The Second European Sprints & Hurdles Conference
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Planning and Periodization: Preparing for Moscow 2013
Loren Seagrave, Director of Speed and Movement
Philosophy of Performance

• If its not broken, break it. Then Re-engineer the Athlete
• Speed Development is a Year-round Process
• Power and Neuromuscular Coordination = Speed
• Train Athletes for Power (Speed-Strength) and Elastic Power (Reactive Strength) not just Strength
• Train to Apply Force in the Time Available
• Train Animals, Educate People (Maya Angelou)
Periodization

“the logical and systematic sequencing of training factors...

*in an integrative fashion...*

*in order to optimize specific training outcomes...*

*at pre-determined points in time”*

Brewer, Clive on Bompa and Haff
Fundamental Foci of General Preparation Phase

Develop Work Capacity over the Career of the Athlete

Increase Strength and Power Capacity for the Athlete

Increase Reactive Strength (RS) Capacity of the Athlete

Increase the Technical, Neuromuscular Coordination (NMC), Capacity of the Athlete

Integrate the Increased Power, RS and NMC to Increase Vmax, Start and Acceleration Level of Athlete
What Is Work Capacity?

Work Capacity is Often Used Synonymously with…
– General Endurance Capacity / Aerobic Fitness

Work Capacity is not Just the Ability to Withstand Large Training Loads.
What Is Work Capacity?

• **Work Capacity is the Ability Maintain the Quality and Intensity of an Activity**
  – under Ever Increasing Volumetric Loads
  – and Be Able to Return to Homeostasis in Both Short Term and Long Term

• **Increases in Work Capacity Realized by Increasing the Capacity in All Bio-motor Abilities.**

• **A Holistic Perspective of Developing Work Capacity**
  – Gives the Athlete a Comprehensive Base Upon Which to Train and Recover

• **Link General Development of Bio-Motor Abilities with Movement Skill Development Enhances the Athleticism of the Individual**

• **Psychological Component to Work Capacity**
Preparing for Sports Performance

- Sports Performance
  - Motor System Work Capacity
    - Neuro-muscular Preparation
    - Musculo-skeletal Preparation
    - Bioenergetic Preparation
    - Psycho-Behavioural Preparation
    - Technical-Tactical Preparation
    - Genetic Predisposition

Adapted from Verkhoshansky (2006) by Brewer
Work Capacity: Focus on Long Term Athletic Development

If Properly Addressed in Training...
  – Work Capacity is Additive Over the Career of the Athlete

Reducing Restrictions, Imbalances and Instability through a Blend of Therapeutic Exercises...
  – Has a Positive Effect on Reducing Injury Likelihood
  – Don’t Build Work Capacity on Dysfunction

(Gray Cook paraphrased)
Complex (Multi-Lateral) Approach to Training Program Design

Takes a Balanced Approach to the Training of the Bio-motor Abilities

- All the Biomotor Abilities are Important to Attain High Levels of Sport Performance
- Each Bio-motor Ability is Requisite to the Other and Interdependent
- While Specialization is Necessary at Appropriate Times, the Younger the Athlete the More General is the Training
- Balanced Development of General Qualities Will Lead to Better Long Term Development
General versus Specific Training
General versus Specific Training

General to Specific Training Continuum

– General Training Seeks to Improve the Bio-Motor Abilities in a Manner Independent of the Sports Task and Works Toward Increased Athleticism

– Specific Training Emphasizes Development of the Bio-motor Abilities that Predominate Success in an Event

• A Shift of Emphasis on the Proportion of the Training Load to One or More Biomotor Abilities Increases Specialization

• Increasing Special Training Requires a Decrease in Other Bio-motor Qualities to Maintain Training Load

• Specialized Training Increases through the Macrocycle and is More Appropriate as the Athlete and Their Career Matures
The Relationship between General and Specific Training

Inverse Relationship between General & Special Training as a Macrocycle Progresses

- Elite Athletes’ Training Progresses to Become either Special or More Special
  - Principle of Reversibility Applies such that Over-Emphasis on Special Training Results in Diminished Capacities in Some Bio-motor areas

With Speed and Power Specificity is Inversely Related to Time Available to Apply Force
With Speed and Power Directly Related to Horizontal Velocity
Developing Work Capacity: Speed – Power Athletes

- Active-Dynamic Warm Up
- Circuit-type Training Using Multi-Lateral Loading
- Jump-Run
- Integrating Strength and Power Training (Weight Room) with Speed and Extensive Repetition Training
- Integrating New Interval Training Principles into Other Aspects of Bioenergetic Training
Speed Development

Speed is a Product of increased Power and Reactive Strength with Increased Capacity for Neuromuscular Coordination and Technique

