

## Periodization of Strength, Speed, & Power

Programming for a Purpose

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## The Lecture Overview

- Generating Speed and Power
- Reaction Time
- Developing Propulsive Force
- First Step – Getting Off the Line
- Acceleration – The Difference Between Good and Great
- Developing the Program

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Sport is over in less than two tenths of a second. By the time you actively blink your eyes and refocus, you have been beaten. Then you are playing catch up. The best athletes in the world make the transition from thought to execution subconsciously which is really conscious reaction-action movements that are so well planned they seem automatic.

David Sandler, 2007

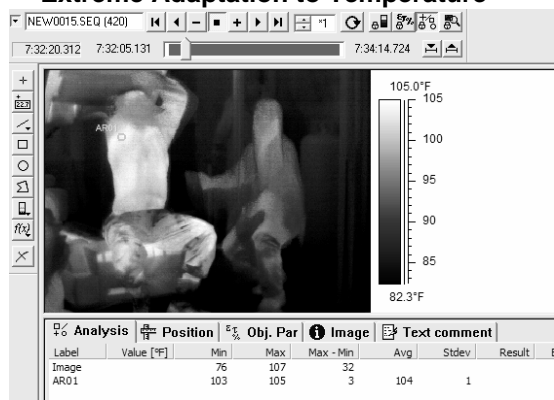
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## Can the Body Adapt?

- The Human Body Will Respond if Stimulus is Properly Applied
- The Human Body Can Go Far Beyond The Capacities Imagined or Researched As Practical Application Has Shown
- The Impossible Can Become Possible if The Limits of Pain Can Be Altered
- Time and Repeated Stress are Keys to Adaptation

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## Extreme Adaptation to Temperature



## What is Speed

- Speed versus Velocity
- Distance over a period of time defines average velocity/speed
- Calculated by Stop Watch or Light Timing System
- Is Time to cover the distance more important than how the distance is covered?
- How does straight line sprints relate to sport?

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## Typical Ways To Improve Speed

- Work on Starts
- Work on Body Mechanics
- Work on Transitions
  
- All great methods to improve “Time to Cover a Specific Distance”
- Inherent problem with this training ONLY
  - does not address sport specific needs

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## Speed Training

- Covering Distance in Shortest Time Period
- Acceleration vs top speed vs speed maintenance
- Drill Purpose:
  - Improve break-away and closing speed
  - Improve 40 yard time
- Types of Drills:
  - Sprints, ballistic strength, rotational speed

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## Speed Drills

- Sprint distance about 20-40 yards
  - Work on “jog to sprint”
  - Work on 10 ⇒ 20, 10 ⇒ 30, 20 ⇒ 40
- Ballistic strength exercise (6 reps max)
  - Speed squats, speed bench press, etc.
  - Reduce time to complete reps
- Rotational speed exercises
  - Med ball and tube work

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## Important Components of Being Fast

- Acceleration FROM EVERY POSITION not just the starting 40yd dash position
  - Acceleration = Velocity / Time
  - Acceleration = Force / Mass
    - Force = mass x velocity / time
    - This second equation gives a clearer picture of what needs to happen to improve acceleration
- Increase Force and Decrease Body Weight to Improve Acceleration

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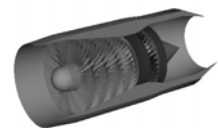
## Important Components of Being Fast

- Ground Contact Time
  - The longer the time that the feet are in contact with the ground, the greater force produced
    - Impulse is the ability to PRODUCE FORCE for a period of Time
      - Net Force applied over time ( $F \times T = I$ )
      - Change in Linear Momentum
  - The longer the time the feet are in contact with the ground, the longer it takes before leg turnover occurs

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## Important Components of Being Fast

- Propulsive Force
  - Thrust and Newton's Third Law
    - Every action has equal and opposite action
  - Directing Force: The Airplane Analogy
    - Lift, weight, thrust and drag
  - Human Muscle Power
    - Rapid Motor Recruitment



## What is Power

- Combination of Speed of Strength
- Ability to rapidly convert eccentric pre-stretch to concentric force
- Most important is Rate of Force Production or Development (RFP or RFD)
- Improving mechanics of the Stretch Shorten Cycle (SSC)
- In Physics:
  - Power = Force x Velocity ( $F \times V$ )
  - Power = Work / Time ( $W / T$ )
    - $W = \text{Force} \times \text{Distance}$  ( $F \times D$ )

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## Typical Ways to Improve Power

- Plyometrics
- Explosive Lifts
  - Olympic Lifts and variations
- Increase Strength
- Increase Speed
  
- All great methods of improving power but MAY not address specific needs of your sport

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## Components of Being Powerful

- Acceleration and Propulsive Force
  - Power is the ability to convert an Eccentric Load into a Concentric Action (activating the SSC) as rapidly as possible
  - Resistance to stretch and or time to handle load will ultimately slow this pattern down.

