OREGON
SPEED TRAINING:
CONCEPTS, METHODOLOGIES, & PROGRAMMING

Mark Dillon, MS, CSCS, RSCC, USAW
University of Oregon
Three Movement Constants

1.) The Body
- Produces & reduces force in all 3 planes
- Involves synergists, stabilizers, agonists, & antagonists.

2.) The Ground
- Gives back the force we put into it to move.
- Used to generate & absorb force.
- Ground reaction forces.
  - *Where the rubber meets the road*

3.) Gravity
- Effects all bodies the same, constant resistance.
- Body designed to move with & against it.
Ground Negotiation

1.) Hip “Hinge”
- Ability to set the hips
- Flatten or arch the back
- Push the tail back

2.) Hip “Projection”
- Directional projection of the hips
- Maximal ground reaction forces
- **PUSH** mechanics

3.) Hip “Whip”
- Tall posture to enhance a cyclic leg action
- Maximize force, minimize contact time
- “Swing & Scissor” stretch tension and re-acceleration

(Ack.: Radcliffe, J., 2013)
Basics of Speed Development

- Don’t over think it!
- Increase lean body mass
- Get Strong...Build a bigger motor (must squat)
- Improve muscle/tendon elasticity (bounding)
- Practice/Improve technical efficiency (A & B series)
- Speed Application (sprint often)
Thank You!

- Any Questions?.....
- Just Joking!
Yearly Speed Training Overview

- Continue to increase “purposeful” strength, strength to body weight ratio, lean body mass, & movement quality.

- **July – August**: Build tolerance to load, increase durability, correct movement/technique errors, reinforce acceleration / deceleration/change of direction skills, low level plyometrics.

- **September – November**: Increase max strength, resisted sprints, acceleration & max velocity development, reactive agilities, multiple response plyometrics.

- **December – January**: Conversion to power, movement specifics (base running, position sprints, etc.), shock plyometrics.

- **February – Mid-June**: Put the Ferrari on the race track, and remember...there’s going to be rubbing...rubbing is racing!
Qualities for Speed

- **Functional Strength: Purposeful**
  - Speed must go hand in hand with strength, power, reactive/elastic strength, general fitness, and flexibility
  - Stretch-shortening cycle development (elasticity)
  - Better force application = faster speeds

- **Posture, Balance, Stability, & Mobility**

- **Relaxed efforts**

- **Power angles and movement mechanics**
Programming Guidelines

- Speed is an acquired fine motor skill
  - Teachable and trainable
  - Most difficult attribute to improve
    - Dependent on many bio-motor qualities

- Goals:
  - Optimize ground reaction forces
  - Optimal efficiency
    - Biomechanical
    - Physiological
Programming Guidelines

- Basic Technical Progression Model:
  - Master sound start & acceleration mechanics and gradually extend to longer sprinting distances i.e. 20-30yds, extending to sprints of 30-50yds, moving out to sprints of 50+yds

- Minimize fatigue
  - Fatigue inhibits CNS
    - Speed Development vs. Conditioning
  - Most optimal learning state
  - Train fast to be fast
Programming Guidelines

- Be systematic and have a plan of action
  - daily, weekly, monthly, annually

- Be intense

- Quality over quantity (less can be more)

- Learn, teach, and practice sound mechanics
  - Poor movement can exist anywhere in the body, but poor movement patterns can only exist in the brain.

- Perform drills for a purpose
  - A drill should never be an end unto itself, but rather a means to an end result
3 Stage Model of Motor Learning

1. Verbal – Cognitive Stage
   - Unconscious incompetence
     - Numerous errors, lack of consistency, don’t know what to do to improve

2. Associative Stage
   - Conscious incompetence
     - Knows what to do but the skill is still not mastered
   - Conscious competence
     - Skill requires little conscious effort, but not automatic

3. Autonomous Stage
   - Unconscious competence
     - Skill can be performed automatically
     - May take 500+ hours of practice to achieve
Performance Characteristics

1. Improvement
   - New behaviors & reduce errors.

2. Consistency
   - Reduce variability

3. Stability
   - Return to response after perturbation

4. Persistence
   - Retention after period of no practice

5. Adaptability
   - Context & skill
# How The Speed Continuum Applies To Sports

<table>
<thead>
<tr>
<th>0-10</th>
<th>10-30</th>
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<tbody>
<tr>
<td>Initial Acceleration</td>
<td>Transitions, From Explosive Strength/Starting Strength To Elastic Strength</td>
<td>Absolute Speed, Elastic Strength</td>
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<tr>
<td>Strength &amp; Explosive Strength</td>
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**Football Linemen, Basketball 4 & 5 and Hockey**

**Basketball 1Thru 3 and Some 4’s**

**Football RB & LBs DBs, Receivers, Special Teams & Two, Baseball, Softball, Soccer, and Field Hockey**

Adapted From Charlie Francis
Strength Qualities for Sprinting

- **Explosive concentric strength of muscle**
  - 0-30m

- **Explosive muscular stiffness and elasticity**
  - 30-60m

- **Speed Maintenance**
  - 60-100m

Ground contact times:
- 100-75ms
- 100-120ms

Contact time & the different strength qualities of 100m sprinting
Periodization of Speed

- Common model of periodization for speed development:

<table>
<thead>
<tr>
<th>TRAINING PHASES</th>
<th>PERIODATORY</th>
<th>COMPETITIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Aerobic Endurance (General Fitness)</td>
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<td>Develop Foundation of Speed</td>
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- Periodization of Speed

- Common model of periodization for speed development:
Periodization of Speed

- The Oregon model of periodization for speed development:

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<td>Speed Foundations (School)</td>
<td>Speed Development</td>
<td>Specific Speed Skills</td>
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Periodization of Speed

- **Speed Foundations:**
  - Drills for the improvement of coordinated muscular actions with progressive tempo, rhythm, & cadence (e.g. closed system drills)

- **Speed Development:**
  - Methods of loading & unloading to develop strength/power & speed of coordination, respectively, in order to improve acceleration abilities

- **Specific Speed Skills:**
  - Aims to develop acceleration/agility abilities with emphasis on movement specifics

- **Specific Speed:**
  - Training all qualities of speed and agility under normal conditions (e.g. without resistance or assistance; practice/game like situations)
1.) Starts/Stances: (first step efficiency)
   - Overcome inertia and get body into an efficient position to push & accelerate the body as quickly as possible

