

Biomotor Abilities and Physical Capacities Training

Here's an abbreviated overview the program looks like and what you all can expect for Speed and Movement Development Training and Strength & Conditioning.

We use many approaches for our Physical Capacities Training, for many different areas of emphasis of training. The volume of different training area of emphasis is extensive. For the purposes of this document, we will discuss training for General Speed Development Training and Conditioning.

Speed training necessitates training all five biomotor abilities and conditioning that are profitable for other sports, including vertical jump ability and endurance. One must have great coordination/skill, flexibility, strength, and endurance to perform the exercise methods and means used in Speed Development Training.

I have divided this synopsis into five topics.

- 1) General
- 2) Coordination, Flexibility, Speed, Strength
- 3) Endurance
- 4) Periodization
- 5) Pairing

1) General

This Overview is focused on training Speed Development and Conditioning. Field Sport/Arena athletes can be trained similarly for their Speed Development training, with an adaptive focus on acceleration specific to the sport or position.

The training program is focused on balanced biomotor training. Variety is the spice of life and the key to continued adaptation. With four of the biomotor abilities there is intentional effort in my programs to change the methods and means over a training period, so that continued adaptations are pushed, and strengths are drawn from several modalities.

I'm open to outside training methods and am continually learning and incorporating new methods, and speaking with coaches about what types of training and workouts they use. I know that every set of training concepts can be improved. And I know that many Roads Lead to Rome, and that understanding why you're using the training concepts you're using is the most important element of the physical training you employ. I continually modify and incorporate outside training concepts, as well as modify workouts within our own concepts. If for example, you have 4-5 training days that are high demand, either a high central nervous system (CNS) day or an energy system day, for training, changing one of the workouts done during the week, equates to a 20-25% alteration in training method for that particular segment of the daily workout arrangement for the week. I have been known to change or modify at least one day of a particular daily workout arrangement each year.

With repetition mark objectives/targets, whether that be on the Track, Field, Weight Room, Jumping, I use a "Push Method" where each athlete is assigned a mark that matches the participant's ability level. Not everyone is "Pulled" (Pull System) to the same mark. This is advantageous in two ways: 1) The lesser ability participants can have an attainable objective, that keeps their effort level and mental self-efficacy strong. Additionally, depending on the workout, such as a low intensity day, I may want the athlete to be giving an effort level below 90%, and having a repetition mark specifically for them, prevents them from crossing that 90% threshold due to trying to hit the mark in a pull method. 2) Participants are not limited to hitting the standard bench mark repetition performance for a set workout for the day. They are able to get ahead of the set workout bench mark performance.

Further, using a "Push Method" I always give objective repetition mark that are attainable. If the participant can get beyond the objective mark, which sometimes I encourage them to get ahead of the objective mark if they can depending on the workout and the stimulus we are aiming for and what was done the previous day, it doesn't compromise their confidence if they are unable to attain the objective time. With top performers, I may share what the historical bests are for repetition marks for that particular workout from someone who has already done that workout as an inspiration to try and match that mark.

Another aspect of this "Push Method," and an exception, is that if a group of participants are doing the same workout together, I will put participants of fairly similar ability levels with each other. Typically this matching of similar range of ability levels between participants is participants who are within the same personal bests in the following measurements: In running are within 0.2 tenths of a second in the 40 yd dash, 1-2 seconds in the 200m Dash, 1-2 seconds in the 400m Dash, 2-4 seconds in the 800m run, within 15 lbs. of specific exercise, 1-2 inches in the Vertical Jump, 1-3 seconds within the 300 yd shuttle, and within 10m VO2 max repeat range using 30-30s x 24.

2) Coordination, Flexibility, Strength, Speed

Throughout the year all five biomotor abilities are trained. Note: Biomotor abilities without exception almost always overlap.

A few examples are strength + coordination = stability / strength + speed = power / speed + coordination = agility / flexibility + coordination = mobility
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- Coordination – Defined: Ability to move body parts in concert with precision for a specific objective.

The better you can coordinate body parts in concert the better you are able to produce technical queues in movement. We develop coordination through dynamic hurdle mobility drills with several complex variations of movement and rhythm to continue to challenge the coordination system to develop further. We also will use Rotary Runs (Running over wicket mini-hurdles) and Acceleration

Ladders (Newspaper Drills) in order to challenge the coordination system with varying patterns and movements and even distances, as variable practice (doing a movement the incorrect way), has been shown to increase the ability to be aware of how to do a movement the correct way. We also use wickets going laterally to increase the coordination system. We also use agility ladders with variable patterns to challenge the coordination system. Additionally, using a National Academy of Sports Medicine (NASM) training concept, we warm-up and move laterally, diagonally, and rotationally that also develops coordination further. We use Speed Drills that develop coordination, and movement patterns of the limbs through their ROM's of running, but we also will add in drills with rhythms that are challenging and don't directly mimic the movement patterns and order of Sprinting such as two A-Skips on the same leg consecutively (A-2's), Double Calf to Hamstring on the same leg consecutively (butt kicks where the calf comes straight up to the glute – "smash your calves to your butt") A-C skips where an A-skip performed in the Sagittal Plane (Straight ahead and Back) and is followed by a Lateral A-Skip (Frontal Plane).

- Flexibility – Defined: Ability to which movement of joints and body segment may be moved unrestricted through various ranges of motion.

For Flexibility, we use three types of Flexibility Categories:

1. Corrective Flexibility
2. Active Flexibility
3. Functional Flexibility

Corrective Flexibility is designed to correct postural imbalances, muscle imbalances and joint dysfunctions. Corrective Flexibility incorporates self-myofascial release, static stretching, and neuromuscular stretching.

Active Flexibility is designed to improve soft-tissue extensibility. Active Flexibility incorporates self myofascial release, neuromuscular stretching, and active isolated stretching.

Functional Flexibility is designed to improve multiplanar soft-tissue extensibility and optimum neuromuscular control throughout the full range of motion (ROM), while performing functional movements that use the muscles to control the speed, direction, and intensity of the stretch.

