

SCIENTIFIC PRINCIPLES OF **STRENGTH** TRAINING

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WITH APPLICATIONS TO POWERLIFTING

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TABLE OF CONTENTS

PREFACE	8
.....	
IMPORTANT TERMS	12
.....	
THE TRAINING PRINCIPLES & WHAT THEY MEAN	21
.....	
SPECIFICITY	26
.....	
OVERLOAD	72
.....	
FATIGUE MANAGEMENT	104
.....	
STIMULUS RECOVERY ADAPTATION	186
.....	
VARIATION	243
.....	
PHASE POTENTIATION	278
.....	
INDIVIDUAL DIFFERENCE	308
.....	
PERIODIZATION FOR POWERLIFTING	337
.....	
MYTHS, FALLACIES & FADS IN POWERLIFTING	344
.....	



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ABOUT RENAISSANCE PERIODIZATION

Renaissance Periodization is a diet and training consultation company. RP's consultants (including the authors of this book) write diets and training programs for every kind of client. RP works with athletes trying to reach peak performances, businesspeople that need more energy at work, and people from all walks of life who want to look and feel better. When he founded RP, CEO Nick Shaw had a vision for a company that delivered the absolute best quality of diet and training to its clientele. By hiring almost exclusively competitive athletes that are also PhDs in the sport, nutrition, and biological sciences, Nick has assembled a team of consultants that is unrivaled in the fitness industry. In addition to training and diet coaching, the RP team also writes numerous articles and produces instructional videos on diet, training, periodization science, and all matters involving body composition and sport. Visit us at www.renaissanceperiodization.com, email at renperiod@gmail.com.

ABOUT JUGGERNAUT TRAINING SYSTEMS

Juggernaut Training Systems was founded in 2009 with the goal of providing the best training possible for athletes in any sport. Since then it has evolved into an educational hub for all things fitness, providing the highest quality content in strength, conditioning, nutrition and mobility from top athletes, coaches and researchers in their respective fields. Juggernaut strives to bring you information from people who are true experts and leaders in training while helping athletes reach their goals. JuggernautHQ is located in Laguna Niguel, CA and is home to Southern California's premier strength facility, housing under one roof training for powerlifting, weightlifting, CrossFit, sports performance, Strongman and is home to Paradigm Performance Therapy.

PREFACE

You've been searching for information on how to train for a while. We have all surfed the web for articles, being mostly disappointed but for a few gems. There are some great books that cover particular powerlifting programs, which is absolutely awesome if you're going to run those programs. But what about the theories that built those programs, that govern how the body responds to training, that predict whether or not a certain program will work poorly, well, or exceptionally? After all, the human body is not a random assortment of cells... it is constructed in nearly the same way from individual to individual, and responds to training in very similar ways as well. Hypothetically, would it be possible to derive a system of rules or principles that governed strength training and could be applied to powerlifting?

Well, it's been done before for general sports training, that's for sure. The works of Issurin, Bompa and Haff, Stone, Sands, Verkoshansky and others have shined a great deal of light on the very foundational principles that govern sport training and adaptation. Specificity, overload, variation, phase potentiation and the other underlying rules that govern training program design have been well explain in their application to sport training and have given birth to the concept of periodization, the principle-based, logical construction of training for maximum results.

Periodized programming has been in use by nearly every single Olympic training center the world over since the 1970s, and has produced a

uniformity of incredible sport performances that is undeniable in its scope, from weightlifting to swimming to gymnastics.

To our knowledge, this book is the first attempt at a unified discussion of the principles that govern strength training in general and powerlifting training in particular. There are seven of these foundational principles, and they're all very important to the design of effective powerlifting programming.

Learning all of them will allow you to enhance your abilities in several areas:

- Understanding the process of training out of curiosity and a desire to learn
- Being able to critique other programs and alter them to maximize their benefit
- Being able to select an effective coach based on his/her understanding of training
- Designing your own effective general strength or powerlifting programming
- Designing programming as simple or as complicated as you'd like, depending on the degree of your goals.

The last ability is particularly powered by the revelation that the training principles are not just principles, but priorities as well. They're not all equally powerful in their effect on training, so using the most powerful ones as your first tools in program design can all but guarantee both effective programming and preclude spending time on details that may not be worth it for your level of investment.

In simple terms, this book is going to cover seven foundational principles of programming/periodization design for strength training, with particular focus and application to powerlifting training. It's also going to rank order these principles based on their importance, so that you can make sure your programming is always maximally effective for its level of design, no matter if it's calibrated perfectly or a very rough guide to training.

This book will delve deeply into what the principles of training are, the scientific underpinnings of why they are, and the practical ways in which they can be properly applied, as well as the ways in which to avoid common mistakes in their application. This book was not written for everyone. It was written for intelligent lifters who want to think deeply about training as a process, for those who want to understand the "why's" and not just the "how's," and for those that don't want to take a coach or guru's advice on training just at its word. Science is the best path to the truth, and it's a long path... in this case, several hundred pages of pure scientific training fun.

On the other hand, here's a list of things this book will not be:

- "Keep it simple, stupid." The quest for optimal results is not overly complicated, but it's not open-and-shut either. Strength and powerlifting periodization is eloquent but not simplistic. Concepts which produce results rarely are.
- "Minimalist." If you're looking to get some results with the least possible effort, this book is probably not for you. Training to become as strong as possible requires serious work, both within each session and in sessions per week. You can tailor your training for minimal investment, but that will have to be something you do on your own... all of the training

advice here assumes you want the most out of your training and are ready to put in the needed effort.

- “Cookie Cutter” This won’t be a book filled with pre-made routines or exact percentages. The rules are straightforward but will require thought and personalization on your part for the best results for your lifting. This book is also designed more as a tool with which to learn principles and understand training than a “method.” There is no “Renaissance Method” to powerlifting. All of the principles here are derived from those of Modern Periodization, literature about which abounds and is referenced throughout.

This book was written for those who really want to understand the “why” of training for powerlifting. The “why” of some programs being effective and some others not and sometimes both for different people. It was written in a mostly casual tone, but will occasionally delve into deeper scientific language. Because of the forays into technical discussion, the first chapter of this book is actually a list of technical terms with their definitions. Without further ado, the rest of the book awaits!



CHAPTER ONE

IMPORTANT TERMS

Before we really dive into the meat and potatoes of powerlifting training theory, it's a very good idea to become familiar or re-familiarize ourselves with basic terms. This will lay down the ability to make the most sense of the rest of this book. Most of us have seen and used many of the terms to follow, but there is still some confusion in the industry about some of these, and it seems like a good idea to clear them up.

BASIC DEFINITIONS

Intensity: Also known as “absolute intensity,” it is the amount of resistance presented during a movement. Measured as force, and usually expressed in pounds or kilograms. Thus the intensity of a 335lb squat for one easy rep is higher than the intensity of a 315lb squat for 11.5 reps to absolute muscular failure. When most people use this term, they really mean the next term on our list.

Relative Intensity: Proximity to concentric muscular failure of any given set. This means that a set of 405 for 3, where you could have done 6, is less relatively intense than a set of 275 for 8, where you could have only got 9 with a gun to your head.

Volume: The amount of total mechanical work done during a rep, set, exercise session, week, or any other measurement of training time. Technically measured as the sum total force x distance executed. It can be measured precisely by multiplying the sets, reps, and weight as well as the distance of bar path. However, in most cases volume is compared between the same lifts (bench vs. bench, squat vs. squat) of the same lifter, and thus distance can be obviated. For this reason a reasonable proxy of sets x reps x weight can be used to estimate volume.

Frequency: The number of training sessions performed within a certain unit of time, usually measured within the week.

Exercise Selection: The actual name of the exercise, or exercises, used in a training session. For example, it is a true statement to say that you just trained legs, but a more precise statement would explain that you did squats and stiff legged deadlifts.

Training Session: A single bout of training which can be done multiple times per week or even multiple times per day. Each training session generally has a warm up, a working phase, and a distinct end which may or may not involve a cool down.

Light Session: A session of training that is intentionally non-overloading (overload defined in detail in Chapter 4) and relatively easy to accomplish. The purpose of a light session is to enhance the process of recovery/adaptation while mitigating the loss of technique, muscle size, and strength. Light sessions are typically characterized by a reduction in volume and/or intensity.

Off Day: A day during which no training sessions occur.

Microcycle: A unit of training time measured between the repetition of a single training session type. In other words if you train bench and accessories on Monday, next Monday (when you train it for the first time again) is the start of the second microcycle. This of course includes all training sessions and off days within that time frame. An example would be training bench and accessories Monday, squatting and lower body accessories Tuesday, overhead pressing and accessories Thursday, and training deadlifts and lower body accessories Friday. Those four workouts and three off days construct our first microcycle and when they are repeated next week, with planned alterations in weight set and rep amounts, that will construct the second microcycle, and so on. Microcycles are typically (but not always) a week in length.



Accumulation Phase: A series of sequential microcycles during which training gets progressively harder, which occurs through an increase in either volume, intensity, or both.

Deload Phase: Most commonly referred to just as a “deload,” it is an entire microcycle composed of light sessions of various sorts, the purpose of which is to reduce fatigue while preserving adaptations. For a deload to be effective in meaningfully bringing down fatigue, its reduction of volume and intensity from normal accumulation training must be marked and non-trivial.

Mesocycle: An organized sequence of microcycles ordered to elicit a set of distinct training adaptations. The typical mesocycle is composed of two distinct phases, an accumulation phase, which usually lasts for three to five weeks and a deload phase, which usually lasts for about a week. The typical mesocycle usually lasts for about a month. Sometimes defined elsewhere as “summated microcycles.”