2.) Acceleration: (first 10-20 yards / first 6-8 steps)
   - The rate in change of velocity overcoming inertia allowing one to reach maximum speed in the least amount of time possible

3.) Maximum Velocity (Top End) Speed:
   - Transition from horizontal posture to a more vertical (upright) posture

4.) Speed Maintenance (Endurance)
   - The ability to maintain the highest percentage of top speed for as long as possible
Ground Contact Time (sec)

- Blocks: 0.360 sec
- Step 1: 0.185 sec
- Step 2: 0.165 sec
- Step 3: 0.140 sec
- Step 4: 0.130 sec
- Step 5: 0.120 sec
- Step 6: 0.115 sec
- Step 7: 0.110 sec
- Step 8: 0.100 sec
- Step 9: 0.100 sec
- Step 10: 0.095 sec
- Max Velocity: 0.085 sec

Source: Ralph Mann, 2007
Starting & First Step Development

- The more efficient the start, the sooner an athlete can accelerate to top speed
  - Multiple Stances & Starts
  - Stationary, moving, or combination starts
  - Posture, arm action, leg action (PAL)
Starting Skills: Coaching Cues

- Starting skills & first step quickness
  - Mechanically correct postural positions
  - Neutral head position (focus on destination)
  - Relaxed shoulders, tight stomach, hips & back set with full foot contact on ground
- Arm action
  - Relaxed but vigorous
- Active foot placement (push off with both feet!!!)
Starting & First Step Development

➢ Efficient stances for quick starts require setting the hips with the back arched and full foot contact with the ground as to assure the ability to push off with both feet and project the hips in the desired direction without a false step (for every action there is an equal and opposite reaction).

➢ Types of stances & steps:
  ▪ Forward – Squared & Staggered
  ▪ Lateral – Open & Cross-Over
  ▪ Backward – Drop & Reverse Pivot
Starts & Stances

- Squared & Staggered Starts
  - Efficiency Check:
    - 1. Hips set high, balanced with knees over instep.
    - 3. Elbows cocked, opposite of lead leg.
    - 4. Rear leg approximate to drive leg for immediate push off effectiveness.
Starts & Stances

➤ Open/Cross-Over & Drop Step Starts

- Efficiency Check:
  ✓ 1. Hips set, balanced with knees over instep.
  ✓ 2. Arched back, shoulders will dip to desired direction.
  ✓ 3. Upon push-off the lead toe, knee, elbow, & shoulder is driven in desired direction.
  ✓ 4. Resume acceleration steps.
Starts & Stances

- Squared, staggered, open, & drop step
  - 1, 2, 3, or 4 point stances
  - progress from 2 & 3 point stances to balanced (1 point) stances on 1 leg.

- Balanced (1 point) stances develop 3 components:
  1. Stability with hips set, back arched, tension in the thigh, & full foot contact with weight over the instep.
  2. Ability to get the other foot in position (with the toe and heel up) to be immediately accelerated back down onto the ground with positive shin angles.
  3. The ability to push off with both feet when needed.
Resisted Starts

Efficiency Check:

1. Resistance is placed at the hip bones.

2. Posture and balance remains in control of starter.

3. Fosters push-off with both feet & the limb drive necessary for proper hip projection.

4. Resistance is either consistent or released upon transition to acceleration (e.g. medicine ball take offs, partner resist & release).
Resisted Starts

SQUARED

STAGGERED

OPEN

DROP STEP
Starts & Stances

- Dilemma Positions
  - Efficiency Check:
    - 1. Position is a relaxed yet ready state (kneeling, seated, lying prone, supine, side).
    - 2. Emphasis on summation of prime movers of the body to project the hips/torso in the desired direction.
    - 3. Proper posture and mechanics are employed as soon as possible.
    - 4. The distance covered is short, with reaction and technique the primary goals.
Concepts of Speed Development

- Stride Length (SL) & Stride Frequency (SF)
  - SL x SF = Maximum Velocity

- Stride Length:
  - The distance one’s C.O.G. travels from take-off of one foot to touch-down of the opposite foot
  - The distance the hips travel through the air
  - During acceleration apply force into ground with goal of projecting hips forward as far as possible
  - Traditional focus is more strength = longer stride, however it’s coordination that is the limiting factor
Concepts of Speed Development

- **Stride Frequency:**
  - Ground Time (GT) + Air Time (AT) = Stride Time/Frequency (SF)
  - The time it takes to execute one stride
  - Apply great force into the ground in less time, projecting the hip forward a further distance
  - Strength not deciding factor between good & average sprinters, it’s efficiently reduced ground contact times due to enhanced technique & skill, motor coordination, & elastic-reactive strength (stretch-shortening cycle efficiency)
Goals of Speed Training

- Achieve high stride frequency and optimal stride length by:
  - Maximizing the backward velocity of the lower leg and foot at ground contact;
  - Minimizing vertical impulse and horizontal braking forces;
  - Emphasize brief ground support time, explosive force production, and rapid stride rate.

*Improved stride length & frequency are byproducts of force application. They do not need to be addressed individually.*
Goals of Speed Training

Stride Length-Frequency Interaction As a Function of Running Velocity
Keys For Speed Development

- Athletes must learn to:
  - Apply greater force;
    - Maximum strength development
  - Apply force in less time;
    - Elastic / reactive strength development
    - Biomechanical efficiency & correct techniques
  - Apply force in the proper direction;
    - Technique rehearsal & skill acquisition
    - Eliminate braking forces (Newton’s third law)
  - Apply force through full (proper) ranges of motion;
    - Mobility / flexibility
Basics of Speed Mechanics

Posture:

- Dictated by speed zone
- Body lean starts at the feet & ankles
- Triple extension necessary for straight line of force
- Incorrect posture negatively affects application of force against the ground (bending/breaking at the waist, dropping or picking up the head, etc.)
Basics of Speed Mechanics

- Greater acceleration can be achieved through greater body lean.
Basics of Speed Mechanics

- Sprint mechanics & gaze control
Arm Action:

- Stabilizes torso for optimal transfer of force through hips
- Helps create lift off of the ground
- Increases force application (forward thrust), ground reaction forces, and stride rate (particularly during acceleration).
- Provides balance & stability for the hips at max velocity
- Provides propulsive force transferring momentum to increase ground reaction forces.