Flexibility Stretching types:

1. Self-Myofascial Release (SMR) focuses on the neural and fascial systems of the body. SMR concentrates on alleviating trigger points and areas of irritability located within a band of muscle. It also incorporates the concept of autogenic inhibition (O) to improve soft-tissue extensibility. *When a tissue is injured, the body creates inflammation which in turn activates the body's pain receptors and initiates a protective mechanism of creating muscle tension and causing a muscle spasm. As result of the spasm, adhesions ("Knots" and Trigger Points") form in the tissue. These adhesions cause the tissue, to rebuild itself with an inelastic collagen matrix that forms in a random fashion, which often does run in the same direction as the muscle fibers, that acts as roadblocks not allowing the muscle fibers to move properly.* SMR is used to release tension or decrease activity of overactive neuro-myofascial

tissues in the body. SMR releases spasms that develop in the injured tissue, and break up myofascial adhesions.

2. Static Stretching focuses on autogenic inhibition to improve soft-tissue extensibility, leading to relaxation and elongation of the muscle.

Active Isolated Stretching focuses on using the agonist and synergists to dynamically move the joint through a range of motion, creating reciprocal inhibition of the agonists which results in greater range of motion.

3. Neuromuscular Stretching (NMS), also known as Proprioceptive Neuromuscular Facilitation (PNF) focuses on the neurophysiological mechanisms of autogenic inhibition and reciprocal inhibition. This process includes using a partner to move the limb until the first resistance barrier, and the participant applies an agonist contraction, lasting 7-15 seconds, which is followed by the limb being moved to the newly created, and greater, range of motion.

NMS flexibility, and static stretching are used at the end of practice to elongate the muscle-tendon unit. We develop mobility with Glutes to the Floor/Ground Squats (G2F's) to develop ankle and hip mobility, hurdle mobility, and end range of motions exercises using medicine balls, and utilizing recovery lifting that challenges flexibility and mobility.

· Strength – Defined: Ability to Apply Forces

Our Strength Training utilizes a little bit of almost everything you would see in 2018 training programs, but with a lot of things not seen in 2018 programs. Similar to Mike Young, I have a great admiration for the Russian system. In the 20th century during the Cold War, the Eastern Bloc countries were intently focused on developing strength and power in their exercise systems for athletics while the West was intently focused on developing stamina in their exercise system for athletics. A lot of what we do for strength and conditioning is Eastern Bloc in origin. And like the Eastern Bloc training, I've always believed in training movements versus muscles necessarily, and try to develop ways to train the movements in the weight room as close as possible to the actual movement performed in competition, known as "Special Strength." We use a Triphasic approach to our lifting (Concentric, Eccentric and Isometric) versus concentric lifting alone. Russian Olympic Development Coach Yuri Verkhoshansky points out many of the Russian Olympic coaches in the modern era use a 75:15:10 approach to Concentric, Eccentric, Isometric contraction types in their lifting programs. Our lifting approach is closer to 70:18:12, because I know most of our athletes likely have never done specifically addressed eccentric or isometric lifting, so there's a lot of potential to be tapped into and needs to be developed.

Eccentric lifting- Training eccentrically helps us to decrease ground contact time and increase stride length by increasing muscle and tendon stiffness. Our program for Eccentric lifting includes the following: slow eccentric loading (70%-90%) for a desired number of seconds, Supra-maximal lifting since eccentric contractions are stronger than concentric contractions, Supra-maximal loads are required to challenge eccentric muscle contractions, using loads of (110-140%), Fast Turnarounds with loads of (80-120%), Fast Eccentrics where you either move at free fall speed (passive eccentrics) or pulling the load down quickly (active eccentrics) using loads of (30-70%), and

combination Fast Eccentric/Fast Turnarounds (active powermetrics or passive ballistics).

Isometrics lifting- Training using Isometrics, has shown to be effective at developing strength anywhere from +/- 15 degrees of a given movement, all the way up to diminishing returns over the rest of the movement as high as 25%. Isometric Pause lifts are great at breaking sticking points (point where one goes from eccentric to concentric). Explosive Isometrics (Pushing as hard as possible against an immovable object) is the best way to develop starting strength, and as Verkhoshansky points out "it is doubtful whether it is always productive to maintain a rigid distinction between dynamic and isometric exercise." This is based on the fact that isometric work is the limiting factor in dynamic work on a force velocity curve in terms of starting strength. Time expenditure in using isometrics to develop starting strength is very productive, where in dynamic exercise, explosive isometric contractions last no longer than .1sec, and Verkhoshansky points out 10mins of 6sec explosive isometrics in specially selected exercises can replace an hour of training with weight dynamically. Isometrics are also great for neural potentiation in that they can put the muscle into a state of tetanus (highest rate of motor neuron impulse firing), resulting in a greater magnitude of motor unit force. This can be a great post-activation potentiation method, that can also be used in conjunction with lifting within the same exercise movement. We'll utilize methods such as Explosive Isometrics at the beginning of the sets or Contrasting Isometrics into set and exercises, doing before a lift or during a lift where the exercise is done against immovable resistance and then released into the dynamic movement. We'll also perform explosive against immovable objects or partner resist limb movements, prior to speed work, multiple throws, or plyometrics. Additionally, we'll perform explosive Isometrics over a range of movement in terms of running, where the muscle contractions are plyometric, going from Isometric, to Concentric, to Eccentric back to Isometric and starting the cycle over again. In running joint angles change depending on the relation of the body to the ground. We do Explosive Isometrics on squats at 90 degrees, 45 degrees, 22 degrees (Full, Half, Quarter Squats) as well as the degrees in between 90 and 22. Isometric are also the most direct way to increase tendon stiffness which is important in the transfer of energy and making use of stored elastic energy. I recently read a study where explosive plantar flexions (immovable calf raises) resulted in higher static vertical jump gains than depth jumps. We also use explosive isometrics immediately followed by dynamic work.

Concentric lifting- Concentric lifting is our primary muscle contraction types in our training, and is the most utilized contraction type during movement. Our Concentric Lifting is broken into two categories: 1) Primary Lifts 2) Auxiliary Lifts. In general we do higher sets and lesser number of exercises. The following is our Primary Lifting Line Up:

1. Olympic Lift Variation
2. Squatting Variation.
3. Upper Body Press and Pull variations
4. Wildcard Lower Body Exercise; for us this a Romanian Deadlift or Straight Leg Dead Lift, Barbell Hip Thrust, Barbell Glute-Bridges, Glute-Hamstring Raises, Cable/Band/Tubing Hip Extensions or Hip Hyper extensions.