Accumulation: Deload Paradigm: The ratio of time spent in an accumulation phase vs. a deload phase during any particular mesocycle. Typical paradigms include the classic 3:1 paradigm, but other common uses include the 4:1 paradigm (common to hypertrophy training) and the 3:2 paradigm (common to peaking and tapering).

Training Block: Known elsewhere as “summated mesocycles” a training block typically consists of one to three mesocycles. All of the mesocycles within one training block have a unified or similar purpose. For example, three sequential mesocycles where muscle growth is the dominant training priority form a hypertrophy training block.

Macrocycle: A sequence of training blocks arranged in a particular order to accomplish high level improvement in sport performance. Macrocycles often culminate in a competitive performance. For example, a powerlifting macrocycle is typically composed of a hypertrophy block followed by a strength block and then a peaking block before a powerlifting competition. Most properly designed macrocycles will also include an active rest phase after the competition. When the next hypertrophy block begins, that is considered the start of the next meet macrocycle.

Mass: A concordant block of both training and nutrition designed to

increase the muscle mass of the lifter. Mass phases are characterized by high volume training and hypercaloric dieting, and generally last between one and three months.

Maintenance: A nutritional block during which no attempt to lose or gain bodyweight is made, and a stable training bodyweight is held. Training during this time may consist of any of the possible phases, but is mostly characterized by basic strength and peaking training. Maintenance phases usually last at least a month, but have no top end limit in length so long as significant alterations in body composition are not the goal.

Cut: A concordant block of both training and nutrition designed to decrease the fat mass of the lifter while maintaining his/her muscle mass. Cut phases are characterized by high volume training, hypocaloric diets, and generally last between one and three months.

Strength: The maximal ability to produce force. Measured in the laboratory in Newtons and in the gym/platform in pounds and kilos.

Task-Specific Strength: The maximal ability to produce force in a specific movement. For example, deadlifting strength is the amount of force you can produce in the deadlift. In task specific strength the maximal force at the weakest point of the lift is the actual task specific strength of that movement. For example, if you can lock out 800lbs from the knees, but you can only break 600lbs off of the floor; your deadlifting strength is only 600lbs.

Hypertrophy Block: A block of training, the goal of which is to add muscle mass (during a mass phase) or prevent its loss (during a cutting phase). Generally characterized by higher training volumes and minimum

intensities of 60% 1RM, which translates roughly to reps in the 6-10 range for most powerlifting applications.

General Strength Block: A block of training, the goal of which is to increase force production abilities. Such training is generally categorized by intensities of 75% 1RM and higher and sets in the three to six repetition range.

Peaking Block: A block of training designed to allow the powerlifter to express his/her basic strength in the task-specific act of one repetition maximums in the competition lifts. This phase is characterized by an accumulation phase of around 90% 1RM lifting, and an elongated deload called a taper during which strength is maintained while fatigue is reduced to enhance meet performance.

Active Rest: A dedicated block of training, which is almost always one mesocycle in length, the purpose of which is to reduce fatigue and prepare the lifter for another productive macrocycle of training. This block is usually characterized by, essentially, a sequence of specialized deload phases. An active rest block is unique in that it does not have an accumulation phase.

Homeostasis: The process of maintaining a stable internal environment within a system with respect to fluctuations in the state of the environment external to the system. All life is characterized in large part by the ability to maintain homeostasis, including the human body when exposed to the external fluctuations of powerlifting training stress. This concept is very important because adaptations are almost exclusively stimulated by a disruption of homeostasis within the lifter's body (usually with hard training).



Periodization: The logical sequencing of training variables for the purpose of eliciting maximal adaptations, reducing injury rates, and peaking the athlete for best performance at a particular time of his/her choosing. The final product of applied periodization is a properly constructed macrocycle of training that leads to beneficial results.

Flexibility: The range of motion possible in a joint, muscle action, or a series of joints involved in a specific task.

Technique: The execution of a lift in the proper sequence and form of movement (positions and motions of the trunk and all limbs) to move the weight with both maximal effect and reasonable safety. All lifters are built differently and thus no one will have identical technique and there is no such thing as ideal technique, but large commonalities of basic execution will apply to all body types.

Mobility: The intersection of technique, strength, and flexibility. A lifter can be said to be properly mobile in the squat if they have the flexibility and strength to hit all of the necessary positions with good

technique. It is possible that someone is perfectly strong and flexible but lacks the technical ability (usually knowledge of correct technique or lack of practice with the correct technique) to execute a lift properly. It is possible that a very strong and technical lifter can be considered improperly mobile because he is not sufficiently flexible enough to execute the proper range of motion of the lift with good technique. It can also be just as true that a very flexible and technical person who lacks the necessary strength to maintain proper technique during some parts of the range of motion is also not properly mobile. Of course, any combination of deficiencies in the technique, strength, or flexibility needed to execute the lift with proper technique through its full range of motion can also contribute to improper mobility.

THE TRAINING PRINCIPLES & WHAT THEY MEAN

Training for powerlifting is not simply a matter of moving the body around randomly and expecting to get stronger. Every single powerlifting program depends on certain training principles to guide its design, and every powerlifting training session is constructed to exploit those principles to be effective in improving performance. Principles are only effective when they are derived from reality. The way we train must be based on the way the body best responds to training, otherwise we wouldn't get very far.

For example, let's say that we invite over a space alien programmer to design routines for our human powerlifters. Back on his home planet, his species is genetically designed to get stronger from just resting, and any deviation from rest taxes their systems away from such improvements. Thus, the very act of working out would harm their performance, and thus the perfect powerlifting program on that world would begin by making sure the lifters only rest when they are not actually competing, in full concordance with their physiology. Humans, of course, just get weaker if all they do is rest, and the stimulus for training must be something that disrupts homeostasis, giving it the stimulus to adapt



physiology and improve strength. Thus, for human lifters, the Overload Principle is super important, as it's virtually impossible to improve in strength without constantly challenging the physiology of the lifter by pushing it past old boundaries of exertion. Perhaps on another planet, their powerlifters have very poor recovery abilities in relation to ours. They require a full two weeks to recover even baseline performance between training sessions, and the best improvements occur with every three weeks training or so.

Could that program simply be applied to humans and expected to work? Of course not. Because humans have a particular physiology that responds in particular ways to training and rest, the principles used to guide human powerlifter training must be based on that physiology.

It turns out that there are seven primary training principles for human (last time we mention alien training, promise) powerlifters. By following these 7 principles of training, programs will be well-tailored for the best possible results. And this is not by accident... these principles are all based exactly and only on the actual physiological and performances responses of lifters. They were not made up, invented, or manufactured; they were discovered. These principles are the simplified version of how the human body responds to training, and getting them right means better progress, period. Ignoring them will almost every time lead to poorer and less predictable performance.

The following is a rank ordered list of each of the training principles, with some of their sub-principles included: (less important but noteworthy details of the main principle)

- 1.) Specificity
 - a.) Sub-Principle: Training Modality Compatibility
 - b.) Sub-Principle: Directed Adaptation
- 2.) Overload
- 3.) Fatigue Management
- 4.) Stimulus-Recovery-Adaptation (SRA)
- 5.) Variation
- 6.) Phase Potentiation
 - a.) Sub-Principle: Adaptive Decay
- 7.) Individual Difference

Because these principles are based in physiology and govern the training process, employing them will increase powerlifting performance in any program in which they are implemented. But the principles do not all affect performance to the same degree. The first several are much more impactful on performance than the latter ones. While all programs that get at least specificity and overload correct will work well, the best programs get even more of the principles right. The more principles a program gets right, the better it is, with the best programs using all of the principles properly in their designs.

Below is a visual graphic to illustrate the relative importance of each principle. Those at the bottom of the chart and with the largest areas are the most important, and those with smaller slivers at the top are the least. Notice that Specificity bounds the entire graphic, which hints at the fact that it is by far the most important training principle and should be the highest priority in all powerlifting training. The next question is why, and the answer is described in great detail in Chapter 3!