Leg Action:

- Dictated by speed zone
- Shin angles
- Relationship of the C.O.G. upon ground contact
Basics of Speed Mechanics

Arm Action

- Weak Upward Arm Drive
- Weak Downward Arm Drive with Extended Elbow
- Rounded Posture and Indirect Line of Force

- Strong Forward Upward Arm Drive
- Downward Posterior Arm Drive with Flexed Elbow
- Strong Posture and Direct Line of Force

Source: Derek Hansen
Posture
- Posture & body lean critical to acceleration
- Acceleration of the C.O.G. is best when forward lean is the greatest
- Forward lean is vital for active foot placement (push the body!)
- Very acute angle (~45°); shoulders ahead of hips and hips well ahead of the feet
- Tight back, butt & stomach (tight gut & butt)

Arm Action
- Move at shoulder, punch hand towards finish
- Arms do not cross midline of body
- Hands slightly higher than shoulders in front & will clear hip when the arm is driven back

Acceleration Mechanics
Acceleration Mechanics

- **Leg Action**
  - Front side mechanics (thigh / knee separation)
  - Push & Punch emphasis
  - Maximum acceleration of the thigh over its full ROM with the knee coming up & down fully & quickly (no butt kick)
  - Cocked ankle (dorsi-flexion)
  - During drive phase toe never gets ahead of knee.
  - Actively drive thigh downward with the foot landing directly under hips
  - Acute shin angles (positive)
  - Lower heel recovery (first 6-8 steps)
  - Longer ground contact time
Top Speed Mechanics

Don't forget to train max velocity!

Max Velocity affects the entire Acceleration profile

20-meter: 3.10 sec
20-meter: 3.20 sec

$V_{max}$ by 0.5 m/s equals $\sim$1m difference in 20m race

Train to improve start AND finish

(Clark, K.; “Speed Science: The Mechanics Underlying Linear Sprinting Performance”)
Top Speed Mechanics

- Relaxation is key!!!

- Posture
  - Tight back, butt, & stomach
  - Involves more upright position
  - Hips high

- Arm Action
  - Swing at the shoulder
  - Elbow flexion
    - 60-90° front
    - ~90° past hips
    - 90-120° behind
  - Relaxed hands

- Leg Action
  - Foot contacts ground directly beneath hips
  - Shin angles become almost perpendicular
  - Higher heel recovery with the ankle of the recovery leg stepping over the knee of the support leg
  - Knee up, toe up, heel up
  - Less ground contact time
Top Speed Mechanics

Influence of Gravity and Elasticity

Source: Derek Hansen
Top Speed Mechanics

Influence of Gravity and Elasticity

- Fully Inflated Ball:
  - Greater vertical force production
  - Less horizontal braking forces
  - Less eccentric load on hamstring
  - Longer lever on ground contact

- Partially Inflated Ball:
  - Less vertical force production
  - Greater horizontal braking forces
  - Greater eccentric load on hamstring
  - Shorter lever on ground contact

Source: Derek Hansen
Top Speed Mechanics
Influence of Gravity and Elasticity

RELATIONSHIP BETWEEN HIP HEIGHT AND GROUND CONTACT TIME

Source: Derek Hansen
Vertical Displacement

The weaker sprinter's center of gravity drops almost immediately during the flight phase and must be raised excessively during the next support phase (ground contact).

NEGATIVE

The top sprinter's center of gravity continues to rise in a ballistic arc well into the flight phase, resulting in a much higher hip height at the start of the next ground contact. (This is sometimes described as lift.)

Source: Derek Hansen
Top Speed Mechanics

Source: Derek Hansen
P.A.L. Drill Sequencing

- **Posture Drills**
  - Wall drills
  - Wall / Partner lean fall holds
  - Partner lean, fall, and release

- **Leg Action Drills**
  - Acceleration ladders
  - Speed hurdles
  - Resisted sprints

- **Arm Action Drills**
  - Giant to small arm swings
  - Arm exchange
    - Rubber Band Drills
Closed & Open System Drills:

- Focus on placing body in positions to generate high horizontal impulses and low vertical impulses.
- Gives opportunity to address mechanical qualities & movement efficiency vital to proper acceleration / sprint mechanics.
- Can serve as part of technical (specific) warm-ups.
Closed System Drills

- Closed System Drills (CSD):
  - Places athletes in optimal movement patterns against the resistance of a closed environment teaching appropriate movement through concept of training specificity (e.g. wall sprints, resisted march/skips)
  - Reinforces proper postural positioning, accelerative patterns (front side mechanics & push-back), and refines the proper direction of force application
  - Utilizing effective coaching cues and good positioning, athletes will activate muscles that are needed in movements during open system drills, in the weight room, on the field/court, or track
Open System Drills (OSD):

- OSD are performed in a less restricted environment, where the athlete has a greater role in decision making such as establishing & maintaining proper accelerative positions & patterns (Farrow, Pyne & Gabbett, 2008)

- Places body in position to generate high horizontal forces as opposed to high vertical forces (e.g. ‘A’cceleration series progression, acceleration ladder, speed hurdles, & lean, fall, run)
Acceleration Mechanic Drills

- Mach “A” & “B” Drills & ‘A’cceleration Series:
  - Drills performed in progressive order fostering development of sprinting skills first in an acceleration, then top speed, and finally a speed maintenance mode, just as the order occurs in athletics.
  - Drills are derived from the Mach (Ack. Gerald Mach) sequence of an “A” (toe up / heel up, thigh acceleration) and “B” (toe/knee/heel reacceleration) series.
  - “A” Drill (toe up, heel up drill): performed at a march tempo, maintaining good upper body form and “driving” or “punching” knees forward and upward hard and fast. Each stride and step is an exaggeration of a quick explosive take-off with the toe up and heel up in preparation for ground contact and reaction.
Acceleration Mechanic Drills

- **“B” Drill (thigh reacceleration drill):** is initiated exactly like the “A” with the toe and heel being lifted upward in preparation for the ground recovery. The thigh is immediately accelerated downward and pulled backward underneath the hip in a “pawing” motion. Maintaining dorsi-flexion (toe-up) during recovery is imperative.

- **Fast Skip Drill:** utilize same mechanics as in Mach “A” drill, but at a faster more impulsive skip tempo, upward flexion of the toe and heel and forward drive of the knee of the swing leg aid the forward hip projection of the support leg with proper upper body running form.