Glute-Hamstring Raises are one only two exercises where you can get hamstring muscles that function as knee flexors and hip extensors at the same time, and the Hip Thrusts and Glute Bridges

can more directly enhance hip extension for the horizontal pull involved in sprinting. We use Inertial Squats (Lifting the weight from a racked position) to develop starting strength, weighted step ups, wide squats to more directly target the glutes, A2Gs to improve ankle and hip mobility. We use Bulgarian Split Squats, Step Ups and Barbell Lunges to improve unilateral strength. Training for the upper body includes unilateral Dumb Bells (DB) Bench and Shoulder Front Raises, which DB's require intense use of the assistant mover muscles and stabilizers more so than a bar, and Arm Swing movements, often called "Running Arms" using DB's/Cables/Bands/Tubing.

Our Auxiliary Lifts and are often done in Super-Set fashion while the Primary Lift movement muscles recovers, which are isolated lifts/single joint, include:

1. Ankle Extension- Ankle Flexor Hops, both with and without resistance, Calf-raises/Leg press toe extensions (done Triphasically – Concentricly, Eccentricly, Isometricly).
2. Hip flexor pulls (A-Skip) using cables/bands/tubing.
3. Running Arms, both heavy resistance and explosively (lighter resistance).
4. Core Training.

Explosive Lifting- Explosive lifting includes attempts to address the bottom three classifications of strength qualities of the force-velocity curve of the following:

1. Isometric strength ($V=0$),
2. Quasi-isometric strength ($V=Very\ Slow$)
3. Strength-Speed ($V=Slow$)
4. Speed-Strength ($V=Intermediate$),
5. Explosive Strength/Ballistic Strength ($V=High$).

Olympic lifting (Oly's), weighted/loaded jumps, lighter resistance cable movements, explosive upper body press and pulls, multiple throws, and assisted jumps are exercise means we use for developing explosive power. Olympic lifting is done from the floor ideally 60:40 as it targets more of the posterior chain and replicates movement patterns closer to a static start. Olympic lifting focuses on the whole spectrum of the force-velocity curve, especially the development of starting strength and acceleration strength. Oly's we use include using heavy clean pulls using supramaximal power clean loads while still trying to move the bar as fast as possible, heavy power cleans (1-2 reps) and medium power cleans (3-4 reps), heavy hang clean (1-2 reps) and medium hang cleans (3-4 reps) heavy snatches (1-2 reps) and medium snatches (2-4 rep). Other exercises we use are jumps, vertical and horizontal (broad jumps) unloaded, loaded (at ranges between 20-30% of 1RM and 20-30% bodyweight) and assisted (using bands tied to the top of the squat rack/ceiling and connecting to the bar), and multiple throws to develop Explosive Strength. All Ballistic movements can be done with and without counter-movements depending on the goal of the stimulus, such improving Starting Strength or improving Stretch Shortening Cycle Reflex. We typically progress from no countermovement to countermovement with each contributing a quality to sprinting, progressively more towards the cyclic nature of it.

Contrasting/Complexing – With all methods we try to use the potentiation benefits for contrasting or complexing various force-velocity curve movements when possible. Sometimes this takes on the

form of heavy lifting + plyo's, squatting to oly'ing to jump squatting, or sprints that go from resisted, assisted, flat or any combinations of the three. I factor the distribution of each method I want over the year so that some form of higher force low velocity movement is contrasted/complexed into the mix to some degree (usually around .33% of the total training volume for that type of exercise) when we start doing low force high velocity movement. We often will contrast our multiple throws into our speed workouts to work ballistic resistance triple extension with the max speed triple extension. If we don't use them within a workout, we'll use them at the end of max strength workout as the body remembers the last thing it did and there is evidence to suggest it will adapt better high velocity capability as a result. We also sometimes do plyos at the end of the day for this same purpose.

Contrasting = alternating modalities between sets // Complexing = alternating modality sets. ·

Speed –Defined: Ability to move body parts or the body as a whole in short periods of time.

I won't keep you in suspense on the question of "when do you directly incorporate speed development?" Similar to Dan Pfaff, Mike Young, Phil Lundin, Clyde Hart, Pat Henry, Jim Heiserman, and Latif Thomas, speed work for us is a perishable skill and is worked year-round both because of the technical demand it takes to sprint properly, and because of the physiological adaptations that can be continually tapped from sprinting through different means and methods. Speed work should be used for everybody, better maximal speed = better submaximal speed = better running economy = better times over any distance. This doesn't mean that one should have speed development supersede Track Endurance Development, but one can make a place for it regardless of distance. Dr. Joe Vigil (Team USA Distance Coach) relied heavily upon during his time at Adams State and it's also something Jay Johnson has promoted; maximal speed work should be a regular part of training even for the endurance athlete. During the General Prep Phase (GPP) Speed training is submaximal to decrease the likelihood of injury and to train proper mechanics, including using hills (looking specifically at foot-strike) and runs at 70- 88% of 60m also looking at mechanics. After GPP, even during our resisted running phases, we still use some volume of pure sprinting over 60m during a Speed Development session to train the technical skill of sprinting.

Outlier Forms of Strength Training- Some outlier forms of lifting we use are Multiplanar Training and Dumbbell Training.

Multiplanar Training- for multiplanar training we use both in unloaded and loaded movements. These include lateral lunges, lunge matrix (Lunging in all directions like a clock from a fixed support leg), step ups with rotation, rotating medicine ball throws, and lifts and chops, where the resistance is held in two hands is taken from the from the knees diagonally, to the contralateral side of the body diagonally about the head, lateral raises, lateral scaption and lateral and medial movements (Abduction and Adduction). We also warm-up in using multiplanar movements, including back pedaling, carioca, lateral hopping arm swings, reverse lunges with overhead reach, lunge with a rotational twist of the torso, lunge matrix.