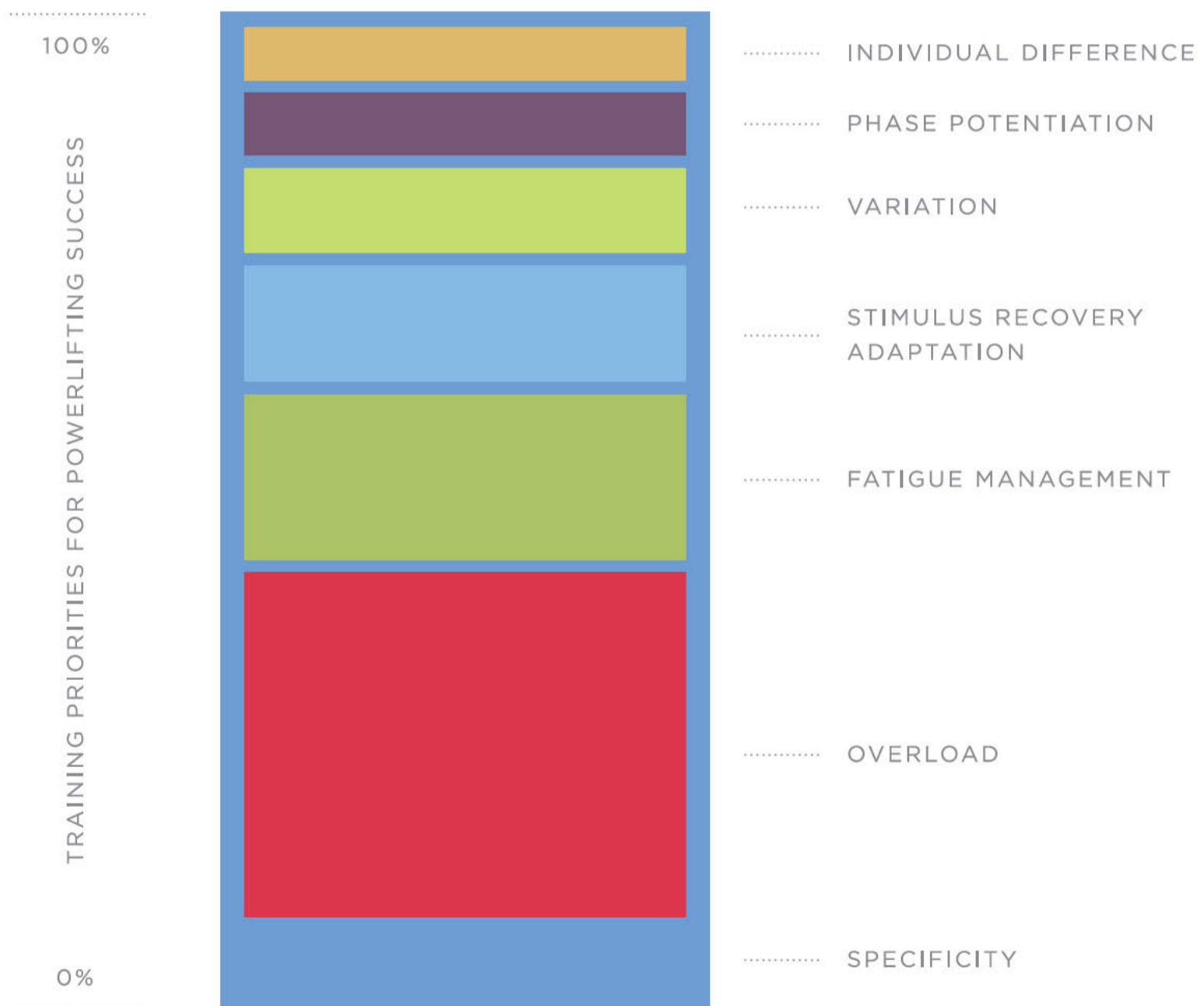
Each training principle will be thoroughly analyzed in its own dedicated book chapter.

Each chapter including this one will be structured as follows

- 1.) The definition of the principle in sport science terms.
- 2.) The definition of the principle as it applies to powerlifting, with expansive implications.
- 3.) Justification of why the principle is ranked as it is in the priority structure of training as compared to the other principles.
- 4.) Instructions and examples on how to properly apply the principle.

- 5.) Examples of typical mistakes in under-applying the principle.
- 6.) Examples of typical mistakes in over-applying the principle.
- 7.) Summary of the principle in basic terms as it relates to powerlifting training.
- 8.) Sources and further reading links.

THE PRIORITIES VISUALIZED



SPECIFICITY

SCIENTIFIC DEFINITION

The principle of specificity is both the most important principle in powerlifting training as well as one of the most scientifically straightforward. Technically, specificity means that training should tax and stimulate the underlying systems of the sport task. That is, specific training trains the systems responsible for generating movement for that sport move in question. This can mean training the muscles involved in the movement, training the nervous system to improve in the direction it would be used in a movement, or even training the direct movement itself. Specificity lies on a spectrum from being quite broad to being extremely narrow, which is described in greater detail in the next section.

POWERLIFTING DEFINITION

In powerlifting, specificity is defined as ‘training that improves the underlying systems of powerlifting performance.’ Specificity ranges from broad to narrow. This roughly means that any training that seeks to enhance the size of the muscles is important in producing forces in powerlifting and is thus broadly specific to powerlifting training. Training to improve the general strength of those muscles is more narrowly specific, and training to improve the execution of actual competitive,

heavy powerlifts is the most narrowly specific form of training for powerlifting.

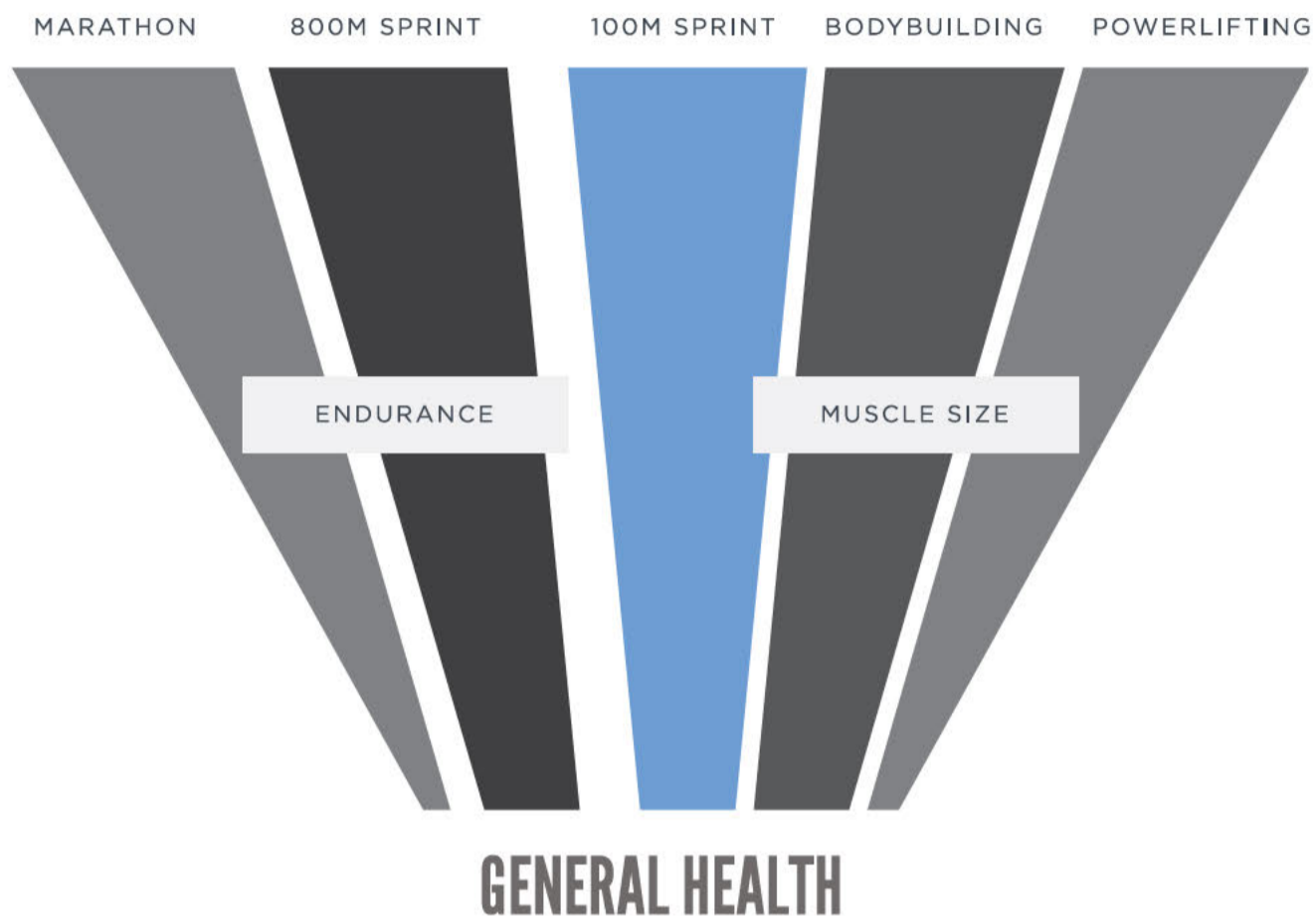


Figure 1: The Specificity Spectrum Tree

DESCRIPTION

The big branches of muscle size can lead to smaller branches of powerlifting success or different branches of bodybuilding success, but size is still specific to powerlifting and bodybuilding, just more broadly than the narrow acts of practicing the powerlifts or working the upper chest more than the lower chest. However, endurance training would be on another branch, that only shares the base of the tree (health of the body, for example) with powerlifting and bodybuilding, and the further you get into endurance training specificity the further you get away from what makes you good at powerlifting and bodybuilding.

As illustrated in the diagram above, the fact that both powerlifters and bodybuilders benefit from size training does not make size training non-specific to powerlifters, it just makes it more broad, or just a bit less specific. But because specificity is a spectrum, there are other forms of training that are MUCH less specific to powerlifting, and as such can only help just a little or don't really help at all. Training for extreme flexibility only several times per week is likely neither detrimental nor helpful to powerlifting, just mostly tangential. Further back, there are countless modalities of training which are so non-specific to powerlifting as to be counterproductive, one of the best examples of which is endurance training.

We can envision a system of categorizing training by specificity which is composed of 4 layers:

- 1.) Training that specifically supports performance (training the lifts themselves, heavy)
- 2.) Training that generally supports performance (training for muscle size and strength in the muscles needed for sport)
- 3.) Training that is mostly tangential to performance (advanced flexibility training)
- 4.) Training that is so non-specific as to significantly harm performance (endurance training)

The idea that specificity ranges from narrow specificity (practicing bench press technique) to broad specificity (putting on chest muscle size) and even to negative specificity (reducing strength by training too much in endurance sport) lays the foundation for one of the two sub-principles of the specificity principle: training modality compatibility.