- **Slide Kick Drill:** combination of high knee or “knee drive” and butt kick actions. Imagine the athlete standing against a wall and performing a butt kick. The foot/heel would have to “slide” up the wall in order to engage the butt. Emphasis is on explosive take-offs and pulling the knee upward and the heel to the butt.
Acceleration Mechanic Drills

- **Cadence Fast Leg Drill:** is an effort to employ a quick light footed rhythm to the toe up, knee up, heel up mechanics with a cadence. Therefore the right leg is continuous in its cyclic sprinting motion, the heel of the foot comes up into the butt, forward, and around to touchdown underneath the body again. The left leg is just keeping a quick supportive rhythm without the strides of a large cycling motion. The cadence can continue until switching to the other leg, or a series of combinations can be employed.
Acceleration Mechanic Drills

- Acceleration Ladders
  - Aids in developing efficient acceleration patterns
  - Ladder consists of 10 - 12 rungs identifying the approximate spacing of each foot placement during the acceleration phase
  - This allows for an exact programming of the neuromuscular system
Acceleration Mechanic Drills

- Speed Hurdles
  - Aids in developing efficient acceleration patterns
  - Develops knee drive and push back (front side mechanics)
  - Fosters good toe-knee-heel mechanics
Resisted Sprinting

Sprint Resistance (Sprint Loading):

- This method includes gravity-resisted sprinting (e.g., upgrade/hill or stair sprinting) or other means of achieving an overload effect (e.g., harness, partner, sled, etc.)

- Objective is to provide resistance without altering athlete’s movement mechanics

- Primary means to improve explosive power necessary for increases in stride length & decreases in ground contact time (due to increased forces)

- Teaches proper body lean, active push back & promotes hip projection
Resisted Sprinting

- Hill / Ramp sprints:
  - Requires lifting and driving the recovered leg through a greater range of motion than when on flat surfaces
  - Athletes must therefore exert a force against the ground sufficient to lift the center of mass somewhat higher than normal resulting in an increase in strength and power where the sprinter needs it most
During uphill sprinting the drop height of the foot per stride is shorter than when sprinting on flat ground. Muscle action will therefore shift from isometric (elastic) to concentric, and energy costs will increase greatly (Bosh, F., 2010).
Resisted Sprinting Methods

- **Hill Sprints**
  - 3-6° Incline
  - Run “into” the hill
  - ~100 yards max
    - Depends on degree of incline
    - 20 - 60 yards most optimal
  - Stairs (?)

- **Resisted Towing Sprints**
  - 10% rule (???)
  - 20-50lbs.
  - Resistance at the hip
Resisted Sprinting Methods

- Partner Towing
  - March / Skip / Sprint Tempo’s
  - Resistance placed at the hip

- Resistive Surfaces
  - Sand, soft dirt, snow
  - 6-8 inches deep
    - Quickness across surface
    - Stay on top of surface

- Contrast Sprints
  - Loaded to unloaded
    - Hill sprint finishing onto level ground, tow and release
Assisted Sprinting Guidelines

- **Sprint Assistance:**
  - Resistance before Assistance
  - Gravity-assisted sprinting (e.g., down-grade sprinting on shallow [1-3°] slopes), high-speed towing (e.g., harness and stretch cord), or other means of achieving an over-speed effect
  - Use in absence of fatigue
    - Assure optimal stride length, rate, & technique
  - 90-95% intensity
    - Other 7-10% from “pull”
  - Primary means to improve stride frequency
  - Reduce ground contact time
Assisted Sprinting Methods

- **Sprint Assistance:**
  - **Downhill Sprints**
    - 1-3° decline
  - **Tubing Sprints**
    - Maximum thickness surgical tubing
    - Progress from shorter to longer distances (40-50 yards max)
  - **Towed Sprints**
    - Towing behind bike, scooter, car, or a specialized pulley system
**Assisted Sprinting Methods**

- **Flat vs. Downhill Running**
  - **Flat:**
    - Hamstrings direct force backwards.
  - **Downhill (1-3°):**
    - Rectus femoris directs force anteriorly.
    - Do not utilize downhill running for long periods of time.
    - Maximum 2-3 weeks, then cycle off.

*Source: Frans Bosch*
Concept of Speed Reserve

- Speed Reserve:
  - “By building a bigger engine, athletes will be able to perform at (higher) submaximal speeds for longer durations. It is conditioning without entering a lactic environment.” – Derek Hansen
  - Athletes must therefore exert a force against the ground sufficient to lift the center of mass somewhat higher than normal resulting in an increase in strength and power where the sprinter needs it most
Concept of Speed Reserve

Speed Reserve Transfer Effect

- 8.3% Increase in max capability
- 10.9 m/s 100% Max Velocity
- 11.8 m/s 100% Max Velocity
- 8.7 m/s 80% Max Velocity
- 9.4 m/s 80% Max Velocity

Pre-Speed Training → Post-Speed Training

Ack.: Francis, C. & Hansen, D.
Speed Maintenance

- Allows for maintenance of technique & maximal velocity over an extended time period and the ability to repeatedly reach maximal acceleration of speed in multiple bouts

- The ability to maintain great technique & the highest percentage of top speed for as long as possible
  - Sprint Intervals
  - Varied Pace
  - Tempo
Varied Pace Sprints
- Consists of several changes in velocity within a sprint allowing the nervous system to “recharge” between bouts of maximal effort
- Teaches athlete’s to run relaxed at high velocities
  - Gear / Hollow / In & Out Sprints
    - Sprint 25yds, stride 25yds, sprint 25yds, stride 25yds
  - Fly 10-30 Sprint
    - 30 yard build-up into max velocity and hold for 10-30 yards.
  - Turnabouts
    - Sprint 20yds & stride 80yds, sprint 30yds & stride 70yds, etc.
Speed Maintenance

- Tempo / Percentage Runs
  - Sprints performed at speeds below 100% intensity
    - Teaches relaxation...vital to faster sprinting!
  - Not as taxing on CNS since performed at sub-maximal intensities
  - Great way to increase volume
    - Strengthen ligaments and tendons
  - Induce body composition changes
  - Facilitates restoration following top speed training
  - Lead to increased capillarization of muscles improving muscular contraction speeds
Special Speed Maintenance

