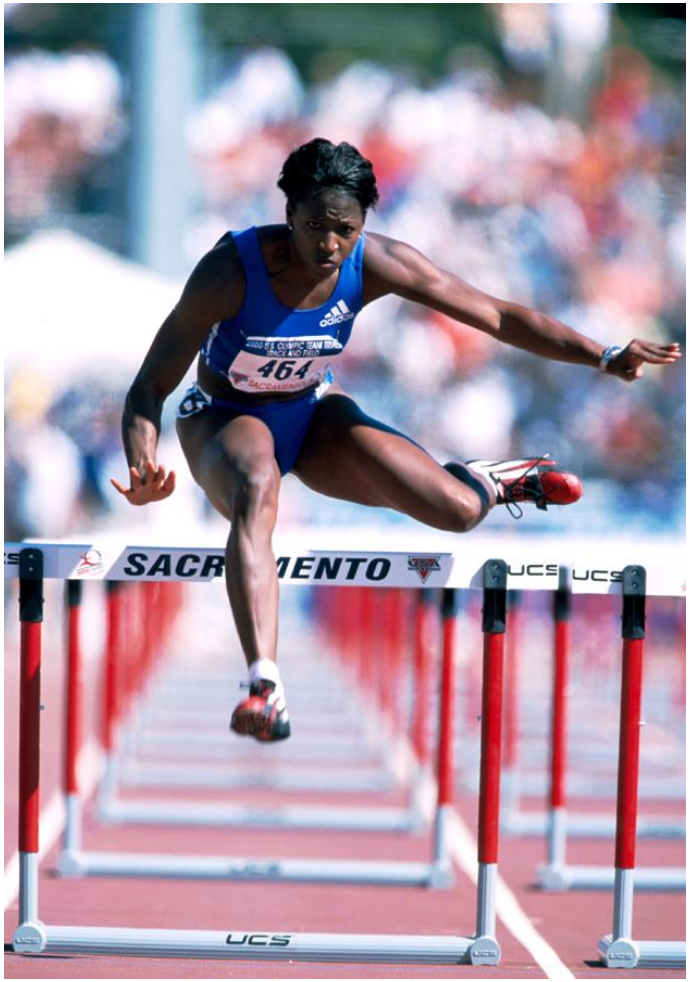
Sequencing - Order of Recruitment

Timing

Intermuscular Coordination

Intramuscular Coordination

Synchronization



Muscle Contraction Characteristics

Slow Twitch versus Fast Twitch

Contractile versus Elastic

Joint Stabilization

versus Body Propulsion

Neuro-muscular Control

Joint Position Dictates Muscle Recruitment

Neuro-muscular Inhibition

Neuro-muscular Facilitation

Neuro-mechanical Advantage/Disadvantage

Passive and Active Insufficiency

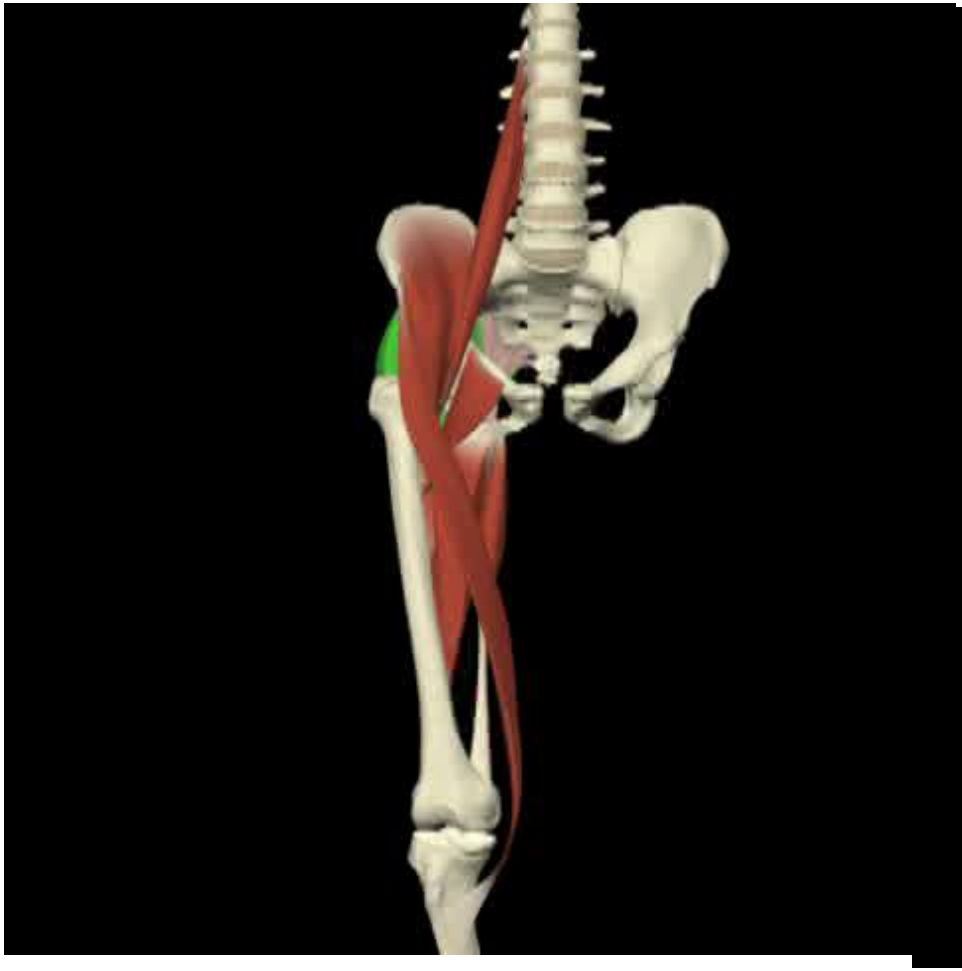
One Joint Hip Flexors

- As the muscle shortens it loses mechanical advantage
- Iliacus, Psoas, Pectineus, Gluteus Medius

Two Joint Hip Flexors

- One joint must be relatively fixed while the other moves
- Sartorius, Tensor Fascia Lata, Rectus Femorus

Passive and Active Insufficiency-Hip



Passive and Active Insufficiency-Knee

Understanding Velocity

Velocity is Product of:

Stride Length

Stride Frequency

$$\text{Velocity}_{\text{m/sec}} = \text{SL}_{\text{meters}} \times \text{Sf}_{\text{step/sec}}$$

$$\text{SL} = \text{Velocity}/\text{Sf}$$

Understanding Step (Stride) Length

Actual Step Length

Point of Touchdown on Right Foot to

Point of Touchdown on Left Foot

Effective Step Length

Center of Mass at Take-Off

Center of Mass at Touchdown

Understanding Step Frequency

Elite Sprinters

Ground Time	0.08 seconds
Air Time	0.12 seconds
Step Time	0.20 seconds