TRAINING MODALITY COMPATIBILITY

One of the two sub-principles of specificity, this idea describes a very important observation in powerlifting training; some forms of training help performance a lot, some less so, some not at all, and some actually hurt performance. Knowing which ones are which is critical to designing a program that seeks to optimize success. Stated another way, some training modalities are just more compatible with each other. Training in one modality contributes to lots of success in several goals. For example, getting more powerful in weightlifting can give you more power to be a sprint swimmer. On the opposite end of the spectrum, training with certain modalities can down right hinder performance in some sports while helping it in others, such as gaining so much muscle in marathon training that repeated power/weight ratio falls and running times get worse.

While the general discussion of training modality compatibility across all sports is quite interesting, it is also quite expansive and a bit outside the scope of this book. In powerlifting training, the most common modality compatibility issues are between the following variables.

Presented below in order of the least modality compatibility to the most:

- Strength and Endurance
- Strength and Flexibility
- Strength and Power
- Strength and Size
- General Strength and Specific Strength

Let's go through each modality conflict and tease out the magnitudes and implications to training design.

1.) STRENGTH AND ENDURANCE

In large part, strength training is seriously hampered by endurance training. Very light cardio sessions aside, serious attempts to improve endurance interfere with a variety of physiological systems that underlie powerlifting performance:

Muscle Loss: Endurance training is catabolic towards muscle tissue, and high levels of such training will risk muscle loss if chronically executed. Less muscle means less contractile tissue to produce force and thus less strength is almost sure to follow.

Fatigue: While all training is fatiguing, training that does not improve performance but adds fatigue will be a net negative, as fatigue interferes with both recovery and hard training. If you train for bodybuilding and powerlift at the same time, you can at least have big muscles that can produce more force and help you lift more, albeit in an indirect and not most efficient way. However, the fatigue that endurance training incurs does not make you stronger or better at powerlifting in any meaningful way (unless you're terribly out of shape, in which case just doing more volume and higher reps is usually a better choice than endurance training). And endurance training is very fatiguing due to the high volumes of training involved, so this is a worse problem than training to play chess while training for powerlifting... at least chess is nowhere near that fatiguing!

Fiber Type Alterations: Skeletal muscle fiber types in humans range on a spectrum from fast-twitch to slow-twitch types. Fast twitch fibers produce force rapidly when activated by the nervous system, but more importantly for powerlifting, they produce more force per cross-sectional area. Not only this, they are much bigger than slower twitch fibers to begin with, and also respond to heavy training by growing faster and more in total than slower-twitch fibers. Thus, having your muscles be predominantly fast twitch (or rather as fast twitch as your genetics will allow) is a very good thing for both acute powerlifting performance (picking up heavy weights NOW) and for later improvements in performance (getting bigger and stronger with time).

On the other hand, slower twitch fibers contract more slowly when stimulated, produce less force per cross sectional area, are smaller than faster twitch fibers, and have less hypertrophy potential. From the perspective of the powerlifter, a greater percentage of fast twitch fibers are almost always a net benefit.

Problematically, endurance training has a greater tendency to shift existing muscle fiber characteristics from the fast to the slow end of the spectrum than most other forms of training. The fiber types themselves don't change through training, but the intermediate fibers (ones of an even mix of fast and slow twitch properties) start to behave more like slow twitch fibers and less like fast twitch fibers. This change in characteristics seems largely (likely wholly) reversible, but both the initial change to slow twitch and reversion to faster twitch can take on the order of months to occur. In a meaningful sense, endurance training will reduce the pool of fast-acting fibers in at any one point and over time, and is thus largely harmful to powerlifting results.



Nervous System Alterations

A motor unit is the motor nerve (emanating from the spine and innervating the muscles) that controls a certain number of muscle cells (fibers), as well as the fibers themselves. When muscles change from faster to slower, the motor unit on the whole does, which means the motor nerve optimizes to slower-twitch activity. Endurance training not only affects local motor nerves, but likely alters nervous system activity at the spinal and even brain level. This altered action makes the athlete better at low-intensity sustained activity, but likely worse at explosive and high force activity. Even at the level of the brain, nervous system changes brought on by endurance training tend to reduce powerlifting performance.

Because of fatigue, muscle function and nerve function issues, endurance training is usually a net negative for powerlifting training and performance, and for that reason should likely be minimized if powerlifting results are of utmost importance. Of course a tradeoff in training commitments can be made as such that endurance training is still included for its own sake or the sake of another sport, but this has to be understood as a tradeoff and an inherent part of most sports aside from weightlifting and powerlifting, not a powerlifting-specific optimization.

2.) STRENGTH AND FLEXIBILITY

Flexibility is defined as the total range of motion a joint or series of joints is capable of operating through. This means that a single joint's flexibility can be described (range of motion of a bicep curl at the elbow) or a set of multiple joints' flexibility can be described (range of motion of a deadlift including all pertinent joints). Flexibility is derived from 4 basic factors:

Muscle flexibility: The length of the actual muscle belly and its degree of safe operating and maximal stretching length. Muscle flexibility is influenced both by tissue and nervous system limitations.

Connective tissue flexibility: The degree of safe stretching possible by muscle fascia, connective tissue that runs through the muscle belly, tendons, and ligaments

Joint flexibility: The positions and shapes of various joint structures (shape of femoral heads, thickness of knee menisci) can in part determine range of motion at that joint

Adjacent tissue interference: At some point, limbs will just run into adjacent limbs or other parts of the body and that will limit their range of motion. No matter how deep you squat, you can't pass your hamstrings through your calves, and for very muscular lifters, this can be a limiting factor

Training for flexibility in powerlifting can be accomplished in 3 ways:

- Going through the normal range of motion (ROM) of the competition lifts (deep squatting, tight back deadlifting, etc)
- Training in supra-normal ROM lifts (high bar good mornings, cambered bar bench presses, deficit deadlifts, etc)
- Dedicated stretching programs to enhance flexibility

While the first two methods of enhancing flexibility have no negative effects on training, there is some good evidence to suggest that dedicated stretching training (especially a serious commitment to it) can contribute to fatigue and interfere with strength adaptations. If flexibility is limiting actual, safe, or optimal performance in a lift, then it might be justified to use dedicated flexibility training as a tradeoff that is positive on the net balance, especially if the first two flexibility-enhancing modalities have failed to provide the needed improvements. However, becoming more flexible beyond the needs of powerlifting ROM is likely to interfere with best adaptations speeds.

There are two other problems with “more than needed” flexibility. The first is that extreme flexibility can compromise joint safety and movement strength. Hyper-flexible joints have been shown to be more susceptible to injury (as have hypo-flexible ones). As well, super

flexibility can reduce tissue tightness at the bottom of a lift (such as the rebound in the bottom of the squat) and thus depreciate the effect of the stretch-shortening cycle (SSC) and slightly decrease strength performance. The second issue with flexibility training is that it has been shown to reliably cause temporary decreases in strength and power expression (short term, from minutes to hours in duration). Thus, flexibility training is most interfering with powerlifting if done right after training, and is likely the least if done later or much earlier in the day on its own time.

Thus, the verdict on flexibility is tentatively as follows:

- Practice the full ROM powerlifts with good technique
- Utilize supra-normal ROM lifts regularly in training, especially when flexibility is a looming issue
- Use dedicated stretching only when the latter two options have failed to produce the powerlifting-specific flexibility needed, and do such work at a time furthest away in the day from the lifts themselves
- Only get as flexible as needed. There is not reward in powerlifting for yoga-esque flexibility.

3.) STRENGTH & POWER

Strength is the ability to produce force. Power is the ability to combine a high force output with a high velocity of movement. The training for strength and power are almost completely compatible, but there are some compatibility issues nonetheless:

- Training for power takes time and effort that could have been used for either more strength training, recovery, size building, or any number of things that actually help improve powerlifting ability. Power production itself has a very small carryover for powerlifting performance. A truly maximal weight (by definition) moves so slowly that velocity of movement is almost irrelevant, and force production is of utmost and almost total importance. Maximal intent of movement is important in powerlifting training (such as in getting past sticking points, for example), but the loads used are the same as would be used to enhance strength. True power training is optimally loaded at around 30% 1RM for most movements, and is thus only weakly specific to the super heavy weights of the competitive powerlifting environment.
- Because power output is HIGHLY fatigue-sensitive, power outputs are maximized at relatively low training volumes. Even the slightest volume increases contribute to fiber-type regressions to slower twitch variants and to neural fatigue that results in poorer power outputs. Strength training, however, is optimized with moderate volumes (significantly higher than those of power training) and size training with high volumes. Thus, power training, by limiting volumes of training to those too low for best strength and longer-term strength (size) developments, is not completely compatible with powerlifting training, which is highly ironic given the misnomer that is “powerlifting.”

Yes, training for strength and power at the same time go a long way in promoting both, but a true attempt to maximize powerlifting performance by making all attempts to increase strength and size must jettison power training in large part. For almost all other sports, concurrent strength/power training is highly recommended, but powerlifting is unlike most sports.



4.) STRENGTH & SIZE

While muscle size directly causes strength expression by supplying the literal machinery for muscle contraction, there are several ways in which size training can (minimally but meaningfully) interfere with powerlifting performance:

- Size training is best accomplished in the high volume range. This creates a significant cumulative fatigue which converts fiber types, interferes with nervous system function, and literally makes the lifter too tired to present the most overload and perform the best in training. Size training is great for powerlifting success, but only in a delayed manner when volumes drop, strength training commences, and the newly built muscle can be trained for strength in a low-fatigue environment.