We use Single-Arms Dumbbell movements as a primary training means. I learned this from Allen Hedrick, who was Head Strength Coach at Air Force for 12 years, and is the current Head Strength Coach for Colorado State University-Pueblo (Division II National Champions in 2014, Perennial RMAC Conference Champions, in Football). As Allen points out a National Strength and Conditioning Association he published (he also has a Human Kinetics Version 1 and 2 book titled "Dumbbell

Training”) One advantage of performing single-arm movements is that it creates an unbalanced condition that the body has to work to correct. For example, when performing dumbbell hang single-arm power cleans with a dumbbell, the muscles of the core have to work to correct the unbalanced weight to one side. This effect is amplified when performing a single-arm movement overhead because the center of gravity is elevated, creating a more unbalanced condition. According to Hedrick From my experience, I have seen that dumbbell training places a greater emphasis on balance, coordination, and motor coordination as compared to barbell training. This is possibly because using dumbbells requires the athlete to control two independent implements. “ As a result, single-arm movements are an effective way to train multiple muscle groups simultaneously because the prime movers have to be recruited to perform the movement and the muscles of the core have to contract to maintain a stable, upright position. It also allows for a great variety of exercises, which we are always looking for to prevent the CNS from getting stale and increasing the variety of stimulus on the body. The following the following is a list of the variations when training with dumbbells while performing the snatch:

1. Power snatch: hang or full
2. Power snatch: alternating-arm, hang, or full
3. Power snatch: single-arm, hang, or full
4. Split snatch: hang or full
5. Split snatch: alternating-arm, hang, or full
6. Split snatch: single-arm, hang, or full
7. Split: alternating-foot snatch, hang, or full
8. Split: alternating-foot snatch, alternating-arm, hang, or full
9. Split: alternating-foot snatch, single-arm, hang, or full

Balance Training- We use balance training in a highly proprioceptive fashion. Balance training stimulates neuromuscular adaptations such as recruiting the right muscles to work at the right time with the right amount of force, leading to improved intramuscular and intermuscular coordination which leads to improved rate coding (Motor Neuron Impulse Firing) and synchronization within an individual muscle. We use single leg support movements from the floor to overhead training with the implement, including step ups to overhead presses. We also use cables/bands/tubing and perform pushes and pulls from a single leg support position. We integrate BOSU balls into our training. We use movements performed with the eyes closed, such as single leg balance and reach exercises, standing on a ½ a foam roll, Airpex Pad, BOSU Ball. We use the National Academy of Sports Medicine Optimum Training model for progressing our balance training, which has three phases. They are:

1. Balance Stabilization
2. Balance Strength
3. Balance Power

In balance stabilization exercises little joint motion occurs during the exercises, which are designed to improve reflexive joint stabilization contractions to improve joint stability. Training involves single leg balances and reaches, and single leg chops and medicine ball throws and catch. Balance strength exercises are more dynamic. They are designed to improve neuromuscular control. These movements require dynamic control in the midrange of motion with isometric stabilization at the end range of motion. Exercises may include step up to overhead press, single leg box jumps, and single leg hop downs.

Core Training- With core training we are looking to develop muscle balance, neuromuscular efficiency, strength, power and endurance of the core musculature. We define the core as the structures that make up the lumbo-pelvic-hip-complex. We train the three systems of the core in a progressive fashion, they are:

1. The Local Stabilization System
2. The Global Stabilization System
3. The Movement System

The local core stabilizers are the muscles that attach directly to the vertebrae. These muscles are primarily responsible for intervertebral stability and work to limit excessive compression, shear and rotational forces between spinal segments.

The global core stabilizers are muscles that attach from the pelvis to the spine. The movement system includes muscles that attach the spine and pelvis to the extremities. These muscles transfer loads between the upper and lower extremities and provide stabilization between the spine and pelvis.

The movement system includes muscles that attach the spine and pelvis to the extremities. These muscles are primarily responsible for concentric force production and eccentric deceleration during dynamic movements.

We progress the training from the following order:

1. Intervertebral Stability
2. Lumbo-Pelvic Stability
3. Movement Efficiency

The National Academy of Sports Medicine has an Optimum Performance Training model that we follow, that uses three phases of core training:

1. Core Stabilization
2. Core Strength
3. Core Power

Core stabilization exercises involve little to no motion through the spine and pelvis. The exercises are designed to improve neuromuscular efficiency and intervertebral stability. In core strength training exercises involve more dynamic eccentric and concentric movements of the spine through

a full range of motion. *Track Athletes' core functions quasi-isometrically, so we would not be assigning them to much dynamic core work* In core power training exercises are designed to improve the rate of force production of the core musculature. The exercises prepare a participant to stabilize and to generate force dynamically at more functionally specific speeds.

Stabilization Training- Also following the NASM OPT model, we train for stabilization to increase the strength of the stabilizing muscle to provide dynamic joint stabilization, and postural equilibrium during functional activities, and to develop optimal communication between the nervous system and the muscular system. This is also known as Anatomical Adaptation. Stabilization training improves muscle imbalances, improves stabilization of the core musculature, prevents tissue overload by preparing muscles, soft tissues, and joints for the later loads of training. We also hybrid in muscle endurance training in this type of training, by training high repetition, with short recovery, making it Stabilization Endurance, which has two goals and they are:

1. Increasing Stability
2. Increasing Muscular Endurance

Exercises in this type of training include super-setting a more stable exercise (such as bench press) and immediately following it with a stabilization exercise (such as a stability ball push up). There are two exercises performed for each set, and are done at medium reps (8-12) for each exercise, so the participant is developing endurance by doing essentially 16-24 reps in a row.

3) Endurance

- General Endurance

Work capacity is the ability to tolerate a workload and recover from that workload. There are three components of work capacity:

1. The ability to tolerate a high workload.
2. The ability to recover from the workload sufficiently for the next workout or competition.
3. The capacity to resist fatigue.

Qualities such as body composition, flexibility, aerobic capacity, aerobic power, anaerobic capacity, strength endurance, and anaerobic power, are prerequisites for handling a higher level of work.

In GPP we are specifically trying to address the components of work capacity of aerobic and anaerobic work and flexibility.

We use several methods for enhancing work capacity. These are the following methods we use, taken from World Renowned Athletic Development Coach Vern Gambetta:

1. Continuous Work Method.
2. Variation Method.
3. Interval Method (including Extensive Tempo Endurance and Intensive Tempo Endurance Intervals).