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## Components of Being Powerful

- Eccentric Loading Time and Magnitude
  - In Plyos, time in contact with ground/hands is know as amortization time
    - Long amortization time decreases transfer of energy to the concentric
  - Magnitude refers to “how great” the load is, hence depth jumps and other “shock level” plyos are used to increase this
    - Increasing magnitude improves power only if it can be handled properly

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## Eccentric Load Training

- Rapid and/or Large Pre-Loading of Movement
- Separately Trained From Power
- Drill Purpose:
  - Increase ability to load eccentrically WHILE MAINTAINING PROPER BODY POSITION
- Types of Drills:
  - Drop landings, speed loading, deceleration training

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## Eccentric Loading Exercise

- Deceleration component in agility, ladder, plyometric, and sprint drills
  - Stop suddenly and completely maintaining balance and body position
- Land on balls of feet
  - Just work on perfect landings on the balls of the feet, keeping tension on achilles
- Rapid loading quick feet/hands plyometrics
  - Keep drills short, fast and minimize GCT

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## Power Training

- Converting Stored (Built Up) Energy to Concentric Force Production
- Drill Purpose:
  - Improve ability to transfer force rapidly
  - Make athlete more explosive
- Types of Drills:
  - Fast feet jumps, general plyos, resisted sprints, resisted jumps, explosive lifts

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## Power Exercises

- Focus on decreasing time
- Focus on rapid transition from eccentric to concentric (rapid SSC activation)
- Keep resistance light so that bar/body travels rapidly
- 3 to 5 rep sets with enough time to recover completely

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## Plyo Programming

Level	Low Intensity	Med. Intensity	High Intensity
Beginner	80	60	40
Intermediate	100	80	60
Advanced	140	120	100

- Choose 4 to 6 different exercises
- Perform for 5 to 6 repetitions
- Do 3 to 5 sets taking 90s to 3 min rest between sets

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## Plyo Programming

	Mon	Tues	Wed	Thurs	Fri	Sat
Lower Body Plyos	✓		✓			
Upper Body Plyos		✓		✓		
Upper Body Weights	✓		✓		✓	
Lower Body Weights		✓		✓		✓
Plyos	✓		✓			
Combo Weights		✓		✓		✓
Plyos	✓			✓		
Combo Weights		✓			✓	

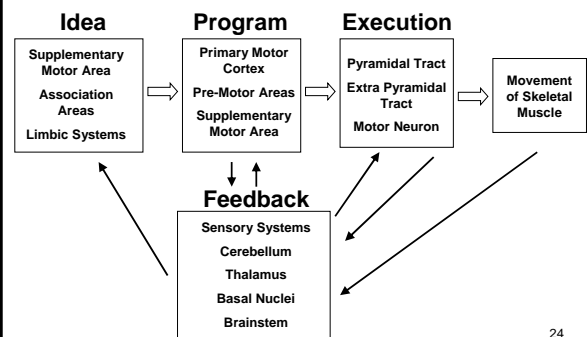
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## Reaction Time

- Neurological Processing Pathway
  - From thought to execution
- Generally thought of as automatic reflex activity
  - Extensor thrust reflex, flexor reflex, and crossed extensor reflex
  - Problem – this only answers the first part of the equation (sense and act) but does not clarify how the movement will occur
- Interpreting a Stimulus
  - All senses contribute

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## From Thought to Execution: The Integration Center



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## First Step Training

- Reaction to the First “Correct” Movement Position
- Drill Purpose:
  - Improve ability to tell feet where to go and when to go
  - Proper body position
    - Hips down, head up, chest up, tight torso, relaxed upper body, and weight on balls of feet
- Types of Drills:
  - Ladders, Agilities with Reaction, Reaction Equipment

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## First Step Drill Considerations

- Challenge step sequence when using ladders
  - Your athletes will “get good” quickly because the step sequences become learned and “rung” distance is standard
  - Use ladder combo drills so that athlete has to enter or leave the ladder in proper position
  - Speed is only one part, if your athlete cannot stop, change direction, restart, and SEE WHAT IS GOING ON, then why do the drill

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## First Step Drill Considerations