Step Frequency	5.0 step/second

Understanding Step Frequency

Developing Sprinters

Ground Time	0.12 seconds
Air Time	0.13 seconds
Step Time	0.25 seconds
Step Frequency	4.0 step/second

Traditional View of Running Mechanics

Three Phases of Sprint Stride

- Drive Phase
- Swing Phase
- Lift Phase

The Contemporary Six Foci for Modifying Sprint Mechanics

Body Position Focus

Recovery Mechanics

Transition Phase

Ground Preparation

Ground Phase

- Frontside
- Backside

Arm Action

The Six Foci: Body Position

Body Position Focus

- Draw-in & Brace
  - Tummy Tight
- Posture Realignment
  - Back flat
  - Butt tucked under
  - Pelvis looking up
- Longitudinal Alignment

Reframing Running Mechanics

Quality of a Phase of Running Mechanics

Determined by the phase that immediately precedes it.

Most Important Phase of Running

Where to Begin

The Six Foci: Recovery Mechanics

Residual Phase

- Begins at take-off
- Ends with positive acceleration of the thigh

Recovery Phase

- Begins with positive acceleration of the thigh
- Ends with the blocking (abrupt deceleration) of the thigh
- Complete deceleration of the thigh

The Six Foci: Recovery Mechanics

Recovery Mechanics (Residual Phase)Cues

- Proper body position
- Toe-up, Thigh Pop, Lift Heel Forward
- Step-Over Opposite Knee (Tony Wells)

The Six Foci: Transition

Transition Phase

- Begins with the blocking of the thigh
- Ends with negative acceleration of the thigh