4. Repetition Method.
5. Cross-Training Method.
6. Short Term Power Duration Endurance Method.

The continuous work method addresses the aerobic component of continuous work. This method includes:

1. Ground and Treadmill Running
2. Stair Stepper
3. Elliptical Training
4. Ski Machine
5. Stationary Bike
6. Slide Board
7. Swimming

The Variation Method is similar to the continuous method in which the intensity is varied throughout the objective time of the workout is reached. The primary way to address the variation method is through Fartlek Training, which is Swedish for "Speed Play." Examples of this type of training include the following:

1. 15/15/15 runs. – 15 sec walk, 15 sec run, 15 sec sprints
2. 10-second bursts with 30 second easy jog recovery
3. 1-minute shuttle – 20 meters- hit as many reps as possible in 1 minute
4. 30 seconds of jogging, then a 10yd sprint

The interval method focuses on the interval of work and rest. Interval methods include Extensive Tempo Intervals which take place below 80% intensity. Intensive Tempo is another method of interval training and consists of work between 80-90% intensity and is max of aerobic and anaerobic work.

The Repetition method is a high-intensity (between 90-100% intensity) workload alternated with complete recovery between repetitions. It is also known as "Special Endurance." Examples of this method include a 45-second all-out run for distance with 15-20min recovery.

The Cross-Training method involves training in a discipline other than the main events/sports of the participant competes for the primary purpose of enhancing performance in the primary event. An

Finally in the strength and conditioning department we may use some power endurance weight work, vests, or hills at high intensities for time or for reps specifically aimed at what Bompa terms "Short Duration Power Endurance" (30sec-120sec completion periods) as our final path to developing endurance.

- Track Endurance

For Track Endurance, we are adaptable to Short-To-Long and Long-to-Short training approaches. We may use both depending on the event group, type of athlete, athlete strengths and weaknesses, training timeline, and weather and facility specifics.

I believe that training the ability to distribute your speed over the distance you must run through race endurance training is the most optimal investment runners can make in the immediacy of 12-16 week training periods. So we always engineer programs working backwards from whatever peak meet the athlete is trying to drop their best time in with race endurance as the focus. Using split equations ($100m \times 2 = 200m$) and ($200m \times 2 + Y = 400m$) relative to speed indicator tests, we plug in, working backwards, whatever volume/number of weeks of endurance training we need in order to hit a desired split equation. In the case of 100-400m sprinters and 300m and 400m Hurdlers, we have a strong split target relative to their speed indicator marks. 200m should be at least $100m \times 2 = 200m$ and 400m should be at least $200m \times 2 + 3.1-3.5$ for Guys and $200m \times 2 + 4.1-4.5$ for Ladies. We never want to give up a lead if unless the competition isn't withholding excessively in the early stages of any race. We always want to close on the competition in the final 50m. In addition to training endurance as an optimal way to the best times a person is capable of attaining in 12-16 week training periods, it has great psychological advantages for our runners when they know they can go for the kill and maintain, or take a risk by going faster than race strategy pace, and compete against the competition by running their pace, and maybe still out kick the opponent yet.

Depending on the athlete's training age and what I want developed (younger sprinters, multi-year peak, training history) there is definite movement of volume/time dedicated from one extreme of speed development to the other extreme of race endurance development over their career.

For Quarter-milers, we use Baylor 400m Coach Clyde Hart's tempo system as the skeleton for our training. We phase in and out, more or less Speed Days and pop out a tempo day. We've been using the system's concepts since 2005. We have made adjustments and adapted the concepts. We've shortened recoveries, increased speeds, and increased volume. We've mixed and matched other training approaches both of the similar energy system and repeats style of training as Clyde Hart's system and Speed Endurance and Special Endurance training methods. For us, Clyde Hart tempo workouts aren't necessarily about running at a slower pace as an adaptation to training, as much as it is about developing the conditioning that results from running workouts with very short recoveries. New research has shown that the 200m and the 400m are 30% and 40% Aerobic. Specifically, it's more about being able to hit fast times in training at the end of the year at, or near, paces that the competition has been training at for the training periods/season in prototypical speed endurance and special endurance training approaches. By the end of the year, athletes are running tempo workouts at 88-90% Intensity taking rests as short as 60 seconds for 200m repeats, and 3 mins for 350m repeats. How we also are able to use a modified approach where one is at 81-90% Intensity from the beginning of the training period/season with longer recovery. Once the participant has worked down to 90% Intensity in workouts, they reload, and start from 81% intensity with more limited recoveries. This is repeated until the participant is able to hit the workouts with very limited recovery, similar to work rate to rest ratios seen in Clyde Hart's system.

Another conditioning training approach that we use is French Physiologist Dr. Veronique Billat's VO₂max training concepts. In one session an athlete can contribute to the improvement of lactate threshold, vVO₂max, and running economy. Billat's research has shown after performing four easy

sessions and one session at $vVO_2\text{max}$ at lactate threshold for 4 weeks, results in a 3% increase in $vVO_2\text{max}$ and 6% increase in running economy. Workouts are progressed into running further distances with same work rate to rest ratios, and further distances with more challenging work rate to rest ratios.

Another form of endurance training that we do are classic speed endurance training with full recoveries trying to stretch speed over a given distance (generally 60M-600M) and a few limited recovery speed endurance workouts, with favor towards ones developed by Phil Ludin that were used when he was at the University of Minnesota.

For 800m/1500m groups, we use similar training concepts as those used by Coach Hart and Dr. Billat. Athletes can, and possibly should, use homogenous training modalities as part of their programs. Athletes who run within my own 100-800m group and athletes who run in the 800-3k groups in other camps, with coaching allies of mine who we share training ideas with each other, have had nationally competitive performances using similar training concepts across event groups. I recently mentioned to two sprinters prior to a VO_2 repeats workout that their workout for the day is the same as one that will be run by an XC runner who is likely to lead the nation for 10th graders at 3k as part of his XC training and that the sprints, wickets, hurdle mobility, lifting he will be doing is going to be essentially the same workouts we will be doing during the week, just to lesser volumes so he can incorporate his miles.