The Former Model of Late Speed Integration

Current Thinking of Year Round Integration of Speed.
Power versus Reactive Strength Training

- Training for Strength is not the Same as Training for Power
- Without Accurate Measurement Difficult to Assess Effectiveness
- Reactive Strength Somewhat Independent of Contractile Power
- Both are Necessary
- When is the Athlete Strong Enough
Technical Training

• Make a Habit to Put the Stopwatch Away and Coach

• Coaching is Teaching While Training

• Help the Athlete Re-Program Nervous System in GPP

• Lock in Improved Technical Models before Competition

• Utilize Augmented Feedback with the Athlete Regularly

• What Does it Mean When Technical Focus is seen in Competition Phase?
Training Anxiety & Over Training

Focal Task of the Coach it to Construct Training Programs and Deliver Training Programs

- Need to Justify the Role
- Tendency to Overfill Athletes’ Schedule
- Anxiety that Not Enough is Being Done

Never Do You Hear that the Performance was not Successful because We Did Too Much
Central Nervous System fatigue and Recovery

Coaches have four or five hours per day where they have the possibility to control the outcomes of training...

Athletes have the remaining 19 – 20 hours to screw it up.

Impact of Sleep on Recovery

Impact of Video Games and “Computer Stress” on CNS Recovery
Behavioral Training vs Cognitive (Decision Training)

BT Emphasizes Physical Dimensions of Performance

– Uses high levels of feedback
– Easy to hard progressions
– High level of coach control, and low athlete involvement in decision making, error detection and correction and planning performance details. (Vickers, 2000)

• Unable to maintain a high level of performance in the long term
Cognition is...

- “the scientific study of how we use perception, attention, memory, problem solving, and decision making in our daily lives.” (Vickers, 2000)

- Its how we think about the world that we see, hear, feel, and experience.

- And its how we decide our reactions and actions to our environment.
Behavioral Training versus Decision Training

DT Emphasizes Cognitive Development that Evoke Physical Performance Outcomes.

– Uses a *method of coaching aimed at developing*
– *Self-awareness*
– *Responsible*
– *Autonomous,*
– *Informed athletes*
– *Able to make critical decisions and perform under pressure with the maximum flexibility and consistency in performance.*” (Vickers, 2000).
The Role of Cognition in Long Term Talent Development

• Skills learned in a Behavioral Training environment are not performed successfully in transfer situations.

• In other words performance falls sharply over time and in novel environments like competitions.

• Recent research suggests that lack of cognitive training may be part of the answer to performance decrement.
Active-Dynamic Warm-up
Tuesday, October 16, 2012

1. 1 X 30 sec Pillar Bridge Series (Prone, Right, Left, Supine), 3 X Medicine Ball Push-up with Rotation, 1 X Circle Hand-Walk (Clockwise and Counterclockwise), 20m Hand Walk
2. 5 X Head Circle, Truck Circle, Hip Circle (each direction)
3. 30m Low Skip (Arm Circles Forward), 30m Long Backward Skip (Arm Circles Backward), 10 X Prisoner Squat (Thigh Parallel) 10 X Front to Back Lunge, 10 X Leg Raise Series (Supine, Inside, Outside, Prone Opposites, Tin Soldier)
4. 30m Low Skip (Arm Windmill Forward), 30m Long Backward Skip (Arm Windmill Backward), 10 X Wind Outs, 10 X Alternate Thrusts
5. 30m Side Slide Turn-In, 30m Side Slide Turn-Out, 10 X Hip Pops, 5 X Russian Hamstrings, 5 X Single Leg Prone Hip Lifts
6. 2 X 50m Technical Build Up @3/4 Effort, Low Skip & Scoop Back
7. 30m Gallop Alternate, 30m Gallop Alternate, 10 X Jumping Jacks (Long Arms), Split Jacks, Highland Fling, Long Striders
Active-Dynamic Warm-up
Tuesday, October 16, 2012