- Training non-specific muscles can be a very interfering practice to powerlifting ability. Some bicep, medial delt, and calf training is a great contributor to powerlifting success, but excessive training of these muscle groups can add fatigue that's not worth the performance tradeoff. Huge medial delts are sure nice to look at and are very important to bodybuilders, but they contribute very little to powerlifting success, and almost nothing at all past a certain minimal strength. Training them too much does not help powerlifting ability, but causes fatigue and takes up the time that could have been used to train more or recover more from previous productive training.

Of course it's possible to be a powerlifter and be incredibly muscular all-around, not just in the muscles that matter. And there is something to be said for a minimal amount of balance between the major muscle groups to prevent injury. But doing hypertrophy training even during strength and peaking phases, and especially paying undue attention to muscles not very contributive to powerlifting can be somewhat (though in the grand scheme not terribly) harmful to best results.

5.) GENERAL STRENGTH & SPECIFIC STRENGTH

The smallest by far of the interferences between modalities is that of general strength and specific strength. General strength is the general ability to exert force using the body's musculature. Specific strength, on the other hand, is the ability to express that strength in the one-repetition maximum in the squat, bench press, and deadlift.

An illustration of the difference can be between the ability to do heavy dumbbell presses vs. competition bench presses. Some lifters are stronger than others at dumbbell presses, and possibly machine presses, close grip presses, and floor presses too, but don't measure up in the

actual 1RM bench press itself. Likewise, a lifter may have the gym's highest 5RM bench, but not the highest 1RM bench.

Oftentimes, this is a reflection of technique. At maximal loads, good technique is rewarded and bad technique can really hold back performance. To further complicate matters, technique tends to break down (move from better to worse) at the heaviest loads, nearing 1RM. Thus an athlete can have an impressive level of general strength (in other movements and in higher rep ranges), but have problems with technique that impede best expression of maximal, specific strength.

Additionally, the best expression of maximal strength occurs in a low-volume environment which drops fatigue, while the best strength training occurs in a moderate-volume environment. It is thus impossible to perform the best general strength and specific strength training at the same time, though the distinction is quite minor.

Training modality compatibility does not imply that all training that is not maximal 1RM training is a bad idea because it is non-specific. Yes, narrowly specific training like this improves lifting performance, but so do many forms of broadly-specific training such as general strength and size training, so long as they are done at the right times and in consideration of the other demands of sport preparation. However, training modalities in the trunk of the tree (flexibility training, to a large extent) that neither help nor hurt powerlifting performance must be noted and only applied very judiciously, and modalities on the other tree limbs (endurance training, for example) must be actively avoided for the most part.

DIRECTED ADAPTATION

The second major sub-principle of Specificity is that of Directed Adaptation, which is actually quite rarely defined and illustrated in discussions of powerlifting training, though it is incredibly prevalent as a feature of most training programs.

The definitions of directed adaptation build heavily off of the definition of specificity. While specificity states that improving a certain system requires stressing that system or at least the underlying systems, directed adaptation states that these stressors must be arranged sequentially. That is, directed adaptation is the sub-principle of specificity that mandates a sequential and continuous presentation or specific stimuli for maximally enhanced outcomes.

Sequential here means that the stimuli occur in an ordered and relatively time-constrained manner, rather than randomly and over longer periods of time. For example, if you want to get better at squatting for sets of 5, let's say, you should probably be squatting for sets of 5 just about every week in sequence, and not every 3rd week or sometimes even every 6th week.

The reality of directed adaptation is rooted in physiology. Firstly, systems have finite adaptation capacities, and those capacities tend to be quite limited especially in more well-developed and highly trained systems. Secondly, while many small adaptations are made after only one session of training, the degree to which adaptations are retained after a cessation or change in training stimulus depends on how consistently and sequentially they were trained. Not only do systems have a limited number of capacities they can adapt towards (thus giving up one

adaptation for another when needed), adaptations that are meaningfully retained to be used later seem to benefit most from sequential, consistent presentation.

For example, if your goal is to squat for sets of 5, a variety of adaptations such as those of a neural, muscular, and connective tissue nature must take place to maximize your performance. By the principle of specificity, actually squatting for sets of 5 is likely a very good way to train for this endeavor. But let's say you don't JUST want to get good at sets of 5, but sets of 15 as well. So every other squat workout alternates between the two rep ranges. Because of the first constraint of directed adaptation (limited adaptive proclivity), you won't get nearly as good at sets of 5 as you could have if you had just stuck to mostly 5's in training. The very systems which need optimization toward expressing abilities in the 5 rep range are now being tasked to express various different abilities in the 15 rep range. Some of these adaptations (fiber type, neural characteristics, etc..) are either-or, and an improvement in 15 rep ability (in fact, any training toward that ability) is a necessary decrement to maximal adaptation for the 5 rep range. Because of the second constraint (sequence) of directed adaptation, any time you train for sets of 15, the adaptations occurring for sets of 5 begin to reverse and head in the 15 rep direction. That gives less consistency for the stimulus to solidify gains made in the 5 rep range, and thus decreases that chance that progress made during this current training phase (in the ability to maximally perform 5 rep sets) will be retained for later.

The above example is quite a simple one, but real life powerlifting training is often even more convoluted. It's not uncommon to see some programs that do sets of 5, heavy triples, and drop sets of 20 reps in the same week. While all of those approaches have a considerable amount

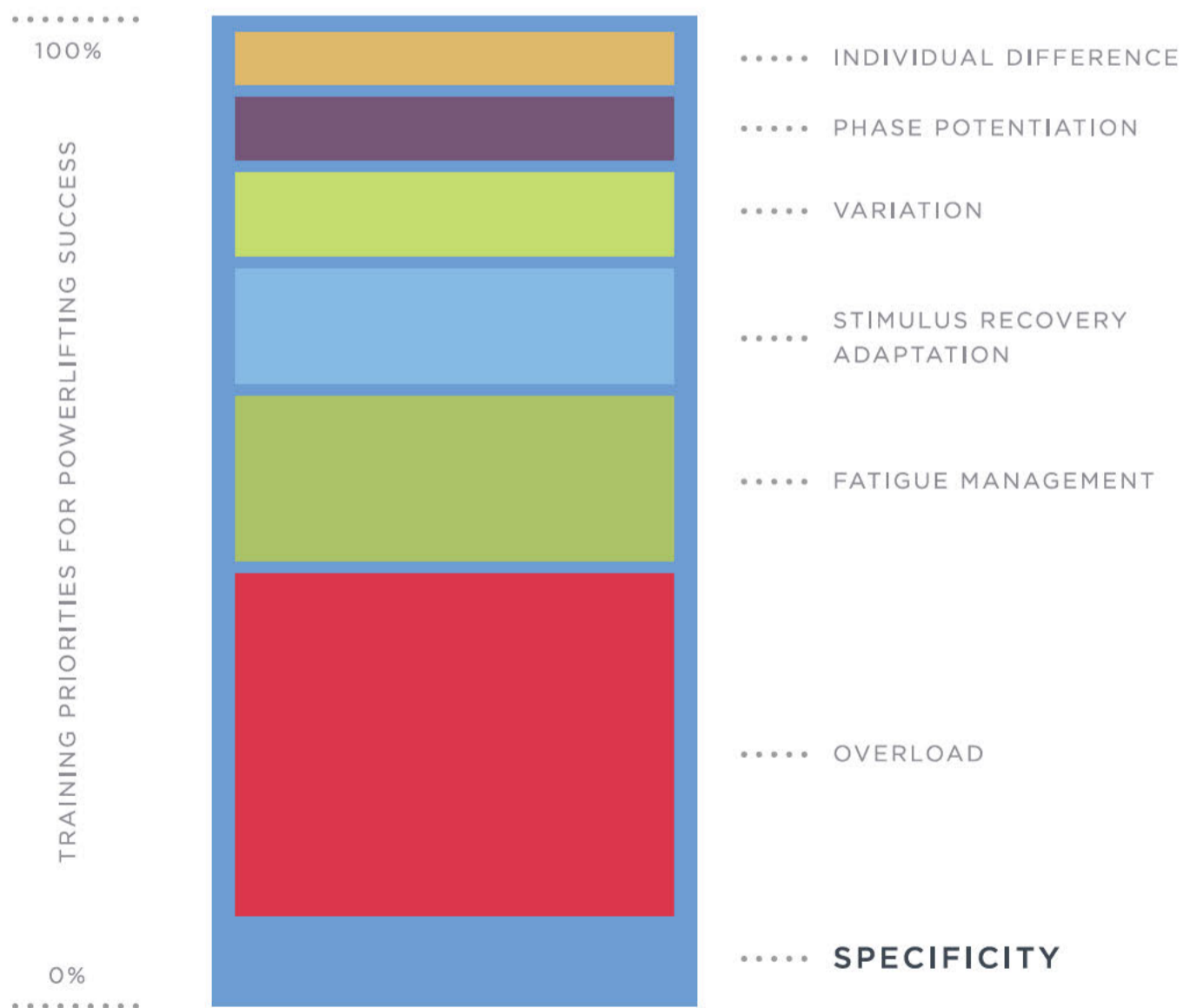
of individual merit, the sub-principle of directed adaptation relegates the simultaneous combination of these methods to inferiority. What ends up happening is that the lifter will get a good deal better at all of the capabilities trained, but not great at any one of them, a sort of “jack of all trades, master of none.” Furthermore, as soon as the focus shifts to a more specific approach (let’s say, sets of 5), the adaptations gained in the combination training phase (neural adaptations for sets of 3, hypertrophic adaptations for sets of 20) are more likely to recede more quickly.