4) Periodization

Our yearly periodization is arranged in a set order based on Delayed Transmutation, where training effects of the preceding block(s) is maximally utilized. This works well because you build on whatever quality you developed prior by taking the next step towards specificity factors of sprinting EX: Building Max Strength and then transmutating it to Power, then transmutating power to Power Endurance. The primary reason we use what Verkoshansky terms "Conjugate Concentrated Loading" is because there are some training interference effects that take place between qualities (such as explosive strength decreasing when max strength increases) and because training stimuli lose their highest level of effect after so long. During the initial period training effects are strong and can be used at a denser dosage within those shorter periods to get a stronger training effect than concurrent training with several methods and means all at once all year. This is not to say that our training as a whole is Conjugated as we concurrently train strength, speed, endurance, coordination, flexibility at all times, all year-round, just in different ways at different times. Some we use for shorter periods, some for longer, with minimum and maximum ranges as outlined by the research of Verkhoshansky. As a rule of thumb we go short to long and slow to fast. Everything is arranged so that muscle contractions go from slower, elemental or starting in nature, to ballistic or finishing, all geared towards enhancing top mph that can be attained over the entire range of a sprint from the start to top end. In the weight room and with multiple throws, this means moving from left to right on the force velocity curve over the year.

Best adaptations are seen in 3-4 week blocks, and it takes a minimum of 2 weeks of training stimulus to get an effect. So, in our conjugate approach we usually try to stick with a mode of training for at least 2 weeks and switch it up after 3-4 weeks.

*Progress from General to Specific to Top End Sprinting

Specificity Factors

1. Type of Muscle Contraction
2. Movement Pattern
3. Region of Movement
4. Velocity of Movement
5. Force of Contraction
6. Muscle Fiber Recruitment
7. Bioenergetics
8. Biochemical Adaptation
9. Flexibility

Some of these might be unchanging throughout the year in big four biomotor training such as movement pattern, bioenergetics, region of movement.

Our simplest form of periodization comes in the form of 4 week cycles. Speed training and high CNS lifting follows a classic step loading approach of 3 weeks full volume and week 4 being a volume reduced by one third. We do this one of two ways: Either simply lowering the total volume of each day by a third or by taking a day off for example in a three day high CNS week. We use the deloading week to test maxes in a variety of weight room lifts, various distance speed indicators using an electronic speed trap, and jumping abilities with and without counter-movements.

With periodization our program makes a distinction between concentric lifting and all other types of lifting.

Concentric Lifting - To keep the CNS from becoming stale/continue to push new adaptations any concentric work changes in reps daily to keep neural confusion high. This is referred to as Daily Undulating Periodization. We use rep ranges from 1-6. 2-4 is typically used by some of the better strength programs out there as there is a greater focus on maximal strength with lower reps and high isolation of hypertrophy only being myofibril in nature. However I like to go up to six to keep the range greater in order to increase variety on the nervous system; 1-5 reps are generally used to increase max strength. So while we may go up a little bit away from max strength and isolated myofibril hypertrophy a little more frequently than some of the LSU's out there, we also go more aggressively towards max strength and isolated myofibril hypertrophy at a higher frequency than they do singles or doubles, which we will do 1:6 for each respectively. A byproduct of this has been athletes have reported to me they are better able to handle one rep maxing, and I can get a more accurate measure of their strength levels, which I get picky about, particularly strength levels to body weight AKA Relative Strength.

*Lifting Considerations that will have variance for each category pending on the

intensity/volume Muscular factors include:

- Volume of contractile protein running in parallel
- Fiber type percentages (ie. the quality of the contractile proteins)

Neural factors include:

1. Intramuscular coordination (including rate coding, RFD, and firing synchronization)
 2. Intermuscular coordination
 3. Various reflexes and counter-reflexes (myotatic stretch reflex, GTO response, etc.)
- Higher Intensities and lower reps are favored by our program.

A classic Tudor Bompa approach to training is to increase muscle cross sectional area in the beginning of the season for 4-6 weeks to increase the structural component of strength training, and then for the remainder of the season focus on the functional component or neural training from max strength training and explosive training. I recognize there comes a point when functional training can only take strength so far where structural training (increasing muscle cross sectional area) must take place so we do indeed use hypertrophy training but we don't really use it in a single phase like Bompa. We avoid getting bulky then filling it in for the rest of the season from an MSF (Mass Specific Force) standpoint if you're going to speed train year round; we don't want "all" of the bulk for year to be added all at once it will slow you down. Therefore, we use hypertrophy training in a way that provides a dual benefit; introduce more variety to the CNS and to accomplish its cross sectional area increase goal. Our program utilizes a spread approach of 4-6 x 3 day lifting weeks worth of hypertrophy 10-12 rep training over the entire training season by inserting a 10-12 rep range after two sessions of max testing, with the hypertrophic session capping off the 3rd CNS day for the week. Because it takes a minimum of 2 weeks of stimulus for adaptation, we stay on hypertrophy training for 5 more sessions. This compliments our efforts of undulating muscle confusion effect as the reps go from 1 rep maxing on Monday and Wednesday, into 10-12 rep muscle building on Friday, and introduces general change in stimulus for 2 weeks away from max strength training. To identify a structural to functional strength deficit I will use a depth jump or depth long jump and compare them to a static vertical or horizontal jump; if the resulting distances are too close b/t static and shock jumps, I will add in more hypertrophy, on top of the 4-6 weeks worth of sessions.

Every 5th week lifting becomes unilateral to emphasize specificity (Squats become Bulgarian Split Squat for example). We use maximal unilateral lifting sparingly because it requires stability (strength biomotor ability + coordination biomotor ability) and balance will always become a limiting factor that inhibits max strength improvements compared to dual leg lifts. Generally, we will use 2 bilateral leg squat variations per week early in the training period, and then 2 unilateral variations per week later in the training period.

Every sixth week I put in 3-Step Squats to increase Growth Hormone secretion for an endocrine boost via time under tension

*Speed

Category 1: Resisted Sprinting (developing starting speed): Hills= Developing stepping over the opposite knee and driving the foot back down and behind with full extension. Sleds= With focus on exit angle and body lean, sleds have shown to increase trunk angularity positively correlated with sprinting than any other form of resisted sprinting. Horizontal resisted sprints such as hills and sleds have shown to increase 0-20m speed, with gains attributed primarily to improvements in the 10m range, more optimally than unresisted sprinting over the same distance. Vest sprinting to develop vertical forces of both explosive strength and leg stiffness.