7. 2 X 30m Power Gallop, Low Skip and Scoop Back
8. 2 X 30m Power Gallop, Back Skip and Scoop Back
9. 10 X Quadruped Series (Fire Hydrant, Kneeling Knee Circle Forward and Backward, Kneeling Scorpion, Kneeling Lateral Ham Reach)
10. 2 X 50m Technical Build Ups @ 7/8 Effort
11. 10 X Supine Leg Swings, Supine Leg Swings Alternate, Prone Scorpion
12. 5 X Mountain Climbers, Groiners
13. 2 X 50m Technical Build Ups @ 9/10 Effort
14. 5 X Leg Swing Series (Frontal Leg Swings, Sagittal Leg Swings, Trail Leg Windmill Forward and Backward)
15. 10 X Horizontal Scissors (Cut-the-Grass), Long Scissors, Rockers, Hurdle Seat Change
3 X 10m Ankling with single Leg Thigh Pop (Rt and Lt)
3 X 10m Ankling with Alternate Thigh Pop
3 X 30m Long Backward Strides
3 X 10m Butt Kicks with Alternate Thigh Pop
3 X Butt Kick into Step-Over Run
3 X 30m Alt Fast Leg
3 X 30m Shake ups
3 X 30m Long Backward Strides
3 X 30m Straight Leg Bound
3 X 30m Straight Leg Bound - Fast Leg (Rt & Lt)
Vmax Session

- 6 X Ins and Outs (20m In – 15m Out – 20m In) In Spikes

Two Laps Jog Cool Down with 5 X 50m Build-Ups

Full Static Stretch: (Supine Knee Hugs, Supine Hamstrings, Side Lying Stork Stretch, Butterfly, Inverted Butterfly, Chair Stretch, Pretzel Stretch (No Twist), Sit on Your Heels, Prone Butterfly, Cradle the Baby, Plough Stretch)
Focal Competitions and Events

• Training Began
  Monday, October 1, 2012

• Italian Indoor Champs
  February 16 – 17, 2013

• USATF and European Indoor
  March 1 - 3, 2013

• USATF Championships
  June 20 – 23, 2013

• Italian Championships

• IAAF World Championships
  August 8 – 18, 2013
Jump-Run: Friday, November 26, 2010

Active-Dynamics Warm Up with Circuit Warm-up

Jump Run X 6

– 30 sec/ 30 sec Jump (Rocket, Split Squat, Drop Squats, Djerabakis, Drop Lunge Alternate, Tuck Jumps)
– [30 sec]
– 6 X 15 sec-[15 sec] (Butt Kickers, Speed Skate Cross-Overs, SLB, Speed Skater Shift Foot, Step-Over Run, Exploding Harvards
– 2 min Recovery Run then [1 min Rest]

5 X 50-meter Build-Ups with Skip Back

Static Stretch after session
Lessons Learned:
Sprint Start & Acceleration Mechanics

Loren Seagrave
Director of Speed and Movement
Key Elements of Sport Speed

- Maximum Velocity
- Acceleration
- Deceleration
- Change of Direction
- Re-Acceleration
- Conversion
Phases of Acceleration (Linear)

• The Start
  • Greatest Rate of Acceleration
• Pure Acceleration
  • Slope of Acceleration Still Steep
• Transition
  • Neuro-Mechanical Link to Vmax
Global Considerations: Start and Acceleration Phases

Force = Mass $\times$ Acceleration
Force/Mass = Acceleration
Limb Length Matters
Global Considerations: Start and Acceleration Phases

Sprinters Don’t Have Jet Propulsion
First Three Phases in the Sprint Race

Sprint Start

15 meters

PURE ACCELERATION
IN
15m

PUSH-PUSH-PUSH

Hip Extension-Acceleration

15 meters

5 m

OUT
20m

TRANSITION

15 meters

5 m

IN

OUT
35m

DRIVE TALLER

Extension-Max Velocity
Neuro-Biomechanics of Pure Acceleration

- Residual Phase
- Recovery Phase
- Transition Phase
- Ground Preparation Phase
- Frontside Phase
- Backside Phase
- Arm Action
The Athlete’s Mission Statement

Reduce the Amount of Time Needed to Apply the Required Force into the Ground by 0.005 Seconds.

Reduce the Amount of Time Needed to Recovery the Limb Through the Required Range of Motion by 0.005 Seconds.
First Consideration for Block Placement

Which Foot is on the Front Block?
First Consideration Block Placement

Which Foot is on the Front Block?
– How is this best determined?
  • Fold your arms on your chest. (Johnson, B)
  • Hop-Hop Start (Even Stance)
Second Consideration for Block Placement

What is the Distance of the Front Pedal from Starting Line?

– Conventional
  • Two Foot Lengths

– Maximum Distance (Santos, J)
  • Knee on Line
  • Foot Plantar Flexed
Third Consideration for Block Placement

What is the Distance of the Rear Pedal from the Front Pedal?