In a preview of the later discussion of phase potentiation, a better approach likely lies in utilizing the principle of directed adaptation advantageously by structuring training in dedicated phases. A hypertrophy phase will present a certain kind of stimulus for long enough (one to several months) for it to become resistance to receding later. A basic strength phase will present a slightly different stimulus that takes the new muscle and makes it stronger, with dedicated (sets of 3-5) training for up to several months. Before the meet, the solidified strength gains of this phase are utilized in the peaking phase to prepare the lifter for maximal loads. Such an approach allows for a diverse set of training approaches to be used to improve the multiple fitness characteristics needed for best powerlifting performances without needlessly training all of those characteristics simultaneously and violating the sub-principle of directed adaptation.

PRINCIPLE IMPORTANCE RANK

When ranking the principles of powerlifting training in order of their importance and impact on the success of a program, the principle of

specificity ranks first, and not by accident or with disclaimer. Specificity is of primary important because it lends direction to all of the other principles. A program can have excellent overload by having a high weekly running mileage, excellent phase potentiation my moving from an aerobic base phase to an interval phase to a competition phase. It can even have excellent fatigue management with light runs and bike rides. But wait, this program won't make you a single bit better at powerlifting, because it is specific to performance in triathlon! By directing the rest of the program to improve the systems and characteristics needed for some particular sport, in this case powerlifting, specificity is the most important of all principles. And as we shall see in a later section on mistaken instances of its under-application, not using enough specificity can be a serious problem for best program design and results.



IMPLICATIONS & EXAMPLES OF PROPER APPLICATION OF SPECIFICITY

1.) LIFT SELECTION APPROACHING A COMPETITION

Because of the advantages of variation (to be discussed in detail in Chapter 7) , the competition lifts do not need to be included in every mesocycle of the training macrocycle. However, as the meet approaches, the lifts performed in training must more closely begin to replicate the competition lifts, including more of the competition lifts themselves. This tendency is based in 3 main reasons, listed below. It is worth mention that variation is the reason that the competition lifts are not performed macrocycle-round, so that “having the competition lifts all the time” is not the best option and not a viable one for this discussion. A more in-depth discussion on the problems with using competition lifts all the time can be found in Chapter 7 on variation.

3 main reasons to progress toward the competition lifts through the macrocycle:

A.) MUSCULAR & CONNECTIVE TISSUE ADAPTATIONS

During the execution of a maximal competition lift, a rather precise arrangement of forces is exerted by gravity and the muscles acting to resist it. This also results in a rather precise set of directions of force application to tendons, bones, and ligaments. While early macrocycle training could have been focused on a varied set of goals (grow the quads by applying front squat and leg press forces and directions of force), the approaching meet will test the force production ability of the muscles AND force tolerance of the connective tissue in a precise way. That precise way is of course that found in the

powerlifts themselves. Research shows that over the weeks of training, both tendon and muscle ultrastructure (collagen alignment in tendons and pennation angle in muscle) changes to become specific to the lifts performed, even if no additional muscle is added. While long-term (months later) optimization of force production and tolerance can be achieved with proper variation, short-term (weeks later) optimization occurs best when the actual competitive lifts are being trained. Thus it is important to optimize those adaptations by training the powerlifts themselves more and more as the meet approaches, with perhaps the most focus on them during the peaking phase (last mesocycle) itself.

Not only do the competition moves need to be more prevalent in phases of training as the meet approaches, there are some good reasons to suspect that the nature of assistance work must also become more specific. Without risking too much overlap with the competition move itself, assistance work should seek to become more specific to the powerlifts themselves as the meet nears, in order that the adaptations have more likely short term transfer of training to meet performance. For example, while skull crushers and overhead extensions may be great triceps builders for far from the meet, JM presses and shoulder presses may be more appropriate assistance movement selections as the meet nears, since they replicated the angles, muscles, and forces of the competition lifts more closely and more likely have shorter term transfer times than the more varied movements.

B.) NEURAL ADAPTATIONS

In order to signal the muscular contractions from section a.) above, the nervous system must be employed. Differences in nervous system employment between assistance and competition lifts are found at 3 levels.

Between Motor Units: At the local level, the nervous system

works in largely the same way between assistance movements and the powerlifts themselves. For example, when the triceps contracts in the bench press OR the skull crusher, every motor unit that activates does so in the same, essentially identical, way. However, not ALL of the same motor units activate in the triceps during the bench press and skull crusher. Some stay silent for most of the bench press and may only activate for small portions of time while being active the whole time during a skull crusher, and vice versa.

Between Muscles: Not only are these differences seen with motor units in the same muscle, they are also seen between muscles. While the pecs contribute greatly to the bench press, their contribution to the skull crusher is minor.

Between Movements: A combination of differential actions (times, durations, strengths of contraction) of the different muscles yields a difference in total nervous system activity between whole movements. While the close grip bench and the competition grip bench may be highly similar, the particular sequence of motor unit and muscle activation may be different, even if largely the same motor units and muscles are used to largely the same degree. Essentially combining motor unit and muscle differences in activity, the nervous system can behave quite differently when executing differing lifts that demand different techniques. Thus, at this highest level of activity, not only is nerve function at the motor unit and whole muscle changed, but brain function is altered to optimize the execution of a competition lift technique.

This need for specific technical prowess in the lifts can be re-stated to imply that the competition lifts are, among other things, specific sport techniques. No matter the more varied prep in the earlier timeframes of meet prep, short-term optimization of sport technique demands the training of that particular technique. This is a major reason why the lifts are to be done closer to a meet.



From a real-world perspective, not having performed the lifts themselves in at least the last several weeks of meet prep will enhance the likelihood of several unwanted outcomes, including:

- Higher chance of injury from connective tissues unaccustomed to specific lines of pull (especially at the maximal weights of the competition)
- Lower force production due to lack of specific muscle optimization from hypertrophic and pennation angle differences and nervous system optimization
- Technical errors in the execution of the lifts (hips rising too fast in the deadlift, for example) due to a lack of technical practice
- This is not simply an exercise in cautioning against a behavior that has never actually been practiced. In the early 2000's,

many lifters (mostly connected to Westside Barbell) used to pride themselves on training every exercise but the deadlift itself on their way into a meet in which the warmup for pulling was going to be their first time deadlifting in months. While the deadlift is particularly fatiguing (something we'll explore in Fatigue Management later on), not training it at all is unlikely to produce the best performances. In simple terms, as the competition nears, it pays to practice as you play and train more with the competition lifts than at other times in the training macrocycle.

2.) ASSISTANCE WORK IN THE GRAND SCHEME

When it comes to training that is not composed of literally performing the competition movements (where specificity is rather obvious), it is especially important to understand the way in which the Specificity Principle delineates proper training. There are two basic constraints that the specificity principle applies to assistance training:

A.) KEEPING A GRAND-SCHEME FOCUS

No matter what assistance work you do, that work must always have the purpose of improving your powerlifting abilities. Outside of flexibility work, pure technical work, and injury management (which are really ancillary tools and don't quite qualify as direct sport training), all powerlifting assistance training must focus on only two other outcomes other than direct practice of the lifts with limit weights: muscle size and movement strength

Muscle Size: When training for muscle size, make sure you are training the muscles that need to eventually get stronger. If you're training your calves a lot, or your goal is to have big medial deltoids, you are

essentially violating the specificity principle by focusing on muscles that do not contribute much (if at all) to powerlifting performance. Because stimulus, recovery, and adaptation resources are finite, training some group of muscles means missing out on either training or recovering optimally for another. Train the muscles that propel the movements the most, not those for which arguments about their contribution to the lifts are esoteric and unconvincing. Yes, the rear delts may contribute to the bench press, but the chest certainly does... choosing to train chest as a high priority is likely a good idea as opposed to training rear delts as a high priority.

Movement Strength: Just as with muscle size, movement strength must be prioritized on need. If your back tends to round on the deadlift but your movement off of the floor is rapid, you probably need to improve your back strength, and not likely your squatting strength in this case. Know your limiting factors and choose your movements appropriately, especially if you're advanced enough and strong enough to have true limiting factors... more on this in the chapter on Variation. Mind you, your limiting factors may be such because you're already training them too much and not recovering enough. The discussion of Maximum Recoverable Volume in the Fatigue Management chapter will address volume selection for training. In any case, assistance work should not be random... it should always be directed to improve movement strength or the underlying hypertrophy or the muscles contributing to those movements. This avoidance of random selection of assistance work brings us to the second constraint of the specificity principle on assistance movement selection; avoiding non-directed training.

B.) AVOIDING NON-DIRECTED TRAINING

Any time spent performing exercises that don't promote beneficial adaptations to the sport itself is a cost, simply because those exercises could have been replaced with extra recovery, and maybe even more sport-specific training. Outside of some minor other considerations, if an exercise is not growing relevant muscle to be used in prime movers or synergists and if it's not strengthening the movements on which PL performance depends, it's unlikely to be a benefit to programming, and is likely to be a cost.

Some examples of such training can include:

- Calf, high rep ab, bicep work
- Too much lat work (some is likely good)
- Most types of cardio
- Too much yoga, pilates, or mobility work

In a very plain sense, if you're not sure why you're doing an exercise, this is not a good sign!