The application of speed maintenance for activities with exercise relief patterns (work-to-rest intervals) specific to practice or competition

- Position Pattern Sprints
  - e.g. Catcher position specific patterns
    - Athlete sprints patterns specific to what is performed in competition (sprint to back-up bases, chase down foul ball, pop up from stance to field bunts, etc.)
**CATCHER**

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<td>FB-3L</td>
<td>FB-3L</td>
<td>B1</td>
<td>BB-L</td>
<td>FPU-L</td>
<td>B3</td>
<td>B1</td>
</tr>
</tbody>
</table>

**BB-C** = Ball to backstop center
**BB-L(R)** = Ball to backstop left (right)
**B1** = Sprint & back up first base
**B3** = Sprint & back up third base
**FB-FWD** = Field bunt forward
**FB-1L** = Field bunt down first base line
**FB-3L** = Field bunt down third base line
**FPUL(R)** = Foul pop-up left (right)
**PU-BHL(R)** = Pop-up behind home left (right)
**T1(2),(3)** = Pop-Up & throw to 1st, 2nd, or 3rd

***Begin Every Rep From Crouch Position***

Perform each rep @ "Game Speed" | Jog back to position after each rep | :30 - :60 sec. between Innings
Homer Runs the Hard Way:
- Sprint home past 1<sup>st</sup> base (5 strides) & shuffle back,
- Sprint around 2<sup>nd</sup> base (5 strides) & shuffle back,
- Sprint around 3<sup>rd</sup> base (5 strides) & shuffle back,
- Sprint through home plate.

Repeat sequence 4-6 times w/ :30-60 sec. rest between each.

The Cycle:
- Sprint a single & walk/jog back to home plate,
- Sprint a double & walk/jog back to home plate,
- Sprint a triple 7 walk/jog back to home plate,
- Sprint an inside the park home run.

Repeat sequence 1-3 times w/ :30-60 sec. rest between cycles

2-Base Intervals:
- Start clock on first sprint (2-base),
- Every :30 sec. interval start next 2-base sprint,
- Complete each sprint in :7 sec or less,
- Continue until prescribed number of reps are completed.

Perform for 8-12 reps, each rep must be completed in :7 sec. or less for it to count.
CLASSIC METHODS FOR SPEED-ENDURANCE DEVELOPMENT

Competitive-Trial Methods
- Supramaximal training
  - Intensity: greater than competition
  - Duration/distance: less than competition
- Maximal training
  - Intensity: equal to or less than competition
  - Duration/distance: equal to competition
- Submaximal training
  - Intensity: less than competition
  - Duration/distance: greater than competition

Distance-Duration Methods
- Continuous training (70-95% competitive speed/power)
- Variable training (structured changes in intensity, duration, volume, and density)
- Fatigue training (unstructured changes in intensity, duration, volume, and density)

Interval Methods
- Extensive training
  - Intensity: low-medium (60-80% competitive speed/power)
  - Duration/distance: short-medium; for example 14 to 180 seconds at 100 to 1,000 m running distance (advanced athletes), 17 to 100 seconds at 100 to 400 m running distance (beginners)
  - Volume: large; for example 8 to 40 reps (advanced athletes), 5 to 12 reps (beginners)
  - Density: high; short incomplete relief interval allowing heart rate to recover to 125 to 130 beats/min (advanced athletes) or 110 to 120 beats/min (beginners) (<1/3 the time needed for complete recovery); for example 45 to 90 seconds or 60 to 120 seconds for advanced and beginner athletes, respectively
- Intensive training
  - Intensity: high (80-90% competitive speed/power)
  - Duration/distance: short; for example 13 to 180 seconds at 100 to 1,000 m running distance (advanced athletes), 14 to 95 seconds at 100 to 400 m running distance (beginners)
  - Volume: small; for example 4 to 12 reps (advanced athletes) or 4 to 8 reps (beginners)
  - Density: medium; longer but still incomplete relief interval allowing heart rate to recover to 110 to 120 beats/min, for example 90 to 180 seconds (advanced athletes) and 120 to 240 seconds (beginners)

Repetition Methods
- Intensity: very high (90-100% competitive speed/power)
- Duration/distance: very short-medium; for example 2 to 3 seconds up to several minutes
- Volume: very small; for example three to six reps
- Density: low; long incomplete rest interval allowing heart rate to recover to ≤100 beats/min; for example 3 to 5 minutes

TACTICAL MODELING PROCEDURE FOR ESTABLISHING SPECIAL ENDURANCE TRAINING CRITERIA

1. Identify competition model with respect to (examples are provided):
   - Level
     - Professional, collegiate, high school, club
     - Conference, division, league
   - Scheme, style, system
     - Offensive
     - Defensive
   - Time period
     - Contest, game, match
     - Half, period, quarter
   - Personnel
     - Team
     - Platoon, shift
     - Position

2. Identify nature and scope of tactical events:
   - Intensity level(s)
     - Subjective
     - Objective
   - Outcomes, goals, objectives
     - “Settled” events, such as attack, possession, rally, series
     - “Unsettled/transitional” events, such as clear, fast break, special teams, turnover
     - Power play, extra-man or man-down situation

3. Video record specific competition(s) or segment(s) with respect to selected tactical events and assignments.

4. Evaluate the following:
   - Fundamental exercise/relief pattern
     - Frequency distribution
     - Central tendency versus variability
   - Subdivisions
     - One or more sprints or transitional events (or both) superimposed on continuous activity
   - Set-groupings as a function of extended-recovery intervals consequent to
     - Injuries
     - Penalties
     - Scores
     - Media, official, tactical time-outs

5. Select core training and testing task(s):
   - Workload intensity and duration
   - Position- and situation-specific assignment(s) and technique(s)
Barefoot Running

- Enhances strength, mobility, & proprioception of feet & ankles
  - Strengthens and improves the integrity and function of the ankles and feet
- Promotes more efficient running technique
  - Good landing mechanics (mid-foot)
  - Eliminates rear foot (heel) striking
- More protective of toes, promotes ankle dorsi-flexion (ankle cocked)
Different footfalls. These photos are of two Kalenjin runners from Kenya, a barefoot 12-year-old girl (left) and a boy (right) of the same age in running shoes. Note the differences in foot angulations as the girl prepares for a forefoot touchdown and the boy prepares to land heel first. NATURE|Vol 463|28 January 2010 (Photos courtesy of D. E. Lieberman.)
Barefoot Running