- Agility drills need reaction and body position component
  - Cones are markers for direction change – focus on the transition between footwork patterns
  - Athlete’s head should be looking up SO HE CAN SEE WHAT IS GOING ON!
- Reaction Balls or tools are to get the body to react and move
  - emphasis should be on body position, not whether or not the athlete can actually catch the ball
  - Reaction stimuli should be audible and visual as sport need requires

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## Training Volumes

Athlete Level	Basic Drill (# of sets)	Sport Drill (# of sets)	Complex Drill (# of sets)
Beginner AO	20	10	
Beginner TR	6	4	
Intermediate AO	10	10	10
Intermediate TR	4	4	4
Advanced AO	4	10	16
Advanced TR		4	8

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## Agility Programming

	Monday	Tuesday	Wednesday	Thursday	Friday
Upper Body Weights	✓		✓		✓
Lower Body Weights		✓		✓	
Conditioning Agility		✓		✓	
Speed-Power Agility	✓		✓		
Up / Low Weights	✓		✓		✓
Agilities		✓		✓	
Weights	✓			✓	
Agilities		✓			✓

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## Acceleration/Propulsion Training

- Driving Force To Move The Body
- Most Important in sport:
  - First 5 to 10 yards
    - If you cannot move fast in the first few steps, you are out of the play, and while “closing speed” looks impressive on field, your athlete should not have gotten beaten in the first place
- Drill Purpose:
  - Increase force of drive (thrust), overcome inertia, and decrease drag
- Types of Drills
  - Short acceleration sprints, agilities, long jump and variation, single leg squat, lunge and jump exercises

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## Acceleration Drills

- Most sport require “getting there quick”
- Form, technique, etc. is important but not at the cost of losing valuable acceleration
  - Work on acceleration, build in technique
- 5 to 10 yards all out, all the time, then break it down
  - Don't fatigue athlete and confuse conditioning with increasing overall movement acceleration
- Accelerate from different positions
  - Lateral start, standing start, kneeling start, etc.

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## Acceleration Training

- As you become more explosive, and drive out harder, body position will need to be corrected
- Try doing acceleration training first, then fix mechanics rather than mechanics first
  - You may not be in “proper position” on the field
  - Concentrate on only one thing at a time
- As a coach, try to only fix one variable at a time

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## Strength Training

- Increasing The Total Number of Muscle Fibers Involved in Producing Usable Force
- Exercise Purpose:
  - Improve overall muscle strength, muscle balance,
  - Reduce joint instability and injury potential (Pre-hab)
- Types of Exercise:
  - Multi-joint, ENTIRE body, FULL ROM
  - Solid base exercise that require core strength

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## Strength Exercises

- Major Push – Pull movements
- 5 to 8 rep sets with long rest
- Ground based as often as possible
- 4 to 6 week cycle before switching (to power, endurance, speed, etc.)
- Clean up technique
- Activate core (abs, low back, etc.) and learn postural control
- Pulls, drags, carries and “big strength” exercises

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## Balance Training

- It easy to show that an athlete has weaknesses, but do those “weaknesses” really have anything to do with the sport itself
- Sport is dynamic, recruiting muscle fiber for stationary activity can be done in strength training
  - If you have enough strength, you can “right yourself” with strength
- Balance in sport means TRANSITION from one movement to another while maintaining balance
  - Lateral accelerations into forward, forward into lateral, lateral to backward, backward to lateral, forward to back, back to forward, and combinations of those

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## Take A Deeper Look

- You've all heard the saying “Don't train sport athletes to be good at weightlifting or powerlifting movements
- So now everybody has switched to “functional exercises”, plyometrics, speed, etc.
- So now we are training our athletes to jump higher, run faster, and rotate more explosively
  - I guess High Jumpers and Sprinters make better athletes players than Powerlifters or Olympic Lifters
- **Have We Really Solved The Problem??**

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## What Makes A Great Athlete

- While people tend to put a lot of stock in vertical jump and 40 yard dash time, and pro-agility, arguably, the best athletes, have never been the best at one aspect such as jumping, speed, etc.
- Furthermore, after combines, the Pros rarely do those same tests again
- Sport is not just about speed, power or strength
- So the question should be "What can we do AS STRENGTH COACHES to help improve skill"

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## Planning A Training Strategy

- Difficult for HS coaches and/or programs with limited facilities and coaches
- Generally speaking, every athlete needs speed, power, strength, etc. but further analysis will show that every athlete needs the components of that make up these aspects more
  - The approach should look at including more drills that address specifics such as eccentric loading, reaction with specific action, and maintaining sport useable position.