3.) LEARNING & PRACTICING PROPER TECHNIQUE

Because the powerlifts are judged on precise criteria (let's get our collective eye rolls about those circus clown federations over right now, haha). At least in the serious federations, the execution of the lifts will have a high degree of consistency/precision. Lifting in training must reflect this in such a way that training lifts (of the competition movements) will need to be performed exactly like the competition moves or very closely.

Because straps can help increase the weights, sets, and reps done in the deadlift and paused bench presses may put a bit more stress on the shoulders of some lifters, such modifications as using straps for deads and touch-and-go on the bench can be OK far out from a meet. But as a meet gets closer, and especially during the last month of training, the training lifts must be performed exactly like the competition lifts. An important note is that a month is probably the closest to the meet that the transition to pure competition techniques should be made. Switching only weeks out, when your lifts are the heaviest and hardest can be a serious issue, so it pays to switch earlier, likely before the peaking phase begins.

A classic example of the difficulties that can arise with too late of a switch to competition technique is with paused vs. touch and go bench presses. Programming to do sets of 3 in the paused bench press based on your touch and go numbers can mean you're unknowingly programming for sets of one because pausing is so much harder. This can throw off your whole program and require annoying adjustment late in the game. Not just the disparity in weight between the two but the transition between them can be a speedbump best avoided. Going from touch and go to paused benches and similarly from touch and go to paused deadlifts can require several weeks of minute technical adjustments during which the lifts will feel a bit alien and awkward. During the peaking phase before a meet, when the heaviest training lifts are performed, the last thing you want to feel is alien and awkward.

In summary, learn the proper techniques, practice them year-round, and make no exceptions to them especially in the last months of meet prep.

UNDER-APPLICATION OF SPECIFICITY

Specificity is the most important principle of training for best performance in powerlifting. Thus, in order to maximize the effectiveness of training, specificity must be appropriately incorporated into the training plan. Appropriate incorporation means that a certain best amount of specificity is employed, while becoming overly specific or not specific enough in training should be avoided. In this section and the next, we'll discuss the under- and over-application of specificity and the potential negative effects of such programming features. First, three of some of the most common instances of under-utilizing specificity in powerlifting program design.

1.) TRAINING WITH INCOMPATIBLE MODALITIES OUTSIDE OF POWERLIFTING

Because the body has a finite ability to recover and adapt to the training process, and especially due to both training modality compatibility and directed adaptation, all forms of physical training outside of powerlifting will have the potential to interfere with powerlifting performance and progress. Some forms of training will have much higher capabilities to interfere with powerlifting success than others.

Four main variables determine which external training forms are most interfering:

- a.) Volume of External Training
- b.) Impact/Disruption of External Training
- c.) Modality of External Training
- d.) Timing of External Training

a.) The higher the volume of external training, the more such training will interfere with energy levels (and thus workout productivity) in your powerlifting training as well as recovery from your powerlifting training. If you play tennis 2 times a week for an hour each time, the interference to powerlifting will likely be minute. If, however, you play tennis 6 days a week for 2 hours each time, the interference effects will likely be large and possibly quite deleterious to powerlifting performance and progress.

b.) The degree to which external training disrupts physiology plays an important role in its degree of interference to powerlifting. If you do Yoga outside of the sport for 6 hours a week, very little added stress is accumulated, and you don't have any additional injuries, bumps, or bruises to work around in your powerlifting training. However, if you pick up MMA or BJJ training as a hobby, the intensity and homeostatic disruption is considerable, never mind the straightforward accumulation of at least minor injuries that must be dealt with in powerlifting training later.

c.) The modality of external training matters and much of the detail of that discussion has been elaborated on in the earlier explanation of training modality compatibility as a sub-principle of Specificity. Doing Marathon running training may be a lot worse for powerlifting performance than doing bodybuilding work, as endurance training is much more interfering at the biochemical, muscular, and nervous tissue levels than bodybuilding training when powerlifting performance and progress are concerned.

d.) Though a smaller concern, the timing of external physical activity is a feature of the degree of interference it will cause. There are two largely separate features of timing in this regard; proximity of external training



session to hard powerlifting workouts during the training day/week, and timing of degree of involvement in the activity with respect to the competitive powerlifting macrocycle. In order to have maximum energy for productive powerlifting workouts and to allow for the beneficial processes of recovery and adaptation to occur without interference, external physical activity should likely be placed as far apart from hard powerlifting workouts as realistically possible. This means that playing soccer in the AM and powerlifting in the late PM is generally a more effective approach than performing them back-to-back. On a weekly timescale, perhaps live rolling or sparring for BJJ or MMA should be done over the weekend, while the heaviest powerlifting training should be done Tuesday-Friday, giving the body systems a chance to recover before hard powerlifting training is demanded of them. In the long term,

macrocycle-length timescales dictate that specificity must increase as the training phases progress closer towards the meet. This means that if a certain amount of external physical activity is given, it's probably best for powerlifting success for this activity to be concentrated most heavily in the earlier phases of the macrocycle so that the latter phases can have lower activity levels and thus allow for a more specific focus on powerlifting performance, recovery, and adaptation.

When former Soviet lifters were paid to be members of the Olympic team as lifting professionals (in weightlifting), they were explicitly prohibited from doing ANY external physical activity that interfered with sport outcomes, and in fact spent much of the year in training camps secluded away from any opportunities to do so. For most people today, powerlifting is just a hobby and not a profession, so involvement in external physical activity can not only be expected, but it can be enriching on the net balance from a quality of life perspective. However, depending on your degree of commitment in approaching the sport, use the above four criteria to choose what kind, how much, and when to engage in external physical activities so that you make an informed and desired tradeoff of performance and improvement with respect to powerlifting, and not just squander a high degree of potential performance or needlessly avoid all external physical activities on principle.

2.) USING NON-SPECIFIC GPP WORK

In many already well-established powerlifting training methods the concept of general physical preparedness has been fairly well explained and popularized. Essentially, general physical preparedness (GPP) gets

the powerlifter in good enough shape to be able to most benefit from the specific training to follow, which tend to be the more conventional strength-based training in the powerlifts and their close derivatives in the 3-5 repetition range.

While there is much consensus on what constitutes basic powerlifting training (also known as special physical preparedness or SPP), many approaches to GPP are popular, and some of them violate the specificity principle to a considerable extent. The purpose of GPP in general is to prepare the athlete to train productively for their chosen sport. In powerlifting, this largely means that the athlete must establish the muscle mass with which to get stronger later as well as the work capacity to be able to recover from and adapt to the later SPP training. In modern periodization, this is accomplished through the hypertrophy phase, in which the muscles most utilized in the powerlifts are trained in a slightly higher rep range (sets of 6-10 reps, usually) and with more volume to both grow the muscle needed for the strength phase (SPP phase) later and establish a higher work capacity with lots of these higher rep sets. Because specificity and generality lie on a spectrum, even the exercises and muscle groups in this phase are quite sport-specific, with the close derivatives of the powerlifts (front squats, close grip benches, deficit deadlifts, etc...) being heavily relied upon and transferring best to later performance.

So if the purpose of the GPP phase in powerlifting is to grow muscle in the very groups that determine performance and build work capacity in the movements closely related to the powerlifts themselves, what place do modalities like kettlebell swings and sled pushes have in GPP work for powerlifting?) The blunt answer is, not much. Kettlebells are neither specific enough to the muscles and movements used in powerlifting

not nearly taxing and simulative (overloading) enough to be maximally effective. Sled work is used successfully by football and rugby players to build work capacity, but that work capacity is to enhance preparedness for football and rugby practice, not powerlifting practice. Although different and fun, alternative modalities such as kettlebells, circuits, and sled work don't have much of a place in the GPP phase of powerlifting programming because they are so non-specific as to be outcompeted by more specific and thus effective modalities like the close derivatives of competitive powerlifts. Not only does this concept apply to powerlifting, but in fact to every sport. GPP is always and everywhere sport specific... to some extent. Referring back to Figure 1, GPP may be on the main branch out from the tree, not the main trunk, and definitely not another branch altogether!

3.) NOT KEEPING & UNDERLYING FOCUS ON SPECIFICITY IN PROGRAM DESIGN

The last example of under-application of specificity is really just an all-encompassing guide to selecting training modalities for powerlifting. Kind of a cheat sheet, if you will. When selecting any training method, modalities, or exercises for powerlifting programming, each and every selection must address, in no ambiguous or unclear manner, at least one of the following concerns:

- Size
- Strength
- Peaking
- Technique
- Recovery
- Adaptation
- Injury

And all of those must be in reference to powerlifting performance per se. For example, size must concern the muscles used in the powerlifts, not just ALL muscles, and technique must reflect powerlifting technique, not some other sport.

For example, mobility work can improve technique abilities rather directly by allowing the lifter to safely and comfortably execute the proper range of motion of the lift. However, too much mobility work can become a misuse of time once enough mobility for the lifts has been achieved, as extra mobility does not seem to confer any meaningful advantages. If your goal is to tailor training to powerlifting, then every feature of your program must be explainable to that end in a straightforward way. Not necessarily an overly simple way, but in a way that doesn't take too many tangents or qualifiers to explain. In simple terms, if you can't really answer why you're doing a certain exercise or rep range or set scheme within a short paragraph pretty much on the spot, the likelihood that this training feature is specific enough to the sport to be beneficial falls dramatically. If it doesn't address some aspect of powerlifting training, it's probably best to leave out of the program. It's not quite KISS (keep it simple, stupid), but rather KIR (keep it relevant).