– Front Pedal so Projection Angle is 90 Degrees to Surface of the Pedal
– Rear Pedal Between 30 or 35 Degrees and 45 Degrees (when lowest setting)
Preparation for Loading into the Starting Blocks

• Disappear inside a Phone Booth (Wells, T)

• The Argument for Dual Personalities in Sprint Start (Reardon, J)

• Increase of “Neural Drive”

• Ritual to Turn Light Bulb into Laser Beam - Coherent Entrainment (Kwai Chang Caine)
The “On Your Marks” Position

Hand Position

– Hand Spacing and Alignment
– Hand Configuration
– Shoulder Position
The “On Your Marks” Position

Foot Position

– May Vary With Block Pedal Height
– Medium Spacing, Equi-Distance
– Vertical Alignment of Feet & Thighs
The “Set” Position

- Front Knee Angle Approx 90 Degrees
- Rear Knee Angle between 120 & 140 Degrees
- Hips Higher than Shoulders
- Center of Mass Anterior to the Front Pedal
- Shoulders Above the Hands
  - Basic Technical Model
- Shoulders in Front of Hands
  - Advanced Technical Model
Block Acceleration

- Synchronous Double Leg Force
- Summation of Hip and Back Extension Forces

Length of 1st Step

Length = $\cos 45 \times \text{Xiphoid Height}$ (Wells, T)

Factors Determining 1st Step Length

– Leg Length
– Muzzle Velocity
– Angle of Take Off
– Air Time
Mechanics of 1st Step

Utilize Block Reaction Forces with Active Hip Flexor Action (Thigh Pops Forward)
Foot Stays Low (Almost Drags)
Ankle Dorsi-Flexed (Sole Down)
Shin Angle More Vertical (ATM)
Active Landing (NFS)
Anticipatory Firing (Firm Foot)
High Angular Acceleration @ Hip
Mechanics of 2\textsuperscript{nd} Step

Increase in Step Length Over First Step
Almost Identical Recovery Action
Acceleration Pattern

There is a regular acceleration pattern that gives optimal results (Winckler, G)
The Rate of Incremental Increase is Athlete Dependent.
Empirically the Highest Level Athletes Can Increase by 15% of Trochanteric Leg Length.
Pure Acceleration Phase

Duration is about 2.0 Seconds
For Top Level Sprinters about 15 meters
(Tabachnik, B)

Force is Generated Primarily by Muscle Contraction.
Transition Phase

Serves as the Neuro-Mechanical Link between Acceleration and Vmax

Duration to Reach 95% of Vmax for Elite is 4.5 to 5.0 Seconds

Step Length Increases Asymptotically Toward Vmax

Elastic Forces Predominate as Velocity Increases
Fault – Reason - Correction
Loren Seagrave, Director of Speed and Movement
Fundamental Skill Set for Coach

Discrete Skills Required to Effectively Help Athlete to Improve Technical Efficiency

– Observation Skills
  • Positioning of the Coach
    – Side, Front and Rear
      » Advantages of each and where to use each
  • Distance from the Action
    – Close to the Movement
    – Further Away from the Movement
  • Wide Focus or Narrow Focus
Recognition of Technical Faults

• **What Constitutes a Fault?**
  - A Movement or Motor Pattern that does not Maximize Movement Efficiency
    - Leakage of Power
      - Lack of Core Stability
      - Poor Joint Positioning
    - Issues in Timing
      - Lack of Joint Stability
  - Excessive Breaking Forces
    - Lack of Strength of Timing to Maximize Joint Stability
    - Poor Joint Positioning
    - Retardation of Recruitment
Developing the “Coaches Eye”

• Coaches First Recognize Positions
• Learning to Identify the Most Important Fault
  • Often Multiple Faults will be Recognized
  • Correction of the Most Important Fault will Frequently Correct Other Secondary Faults
• Developing the Skill of Movement Reflection
• Use of Video Replay and Video Analysis Software
  • Dartfish
  • Kinesiocapture
Selecting Appropriate Technical Model for Athlete’s Development

• **Rough Technical Model**
  • Requires Rudimentary Levels of Strength and Power

• **Basic Technical Model**
  • Requires Basic Levels of Strength and Power

• **Advanced Technical Model**
  • Requires Advanced Level of Strength and Power
Establishing the Reason (Cause)

• Check Athlete’s Conceptual Technical Model
  • Not Infrequently Athlete Has Wrong Idea
• Insufficient Strength and Power
• Poor Body Position
  • Lack of Stability
  • Postural Realignment
  • Longitudinal Alignment
• Improper Joint Positioning
• Faulty Nero-Motor Recruitment
Correction: What To Do About It

• **The Process of Fault Correction**
  • Observe the Athlete Perform
  • Identify the Faults
  • Select the Primary Fault
  • Formulate the Message to be Sent to Athlete
  • Choose the Method to Send the Message
  • Get Athlete’s Attention
  • Send the Message
  • Get Confirmation of Receipt of the Message
  • Have Athlete Reconfirm the Action to be Taken