- Shoes can be the cause of many foot/ankle, knee, hip, & low back injuries:
  - 1.) Shoes allow incorrect running by landing on the heel, creating high breaking forces. Excess forces travel up the body & can lead to knee, hip, & low back injuries.
  - 2.) Shoes do not allow support structures of the foot & ankle to function correctly.
Barefoot Running

- Chronic ankle bracing and taping can lead to:
  1) Foot/ankle stabilizer muscles to weaken & atrophy.
  2) Tendons and ligaments weaken & lose ability to handle landing forces & lose ability to produce additional force in the push-off.
Barefoot Running

- Can have a therapeutic effect on the feet
  - Rehabilitate flat-footedness
    - Strengthens muscles on the plantar surface of the foot, aiding to uphold the arch, including flexors of the toes

- Great influence on the mechanoreceptors and tactile sensors of foot
  - Over time a gradual build-up of mechanoreceptors and sensors on the bottom of feet can help to better feel and distinguish against the ground with the feet
Running into Trouble

- Running on flat ground requires hamstrings to direct force backwards correctly.
- Running downhill, while being towed, or on a treadmill the force is directed more forwards, with more activity by the quad (rectus femoris).
- Inclined treadmill running there is less drop height to be processed elastically at stance.
## 4-Day Weekly General Training Template: Speed / Agility / Conditioning

<table>
<thead>
<tr>
<th>Emphasis</th>
<th><strong>DAY 1</strong></th>
<th><strong>DAY 2</strong></th>
<th><strong>DAY 3</strong></th>
<th><strong>DAY 4</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Acceleration / Agility]</td>
<td>[Speed Maintenance]</td>
<td>[Speed / Agility]</td>
<td>[Speed Maintenance]</td>
</tr>
<tr>
<td>General Warm-Up</td>
<td>General Warm-Up</td>
<td>General Warm-Up</td>
<td>General Warm-Up</td>
<td>General Warm-Up</td>
</tr>
<tr>
<td>Plyo/Slack Reduction:</td>
<td>Speed Maintenance:</td>
<td>Plyo/Slack Reduction:</td>
<td>Speed Maintenance:</td>
<td>Speed Maintenance:</td>
</tr>
<tr>
<td>- Jump, Hop, Combos</td>
<td>- Tempo Sprints</td>
<td>- Skip, Bound, Combos</td>
<td>- Tempo Sprints</td>
<td>- Tempo Sprints</td>
</tr>
<tr>
<td></td>
<td>- Interval Sprints</td>
<td></td>
<td></td>
<td>- Interval Sprints</td>
</tr>
<tr>
<td>Resisted Acceleration:</td>
<td>Specifics:</td>
<td>Max Speed Sprints:</td>
<td>Specifics:</td>
<td></td>
</tr>
<tr>
<td>- Hill and/or Sled Tow</td>
<td>- Position Pattern Sprints</td>
<td>- Acceleration and/or Top Speed</td>
<td>- Homers the Hard Way</td>
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</tr>
<tr>
<td></td>
<td>- Cycles</td>
<td></td>
<td>- 2-Base Intervals</td>
<td></td>
</tr>
<tr>
<td>Change of Direction / Agility</td>
<td>Forward + Backward</td>
<td>Change of Direction / Agility</td>
<td>Forward + Backward</td>
<td>Forward + Backward</td>
</tr>
<tr>
<td></td>
<td>Barefoot Strides</td>
<td>Agility</td>
<td>Barefoot Strides</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specifics:</td>
<td></td>
<td>Specifics:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Base Running Tech.</td>
<td></td>
<td>- Fielding / Base Running Techniques</td>
<td></td>
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</tr>
<tr>
<td>- PitcherStride Sled Tow</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Forward + Backward Barefoot Strides</td>
<td></td>
<td>Barefoot Weaves &amp; Cuts w/ Backward Strides</td>
<td></td>
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<tr>
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<td></td>
</tr>
<tr>
<td>DAY</td>
<td>MONDAY</td>
<td>TUESDAY</td>
<td>THURSDAY</td>
<td>FRIDAY</td>
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<tr>
<td>-----</td>
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</tr>
</tbody>
</table>
| Prep: | Dynamic Warm-Up:  
- A-skip, A-run, straight leg run  
- lateral shuffle, carioca, lat.skip  
- bkwd skip, bkpedal, bkwd shuffle | Dynamic Warm-Up:  
- A-skip, A-run, straight leg run  
- lateral shuffle, carioca, lat.skip  
- bkwd skip, bkpedal, bkwd shuffle  
- Hurdle Hip Mobility Routines | Dynamic Warm-Up:  
- A-skip, A-run, straight leg run  
- lateral shuffle, carioca, lat.skip  
- bkwd skip, bkpedal, bkwd shuffle  
- Hurdle Hip Mobility Routines | Dynamic Warm-Up:  
- A-skip, A-run, straight leg run  
- lateral shuffle, carioca, lat.skip  
- bkwd skip, bkpedal, bkwd shuffle  
- hurdle hip mobility routines |
| Tech: | Postural Wall Sprint Drills  
- Arm Action Drill (mini-band or elbow tap)  
- ‘A’ & ‘B’ Series [march/skip/run]  
- Starts & Stances  
[ square/stagger/open/drop/dilemas]  
- Acceleration Ladders  
- Box Lean Acceleration | Form Movements:  
- Fast Paw & Wall Slide Strides  
- ‘A’ & ‘B’ Series [march/skip/run]  
- Stick Strides | Agility Progression (Sway Series)  
- Deceleration Skills | Hash Mark Stride Routine:  
- Heel Walk  
- Every Mark  
- Every Other Mark |
| Developmental: | Muscle Slack Reduction Development  
- Static & small amplitude jumps  
Elastic-Reactive (SSC) Development  
- Jump, Leap, & Hop Progressions  
Start & Acceleration Development:  
- Hills Sprints (6-8 x 10-30yds)  
Change of Direction:  
- Speed Weave Drills | Speed Maintenance:  
- Tempo Sprints  
- Sprint Intervals | Muscle Slack Reduction Development:  
- Static & small amplitude jumps  
Elastic-Reactive (SSC) Development:  
- Skip, Bound & Hop Progressions  
Acceleration Development:  
- Sled Tow Sprints (6-8 x 20-30yds)  
- Pitch Stride Sled Tows  
Max Velocity Development:  
- Fly 10’s – 20’s (field players only)  
Change of Direction:  
- Power Cut Drills  
- Grafting Drills (weave & cut) | Speed Maintenance (early summer):  
- Tempo Sprints  
- Interval Sprints | Specific Speed Maintenance (late summer):  
- C.O.D. Intervals  
- 2-Base Intervals  
- Homers the Hard Way |
| Trans: | Base Running Specifics:  
- Base Stance, Starts, & Turns  
Recovery Barefoot Work:  
- Backward + Forward Strides | Specifics  
- Position Pattern Sprints  
- Cycles | Recovery Barefoot Work:  
- Weaves & Cuts w/ Bkwd Strides | Recovery Barefoot Work:  
- Backward + Forward Strides |
# 3-Day Weekly General Training Template: Speed / Agility / Conditioning