Results: Better step over drive down, better trunk angularity, shorter top end ground contact time. Better 0-20M starting speed

Category 2: Short Sprints (developing sprinting ability 0m-55M): Learning to drive through phases of running properly (applying forces through a power line and fully + attaining body lean and shin angles + shoulder swing and hip flexion). Developing Acceleration.

Results: Better ability through maximum acceleration + low end development of stride rate

Category 3: Vmax Sprints (developing sprinting ability 55m-60m): Increasing stride rate through 60M sprints that work acceleration and Vmax, moving onto flying start 30's and 40's and sprint-float-sprint sprints

Results: Faster stride rate

Category 4: Speed Endurance (developing speed over 60m): Increasing specific speed endurance through runs of 60-150M or incomplete recovery 60s- speed development training.

Results: Holding Vmax longer.

Phase 1: Hill Sprints

Phase 2: Sled Sprints

Phase 3: Vest Sprints

Phase 4: 0-10M Sprints

Phase 5: 10-25M Sprints

Phase 6: 30-55M Sprints

Phase 7: 60M Sprints

Phase 8: Flying Start Sprints

Phase 9: Over Speed Sprints

Phase 10: Speed Endurance Sprints

In the progression above, one can move to different start points on the list and/or remove pieces depending on individual strength and weaknesses. My preference is to go for four weeks for each modality before switching it up, with phases 4 through 6 being cut down to three week blocks and reallocated towards 1 more week of flying sprints and two more weeks of Speed Endurance Sprints. Additionally, pending facility and equipment limitations, Over-speed sprints may be worked in during 60M and Flying Start Sprints in smaller doses if there's a limitation to having a full session of over speed runs for a group of sprinters. And contrary to belief as Mike Young has pointed out, Over Speed sprinting has value as a sprint specific eccentric training option.

*Isometrics

Phase 1: Loaded Pauses Isometrics (break sticking points): Break sticking points and ROM deficiencies

Phase 2: Explosive Isometrics (develop starting strength): Increase the ability to overcome inertia and break sticking points.

Phase 3: Contrast Sets (create neural potentiation + break sticking points): Either Explosive Isometric or Loaded Pause Isometrics mixed with Eccentric and Concentric Loading

Phase 4: Explosive Isometric Dynamic and Power Resist Methods (create neural potentiation): Increase strength output in Max Strength or Explosive Lifting.

* Eccentrics (all to increase leg stiffness, from static to dynamic)

Phase 1: Slow Eccentrics

Phase 2: Supramaximal Eccentrics

Phase 3: Rhythmic Eccentrics ($\frac{1}{2}$ and $\frac{1}{4}$ ROM Emphasizing fast turnaround)

Phase 4: Drop Catch Eccentrics (Free Fall to abrupt Stop- similar to a stick landing)

Phase 5: Speed Eccentrics (Pull Eccentric load faster than free fall, turnaround to concentric, do as many reps as possible in 5 seconds)

Phase 6: Drop Catch RDL

*Olympic Lifts / Multiple Throws / Loaded Jumps Series

Phase 1: Clean Pulls / 12lb Med Ball BLT with Bound/ No Loaded Jump Series

Phase 2: Heavy Power Clean / 12lb Med Ball OHB with Bound / No Loaded Jump

Series Phase 3: Medium Power Clean / 12lb Med Ball BLT / No Loaded Jump Series

Phase 4: Heavy Hang Clean / 12lb Med Ball CP / No Loaded Jump Series

Phase 5: Medium Hang Clean / 8lb Med Ball BLT with CM / No Loaded Jump

Series Phase 6: Heavy Power Snatch / 8lb Med Ball CP with CM / No Loaded

Jump Series Phase 7: Medium Power Snatch / 8lb Med Ball GT / 20-35% 1RM

Jump Squats

Phase 8: Heavy Hang Snatch / 8lb Med Ball ST / 20-35% 1RM Jump Squats with

CM Phase 9: Medium Hang Snatch / 6lb Med Ball GT with CM / 20-35% BW

Loaded Jumps

Phase 10: Speed-Strength Short Term Power Endurance in place of Oly Lift (Power endurance resisted running + lifting exercises) / 6lb Med Ball ST with CM / 20-35% BW Loaded Jumps with CM. Depending on the strength qualities of the athlete you can start at different phases or eliminate phases of the beginning or end of the serial sequence. I typically will do this full progression all the way down to snatches, particularly if I see an athlete with good jumping ability but 60M times that do not correlate up to par with their good starting strength (more speed-strength stimulus could be needed). If they have good top end speed but poor jumping ability I may have an athlete go only through phase 6 with longer doses (more strength-speed stimulus). Generally speaking, we will stick with an Olympic lift for 3-4 weeks before changing it up to another phase if we have the full 45 week macrocycle to train on. This 3- 4 week block for each module would stay constant even if the season is short so as to promote a strong enough signal to get adaptations versus lots of weaker signals EX: We would do phase 1-4 x 3wks vs. Phases 1-10 x 1.2 wks during a typical outdoor season.

As mentioned earlier it takes a minimum of 2 weeks of training stimulus to elicit a training effect. Of this progression list, if anything were to be cut to 2 weeks, it would be the series of snatches as other loaded jumps will be present in these periods that will have very similar Force-Velocity characteristics as Snatches. In their place I would reallocate 1 more week to Clean Pulls, and 2 more weeks towards a Power Endurance modality.

For multiple throws, early they may take on a more coordinative demand such as being mixed with hops and bounds into direct turnaround throws to challenge the coordination system (I prefer to train

both coordination and technique hardest early on). They also will go from a folded upper body start to unfolded such as between the legs forward throw and overhead back throws with our without a twist to and unfolded upper body at the start such as granny throws and squat throws to increase specificity towards the type of speed training being worked – short to long or in other words unfolding vertical push at 45' to unfolded vertical push. Med ball throws here are Between Leg Forward Throws, Overhead Back Throws, Chest Passes, Granny Throws, and Squat Throws. CM indicates a countermovement or fast loading period prior to throw versus intentional static starts.