The Six Foci: Transition

Transition Phase Cues

- Eliminate turnaround time
- Block the thigh, change directions
- Feel the Sense of Urgency

The Six Foci: Ground Preparation

Ground Preparation

- Begins with negative acceleration of the thigh
- Ends with touchdown of the foot

The Six Foci: Ground Preparation

Ground Preparation Cues

- Active thigh back
- Loose knee joint, toe-up
- Stabilize knee with co-contraction
- Grab the foot under the body

The Six Foci: Ground Phase

Frontside Mechanics (Impulsion) Cues

- Explode through the ground
- Tear back the track

Mid-Stance

–Firm Leg

The Six Foci: Ground Phase

Backside Mechanics (Propulsion) Cues

–Thigh Pop

The Six Foci: Arm Action

Arm Action Cues (Traditional Approach)

- Backward elbow drive, only
- Thumbs up, palms facing in, hands open
- Hammer the hands back (Kevin McNair)

Arm Action Cues (Contemporary Approach)

- Forward Arm Punch, in conjunction with above
- Arm to Shoulder Level, Elbows Stay Open
- Potentiation of Thigh Pop with Arm Punch

Does This Work for 400-meter Runners

Sprint Drills

- **Ankling**
  - Proper body position,
  - Foot dorsi-flexed
  - Load the ankle elastically on the ball of the foot under the hip

Sprint Drills

- **Butt kicks with Thigh Pop**
  - Proper body position
  - Foot dorsiflexed
  - Pop the Thigh
  - Lift the heel-up Forward

Sprint Drills

- **Side Lying Recovery (Traditional)**
  - Lie on your side with the body in a straight line
  - Foot dorsi-flexed
  - Heel-up, knee-up together
  - Step over the opposite knee

Sprint Drills

- Standing Recovery (Traditional)
  - –Standing supported with one hand, proper body position
  - –Foot dorsiflexed, toe-up, heel-up, knee-up together
  - –Step over the opposite Knee

Sprint Drills

- **Step Over Run (Recovery Focus)**
  - Foot dorsi-flexed
  - Heel-up
  - Step over the opposite knee

Sprint Drills

- **Step Over Run (Recovery Focus)**
  - Foot dorsi-flexed
  - Thigh Pop
  - Heel-up
  - Step over the opposite knee

Sprint Drills

- **Fast Claw**
  - Ready Position
    - Step Over Position
  - Initiation
    - Thigh Extension
    - Knee Joint Relaxed
    - Ankle Dorsiflexed
  - Execution
    - Fix Knee Joint
    - Ball of the Foot Landing
  - Completion
    - Active Recovery Action

Sprint Drills

Vmax A-March, A-Skip (Ground Preparation Focus)

- Grab the foot under the body

Sprint Drills

Long Backward March, Skip and Stride

- Perfect sprint mechanics backwards
- Toe-up, knee-back, heel-up
- Step back through the window
- Grab the foot under the body

Sprint Drills

- **Shake-ups**
  - Foot dorsi-flexed
  - Body lean from the ankles
  - Recover the thigh elastically
  - Pull the straight leg behind the body
  - Load the ankle elastically on the ball of the foot

Sprint Drills

- **Straight Leg Shuffle**
  - Foot dorsi-flexed
  - Leg is like a long iron rod, no knee joint
  - Grab the foot under the body

Sprint Drills

- **Straight Leg Bound**
  - Foot dorsi-flexed
  - Leg is like a long iron rod, no knee joint
  - Grab the foot under the body
  - Maximize hip projection

Sprint Drills

Single Leg Skills (General Cues)

- Execute proper recovery mechanics
- Block the thigh, grab the foot under the body
- Very active thigh back

Sprint Drills

- **Fast Leg Routine (Right and Left)**

Sprint Drills

- **Alternate Fast Leg Routine**

Sprint Drills

- **Double Fast Leg**

Sprint Drills

- **Alternate Double Fast Leg**

Sprint Drills

- **Continuous Fast Leg**

Sprint Drills

- **Straight Leg Bound /Fast Leg**
  - Begin straight leg bounding
  - Add fast leg routines
    - Single fast leg

Sprint Drills

- **Straight Leg Bound/ Fast Leg**
  - Begin straight leg bounding
  - Add fast leg routines
    - Alternate fast leg