<table>
<thead>
<tr>
<th>Emphasis</th>
<th><strong>DAY 1</strong> [Acceleration / C.O.D.]</th>
<th><strong>DAY 2</strong> [Agility / Speed]</th>
<th><strong>DAY 3</strong> [Speed Maintenance]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPEED MENU:</strong></td>
<td>General Warm-Up</td>
<td>General Warm-Up</td>
<td>General Warm-Up</td>
</tr>
<tr>
<td>Technical Warm-Up:</td>
<td>- Posture, Stance, &amp; Start Skills</td>
<td>Technical Warm-Up:</td>
<td>- Posture, Stance, &amp; Start Skills</td>
</tr>
<tr>
<td>Plyometrics/Muscle Slack Reduction:</td>
<td>Change of Direction / Agility</td>
<td>Plyometrics/Muscle Slack Reduction:</td>
<td>- Skip &amp; Bound Progressions</td>
</tr>
<tr>
<td></td>
<td>- Jump &amp; Hop Progressions</td>
<td>- Planned → Reactive</td>
<td></td>
</tr>
<tr>
<td>Acceleration Development</td>
<td>Acceleration + Max Velocity Speed Development</td>
<td>Speed Maintenance Development:</td>
<td></td>
</tr>
<tr>
<td>Change of Direction / Agility:</td>
<td>Specifics:</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Planned → Reactive</td>
<td>- Position pattern sprints, base running techniques/routines, pitcher stride sled tow, etc.</td>
<td></td>
</tr>
<tr>
<td>1v1 / small sided competitions</td>
<td>1v1 / small sided competitions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fwd+Bkwd Barefoot Strides</td>
<td>Fwd+Bkwd Barefoot Strides</td>
<td>Barefoot Weave+Cut w/ Bkwd Strides</td>
<td></td>
</tr>
</tbody>
</table>
### 3-Day Weekly Training Template:
**Fall / Winter Off-Season - Speed / Agility / Conditioning**

<table>
<thead>
<tr>
<th>DAY &gt;&gt;</th>
<th>TUESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERIOD</td>
<td>Dynamic Warm-Up: Square Routine  &lt;br&gt;- Activation Work  &lt;br&gt;- Mobility (Ankle/MTP, Hip, T-Spine / Shoulder)  &lt;br&gt;- Potentiation Activities</td>
<td>Dynamic Warm-Up: Movement Circuit  &lt;br&gt;- Hurdle Hip Mobility  &lt;br&gt;- Hula Hoop Agility  &lt;br&gt;- Balance Beams  &lt;br&gt;- Crawling  &lt;br&gt;- Bench Vaulting  &lt;br&gt;- Bag/Hurdle High Step</td>
<td>Dynamic Warm-Up  &lt;br&gt;- Activation Work  &lt;br&gt;- Mobility (Ankle/MTP, Hip, T-Spine / Shoulder)  &lt;br&gt;- Core / Pillar  &lt;br&gt;- Potentiation Activities</td>
</tr>
<tr>
<td><strong>Preparation:</strong> General warm-up to stimulate neuromuscular / musculoskeletal systems.</td>
<td><strong>Technical:</strong> Specific warm-up to ensure optimal preparation &amp; technique for quality work.  &lt;br&gt;- Postural Wall Sprint Progressions  &lt;br&gt;- Arm Action Drill (mini-band or elbow tap)  &lt;br&gt;- ‘A’ &amp; ‘B’ Series [march / skip / run]  &lt;br&gt;- Starts &amp; Stances [square/stagger/open/drop/dilema positions]  &lt;br&gt;- Acceleration Ladders  &lt;br&gt;- Box Lean Acceleration</td>
<td>Agility Progression (Sway Series).  &lt;br&gt;- Deceleration Skill Work</td>
<td>‘A’ &amp; ‘B’ Series Progression:  &lt;br&gt;- March / Skip / Run  &lt;br&gt;- Hash Mark Stride Routine:  &lt;br&gt;- Every Mark  &lt;br&gt;- Every Other Mark</td>
</tr>
</tbody>
</table>
| **Developmental:** Primary workload of the training session, introduction of overload. | Change of Direction Routines:  <br>- Speed Weave, Power Cut, Sprint-Backpedal-Sprint, Touch-n-Go, Cross-Over Sprint, Spin Sprint.  <br>- Partner and/or Sled Tow Sprints  <br>- Contrast Sprints  <br>- Pitching Stride Sled Tows (pitchers only) | Muscle Slack Reduction Development:  <br>- Static/Concentric only & small amplitude jumps  <br>- Possible unstable surfaces  <br>- Elastic-Reactive (SSC) Development  <br>- Jump, Leap, & Hop Progressions  <br>- Start & Acceleration Development:  <br>- Hills Sprints (10-30yds)  <br>- Change of Direction / Agility Progressions  <br>- Speed Weave & Power Cut Technique  <br>- Grafting Combinations (weave & cut)  <br>- Reactionary / Competitive | Speed Maintenance:  <br>- Tempo Sprints  <br>- Interval Sprints  <br>- C.O.D. Intervals  
| **Transitional:** Work to promote coordination, synchronization, spatial awareness, and transitional mobility. | Recovery Barefoot Work:  <br>- Backward + Forward Strides | Recovery Barefoot Work:  <br>- Backward Strides |  
| Specifics:  <br>- Base Running Technique: Stance, Start, Turns  <br>- Position Pattern Sprints  <br>- Reactionary Agility Skill Development:  <br>- Wall Ball, Ball Drop, Fetch & Catch Drills  <br>Recovery Barefoot Work:  <br>- Weaves & Cuts w/ Backward Strides |  
|  |  |  |  |
## 2-Day Weekly Training Template: In-Season - Speed / Agility / Conditioning