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## Program Design Considerations

## Designing the Program

- **Exercises**
  - Choice of exercises partly based on body type
    - Long or Short Limbs
    - Flexibility
  - Preference of exercises
    - What your client likes
    - What your client needs

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## Designing the Program

- **Reps**
  - Speed is essential but should be specific to program goals
    - Explosive vs slow and deliberate
  - Fatigue causes a decrease in speed and power
  - Don't train to failure unless strength is ultimate goal
  - Rep range is based on fatigue and technique
    - Most sets not more than 8 reps
  - Distinctive pause between reps

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## Designing the Program

- **Order of Exercise**
  - Explosive movements will normally be done as the first or second exercise in a workout
  - Jumps and speed work first
  - Pulling movements then jerk type presses to follow
  - Slower "strength type" movements next
  - "Cardio", conditioning, flexibility last
  - Full movements before partials

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## Designing the Program

### ● Volume/Session

- The total number of sets x reps x weight used is training volume
- Training Power and Speed is usually a 5-6 rep max deal with 3-5 sets of each exercise
- Watch for signs of technique failure
- Volume may be higher when learning the exercises to facilitate motor pattern development

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## Designing the Program

### ● Intensity

- Refers to the % of 1RM not perception of difficulty
- Often difficult to determine with low skilled lifters
- Often difficult to determine with tubing, bodyweight and “functional” movement patterns
- Power and Speed intensity is lower than traditional resistance exercises
  - Less than 60% 1RM

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## Designing the Program

### ● Rest between sets

- To allow full recovery of ATP-CP system long rest periods are needed
- At least 2-3 minutes
- Heavier resistance require longer rest
  - Up to 7-10 minutes

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## Designing the Program

### ● Recovery between training sessions is a function of:

- Volume
- Intensity
- Failure or not
- Muscle Damage
- Nutrition

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## Designing the Program

### ● Frequency

- General sport training rarely reaches muscular failure rather technique and power drop off will limit total work
- Volume may be best accomplished over several workouts rather than in one session
- Requires careful planning of recovery periods and training cycles

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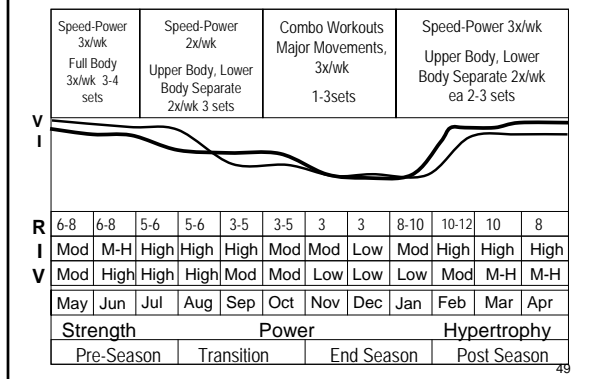
## Designing the Program

### ● Frequency

- 4-5 sessions per week for total body training if not going to absolute failure
- Heavy duty plyometric activity should be limited to 2 times per week
- If incorporating a “regular” weight training session(s) in then 2-3 times per week of “additional” training is sufficient

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## Periodization for General Sport



## What is Sport Specific

- There is no such thing as Sport Specific other than the sport itself.
- If you want to be a better athlete, you need to catch balls, swing rackets, bats and clubs, work on separation, run better routes, and establish proper position
- Do not try to create drills that are for the sport specifically, rather look at the skill and decide what needs to be improved upon...then, practice the sport

## When to Incorporate Specific Training Stimuli

- Good dynamic warm-up
- “New” Training Stimuli
  - More complex skills or new skills next for about 10-15 minutes (don’t over-do-it)
- Follow with support exercises for increasing speed or power
  - Don’t use “heavy-shock” drills on advanced action training stimuli days
- Then hit your strength exercises
- Finish with Good Cool Down

## Example Training Stimuli Program

- Dynamic warm-up
- 4 sets of 3 different specific footwork drills
  - Emphasize body mechanics and movement patterns, not just finish drill
- 4 sets of 3 agility drills
  - Emphasize transitions and body position
- 4 sets of eccentric loading drills
  - Emphasize proper loading technique and body position
- 3 sets of 2 fast plyo drills
  - No depth jumps or shock drills on eccentric load strengthening days
- Strength workout to finish

## Summary

- Training should not be about developing gimmicky exercises
- Don’t over think, but think it through
- Don’t over correct, coach one skill at a time
- Focus on improving mechanics through drills and exercises that will improve on field performance and not just “in the gym” performance