* Rebound Plyometrics *Absorption Plyometrics

Phase 1. Tuck Jumps * Low Squat Foot Jump x 10sec

Phase 2. Hurdle Hops * Low Squat Foot Jump with Jump Lunge Stick

Phase 3. Long Jumps * Low Squat Foot Jump into Speed Russian Lunge

Phase 4. Long Bounding * Double Bounce Split Jump into Stick

Phase 5. Long Bounding with 20m Run In * Altitude Drop 30 inches

Phase 6. Single Leg Bounding * Altitude Drop 36 inches

Phase 7. 20m Run In Single Leg * Altitude Drop 40 inches

Phase 8. Depth Tuck Jumps * Altitude Lunge Drop 30 inches

Phase 9. Depth Long Jumps * Altitude Lunge Drop 36 inches

Phase 10. Speed-Strength Endurance Bounding (60m) * Altitude Lunge Drop 40 inches

5) Pairings

For pairings I arrange each training day with a list of biomotor abilities. I arrange training around the nervous system. The nervous system needs 36 hours (a day break if you have consistent training times) to recover fully. Training begins and ends in the Central Nervous System. I organize everything around the CNS fitness-fatigue model and I will be patient in ensuring full recoveries between quality efforts. As such, so long as the sport allows for it, the maximum we will train the high CNS demand training is three days per week, and we will go to great lengths to see to it that there are only rare occurrences of back to back high CNS days including having mini-speed and weight sessions following a competitive performance or sometimes we will use a low volume speed and weight session the day before as a neural primer (90-120 total meters of speed + An Olympic Lift + A set of Plyos). The remaining training days are low CNS days focused on improving race endurance, general work capacity, static flexibility, and balance/stabilization. Warm up and hurdle mobility protocols differ between the days. High CNS days will be more dynamic in nature and often

include wickets, speed ladders, and newspaper drill ladders (incrementally further). Hurdle mobility is done at a faster tempo and is bouncy in nature providing a plyometric effect as a neural primer; this is often where we hit challenging coordinative hurdle mobility. Stretching is dynamic and build ups, run offs, acceleration ladder and rotary runs are used as CNS primers for pre-speed training. For running, we can plug in any type of running we like, which sometimes may be tempo running even if the day itself is high CNS, or speed training. Plyometrics and/or multiple throws are done on these high CNS days. Weight training involves maximal strength training or explosive power training. Low Intensity days will include hurdle mobility that is more challenging in terms of dynamic flexibility or balance and performed at a slow tempo. The stretches are slower in nature such as inchworms and hindu pushups and also include Neurological Flexibility, as well as general strength circuits aimed at enhancing posture and muscle imbalances to increase delivery of force. Running is race endurance in nature. We may also do some dynamic medicine ball exercise circuits or low intensity hopping circuits to increase general work capacity or address minor muscles not fully addressed by other modalities of training. Weight training involves using weight circuits to help with recovery from a hard day by stimulating growth hormone and enhance general endocrine profile. Jay Johnson (the guy on the front page of Nike Running / Former CU 800 coach) is referring to this process when he refers to his advanced general strength circuits involving some exercises to get GH flowing. These circuits also are good for enhancing general work capacity and boosting metabolic function. The leaner athlete will always win out all else equal, and according to research by Dan Pfaff and Carl Valle, speed-power athletes who participate in active recovery are able to recover better and are more physically resilient. The circuits are submaximal relative to the number of reps and the athlete completes circuit feeling relatively refreshed. I've adapted weightlifting circuits to focus on balance and extreme ranges of motion; movements are unilateral when possible and train mobility such as A2F's to Parallel and back down squats, Pause A2F squats, Abduction, Overhead lunging to target the lower back, Lunge Matrix to address frontal and traverse planes, Windmills, Hanging Abdominal lifts series, Eccentric Curls, and Gymnastic exercises for the upper body such as bubka's and body curls. Often called Body Building Circuits, but since I find that characterization misleading for their aim, I call them Metabolic Endocrine Circuits.

Essentially I think of High CNS days as Engine Days, and Low-Intensity CNS days as Frame Days. By stressing different biomotor abilities, or stressing them in different ways, on different days one can train "hard" six days a week. The concept of Supercompensation might be an insufficient outlook in planning the training year. A two-factor model of the training process following training is one we use, called a Fitness-Fatigue model: 1) A long-term fitness after-effect which leads to an increase in specific fitness 2) A short-term after effect producing a specific type of fatigue. The two after-effects interact to produce physical preparedness. This concept is a pivot point in making the yearly plan; are specific systems and tissues recovered/can they have a good specific workout. The two are inseparable. We also prefer to think of the supercompensatory part of the equation as Adaptive Reconstruction because although the energy systems or adaptation reserves have superadapted, there are changes not directly related to change in size of energy stores; Trophic changes, altered muscle fiber characteristics, stimulated enzyme activity, intensified protein synthesis, activation of the genetic apparatus of muscle cells and increased rate of energy release. The specificity of the workout includes bioenergetics and desired biochemical adaptation; if we're trying to increase speed or strength, we're going to operate within bioenergetic parameters that max strength or max speed is produced in (CP-Pathway) or if we want to increase the energy pathway for intermediate sprinting we're going to aim to superadapt glycogen stores.

Here is an example of how I layout biomotor training objectives daily between the two types of training days:

High CNS

1. Skill/Coordination: Speed Drills, Dynamic and High Coordinative Demand Hurdle Mobility, Wickets, Agility Ladders, Speed Ladders, Newspaper Drill

2. Flexibility: Dynamic

3. Speed: Acceleration Development, Vmax Development, Speed Endurance Development

4. Strength: Maximal Strength, Olympic Lifting, Loaded Jumps, Multiple Throws,

Plyometrics

5. Endurance: Indirectly addressed through total volume or tempo of the training day or directly through Speed Endurance

Low CNS

1. Skill/Coordination: 3-Point Speed Drills, Static and Extreme Motion Hurdle

Mobility 2. Flexibility: Static, PNF, General Strength Circuits

3. Speed: Not addressed

4. Strength: Metabolic-Endocrine Weightlifting Circuits, General Strength Circuits

5. Endurance: Addressed directly through Tempo Running, Medball Circuits, Jumping Circuits, Weightlifting Circuits