<table>
<thead>
<tr>
<th>Emphasis</th>
<th><strong>DAY 2</strong></th>
<th><strong>DAY 3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Speed Maintenance]</td>
<td>[Speed / Agility]</td>
</tr>
<tr>
<td><strong>SPEED MENU:</strong></td>
<td>General Warm-Up</td>
<td>General Warm-Up</td>
</tr>
<tr>
<td></td>
<td>Technical Warm-Up</td>
<td>Technical Warm-Up</td>
</tr>
<tr>
<td>Speed Maintenance:</td>
<td>- Tempo Sprints</td>
<td>Plyometrics / Muscle Slack Reduction:</td>
</tr>
<tr>
<td></td>
<td>- Interval Sprints</td>
<td>- Multi-Jump/Hop/Bound Routines &amp; Combos</td>
</tr>
<tr>
<td></td>
<td>Forward + Backward Barefoot Strides</td>
<td>- Med Ball Pass/Throw/Toss Routines</td>
</tr>
<tr>
<td></td>
<td>Sprint Development:</td>
<td>Change of Direction / Agility:</td>
</tr>
<tr>
<td></td>
<td>- Acceleration and/or Top Speed</td>
<td>- Grafting Drills</td>
</tr>
<tr>
<td></td>
<td>Change of Direction</td>
<td>Reactive / Unplanned / Competitive</td>
</tr>
<tr>
<td></td>
<td>Agility / Agility:</td>
<td>Forward + Backward Barefoot Strides</td>
</tr>
</tbody>
</table>
Acceleration Based Return-to-Play

Hamstring Return to Play Implications:

- Most hamstring injuries occur during sprinting / running.

- Often diagnosed as “strength” deficiency issue.

- Running biomechanics / technical skills are usually an after-thought.

- Acceleration is a “safe” means of providing specific strengthening, regaining neuromuscular timing, and re-teaching/re-training the hamstring to accumulate load.

- Improves qualities required for seamless return-to-play in running based sports; incorporating strength, speed, mobility, and overall conditioning.

If you work with court or field sport athletes, and you rely on the weight room - not speed, acceleration and fast movement - for your primary 'Return-To-Play' activities...

...you are preparing your athletes for Guido's job, not Lightning McQueen's performance!

Ack.: Hansen, D.; SprintCoach.com
10 Commandments of Speed

I. Understand that execution is based upon relaxation and focus.

II. Realize that the quality of neuromuscular coordination comes before the quantity of strength and power.

III. Train for technique (speed foundations) before speed development.

IV. Emphasize specific development of coordinated fast movements.

V. Utilize exercises and drills that are specific to the desired results.

VI. Remember that stride length is more readily developable than stride frequency.

VII. Realize that “effective stride length” is hip projection and ratio of strength and power over body weight.

VIII. Acknowledge that speed and strength are most productive when speed is superior to strength.

IX. Speed development comes before speed endurance.

X. Embrace the fact that improving speed is a long, dedicated, and consistent refinement process.
Conclusions

- For power sport athletes limit jogging / distance running (slow-continuous) as much as possible!
  - Sprint Interval Training
    - Sprint Interval Training – “It’s a HIIT!” (Mark J. Smith, Ph.D)

- For young athlete’s speed & agility work should be playful & game like. No formal drill work before age 10
  - Youth – General (tag games, short relays, etc.)
  - High School – Directed (formal)
  - Collegiate / Professional – Specialized (specific)

- Apply a systematic approach to improvement
  - Coach concepts not drills
Conclusions

- Mobility is a key aspect for improving stride length and ability to move laterally
  - Inadequate ROM for a specific task can result in improper foot placement, longer ground contact times, and higher braking forces
  - Identify limitations due to mobility, and address in training
  - During sprint drill work stress movement at the hip
    - Ex. Hurdle hip clearance activities

- Starting ability is due to the synchronized rapid extension of the ankle/knee/hip
  - Triple extension highly related to work performed in weight room
1. Over / Unders:
   - Linear stepping
   - Angled Stepping

2. Walk-Overs:
   - Bent Leg Forward
   - Straight Leg Forward
   - Bent Leg backward
   - Straight Leg backward
   - Bent Leg Lateral
   - Straight Leg Lateral (behind)

3. Skip-Overs:
   - Bent Leg Forward
   - Straight Leg Forward
   - Bent Leg backward
   - Straight Leg backward
   - Bent Leg Lateral
Conclusions

- Prioritize strength training tasks by their dynamic correspondence with the target activity
  - SSC actions (elastic/reactive strength) & muscle slack reduction development usually deserve high priority in speed and agility training.

- Maximal strength & the ability to accelerate are highly correlated
  - Develop maximal strength through traditional means
  - Squat & lunge variations
  - Derivates of Olympic lifting movements

- 6-8 reps is optimum number for speed & agility development work
Conclusions

- Vary speed training methods & intensities to avoid creating speed barriers/plateaus
- Develop speed before speed maintenance
  - Micro-cycle & macro-cycle
- Coach them up!!!
  - Coaching not training
  - Coaching for you......Coaching for them???
- Be prepared to help athletes unlearn old bad habits & relearn proper patterns from scratch!
  - Sometimes you have to go back to go forward
  - Re-educate and re-emphasize
Conclusions

“Any idiot can make someone tired, but that’s not the purpose of training for speed.”

- Dr. Yuri Verkhoshansky
Conclusions

http://training-conditioning.com/content/perfectly-positioned

http://training-conditioning.com/_ezines/tc2804de/#p=42
References & Thank You’s

- Jim Radcliffe
- Bryan Miller
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- Steven Plisk
- Adrian Faccioni
- Mike Boyle
- Frans Bosch
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- My family
- The coaches and young people that I am privileged to work with everyday
- Rex Mack
- The Ohio High School Fastpitch Softball Coaches Association
- YOU!!!
Contact Information:
Mark Dillon, MS, CSCS, RSCC, USAW
Strength and Conditioning
University of Oregon
Email: mdillon1@uoregon.edu