OVER-APPLICATION OF SPECIFICITY

While Specificity is sometimes under-applied, it can also be over-applied. Because specificity and variation are in many ways mirror-images of each other, over-applications of specificity may be under-applications of variation and vice-versa. Other examples will be used in the discussion on variation in chapter 7. Let's take a look at several common examples of the over application of specificity.

1.) TRAINING “COMPETITION HEAVY” YEAR-ROUND

By training “competition heavy,” we are here referring to training that almost always includes sets of 1-3 repetitions in the limit range (close to personal bests), weekly and monthly through the training year. This is interestingly a training feature which violates many other fundamental training principles, and racks up 4 distinct reasons for violating the Specificity Principles alone!

A.) STALENESS

As the same stimulus is presented for increasing lengths of time, the magnitude of adaptations elicited by the stimulus tends to trend downward. That is, doing the same sort of training for too long a time period tends to make that training much less effective over time, missing opportunities to enhance the training effect with alternate modalities. This reality is the underpinning of the Principle of Variation, and the physiological causes of this phenomenon will be explored at length in that section. Because specificity and variation are, at their extreme levels, opposites of each other, an over-application of specificity can also be termed an under-application of variation.

Too little variation produces muted training responses and thus a needlessly slower rate of gains. Variation can occur in many forms, including exercise selection, rest interval time, and even bar weight/repetition range. Just training in a different repetition range while keeping all other variables constant can lead to an increased rate of performance gain. Thus, training for too long in the heaviest rep ranges begins to yield poorer and poorer results, and just switching the repetition ranges away from sets of 1-3 reps can be of benefit even if no other alterations are made.

Not only is staleness a problem for programs that always and only go heavy, it's a problem for mixed-rep programs as well. Programs in which heavy work is followed by lighter work actually increase the staleness of both modalities, thus in a sense using up a lot more potential variation than either low reps or high reps alone. Dedicated phases of distinct repetition ranges and/or loads are perhaps a way to minimize staleness, among other methods.

B.) MISSING OUT ON HYPERTROPHY WORK

A big component of powerlifting is not just the quest for strength with your current muscularity, but an enhancement of that muscularity as well. Unless you're exceptionally short and stocky when you begin the sport, moving up at least several (and for taller, skinnier beginners, perhaps more than 5) weightclasses usually adds muscle in such a way as to benefit leverage advantages and improve your bodyweight ratio formula, making you a more competitive lifter. Never mind of course that most any increases in muscle have an absolute strength-increasing effect, formula results aside.

The problem with training heavy all of the time is that hypertrophy (the process of muscle growth) is best stimulated with high volumes rather than heavy weights. Yes, there is good reason to believe that the heavier you train at any given volume, the more muscle you put on, but training any heavier than about 80% 1RM is so fatiguing that the optimal volumes needed for muscle growth are all but unsustainable. Thus, if you only train at very heavy weights, you'll be unable to reach high enough volumes to grow at the fastest rates. This untapped growth will limit your potential as a powerlifter, especially over the years as many of your competitors outgrow you.



Can you do the heavy work first and then drop the weights off and add volume to get the best of both worlds? Yes, but to a point. If you prioritize heavy training or volume training and do mostly that form of training per session, that's fine. If you try to accomplish both super-heavy and very high volume training in the same session in a 50/50 priority, what you end up getting is the "ok" of both worlds rather than the best. Your size gains are undercut because of the extra volume you could be doing instead of the super heavy sets, and the high volume of training of the hypertrophy work actually interferes with the strength work of the heavy sets in two ways. Firstly, by causing too much fatigue over time and thus preventing you from going as heavy in the next session's and next week's workouts by being so beat up from all the volume of the hypertrophy work. Secondly, by interfering with the nervous system adaptations that assist in maximal force production, instead favoring those responsible for the repetitive forces

of hypertrophy work. Thus, very much in contrast to the implications of the specificity principle, you end up maximizing neither adaptation, and you're better off just focusing on one and then the other for best long-term results, the details of which will be addressed at length in the discussion of phase potentiation.

C.) MISSING OUT ON GENERAL STRENGTH WORK

Not only is going super heavy a relatively poor way to promote gains in muscle size, it's also somewhat counterintuitively not the best way to promote gains in strength! Strength increases not only need weights that are sufficiently heavy (75%+ or so 1RM), but also enough exposure to the forces those weights provide to make the highest magnitude of adaptations. Stated another way, you need not only lift heavy to get your strongest, but with a high enough volume (sets x reps x weight) to maximally elicit the greatest amount of adaptations.

Training in the 3-5 repetition range (or rather, with weights closer to the 80%1RM mark than the 90%+ range) tends to promote the best combination of heavy-enough weights and sustainable volumes to promote the fastest strength improvements. Training too heavy can generate too much fatigue for the amount of benefit gained, and thus prevents the building of the highest possible general strength base. Any amount of needless maximal lifting adds an unnecessary amount extra fatigue, which implies that the less constant maximal lifting you do, the more energy and recovery ability you'll have to lay down a general strength foundation.

D.) OVERVALUING CONSTANT SHORT-TERM READINESS

By training close to your maximum best effort lifts year-round, you can benefit from being mere weeks out of readiness for a powerlifting competition. All you have to do is drop out some extra volume from your assistance work, drop out heavy work a week or two out, and Shazzam, you're in competition shape, and can be as often as every month. On the other hand, methods of training that incorporate dedicated higher volume phases of lighter training may need months of time to peak.

While this ability to peak rapidly is indeed a benefit, one has to wonder in what realistic scenario any powerlifter on earth would have to peak at such short notice (or absurdly, compete every month!). The great powerlifting coach Louie Simmons used to boast that his lifters could be ready within mere weeks to compete. But the big question following that claim is... so what? For the reader... how many 'surprise powerlifting meets' have you ever heard of? And as we have seen in earlier examples, this constant state of near-readiness comes at the cost of improving long term performance. You're supposed to be beat up most of the time! Without a clear benefit to a constant state of near-readiness, it's not apparent why this would be considered a net benefit.

2.) VERY LOW EXERCISE VARIATION

Just as constraining repetition ranges only to the ones most specific to powerlifting performance (sets of 1-3 heavy reps) can limit the benefits of variation, constraining programming by limiting exercise selection too narrowly can cost potential program benefit. There are two distinct advantages offered by the utilization of exercise selection variation; variation for its own effect and directed variation for athlete needs.

VARIATION FOR OWN EFFECT

Because overuse of any modality can cause adaptive staleness, introducing new training modalities can have a beneficial effect simply due to the effect of novelty. So long as the exercises chosen concord well with the other training principles (hard enough to overload, specific enough to transfer to PL performance, not overly fatiguing, etc...), just using novel movements can be of benefit to performance increase.

This means that after several mesocycles of competition-style bench pressing, just replacing the bench press with the close grip variant can yield more size and strength than was being produced by competition bench pressing towards the end of its utilization period. Going back to the competition bench press after a mesocycle or several of close-grip work will likely yield higher competition bench press results, especially within several microcycles as neural and muscle architecture changes re-adapt the lifter to this (now relatively novel) movement.

Additionally, because the competition bench press is once again relatively novel after the close-grip benching mesocycles, its very reintroduction acts again to improve performance through the effect of exercise variation. This sort of alternating “deletion and replacement” of lifts, where one lift is used while the other is given time to de-sensitize its effect on staleness is a very productive programming method.

DIRECTED VARIATION

While exercise variation is an important training tool no matter which of the effective exercises you potentially pick to vary, it can also be used in a more directed manner. Between genetic proclivities and declivities of individual athletes and their training history, not all athletes have the same strengths and weakness in regards to muscles and

movements. While one athlete may have a very strong squat because of disproportionately strong glutes and erectors, another athlete may have just a strong squat through very developed quadriceps. While training the competition powerlifts does tend to train the limiting factors more (weak quads will get a higher relative stimulus from squatting than super-strong glutes, and thus tend to adapt faster and catch up to some extent), this is not always the case.

Lifters often adapt techniques to net-suboptimal movement patterns to seek a temporary adjustment to weak areas. For example, a glute-dominant squatter may sit back further than biomechanics recommends is best, simply to utilize his/her glutes more and quads less. This results not only in the development of a poor (and potentially limiting) squatting style, but prevents the quads from catching up and makes the problem that much worse by continuing the cycle of glute dependence and squat weakness. This is especially a concern in advanced athletes that have clear limiting factors and clear strength to their lifting, as opposed to intermediates who still need to develop strengths and beginners who need to develop everything evenly.

Another common scenario is that certain links in the kinetic chain of a movement may simply have higher workload tolerances and needs. While the quads may need 20,000kg per week of work to best grow in size or develop in strength, the lower back and hips of the same athlete may only be capable of performing 15,000kg of work per week, past which they fatigue rapidly and begin to become overwhelmingly susceptible to injury. Put simply, there's only so much squatting you can do until your back snaps in half, and sometimes, your quads, glutes or adductors can still use and benefit from extra work.

What's the solution to both this and the problem in the preceding paragraph of relying on dominant contributors to a movement and neglecting other potentially very useful muscles and movements? Exercise variation can be an indispensable tool in this regard. By replacing competition squats with high bar squats in our glute-dominant squatter example, the quadriceps can be much more heavily taxed and thus receive proper stimulus, while the glutes are taxed perhaps just enough to retain their abilities. If a bench presser is relying on his strong pecs by using a wide grip and his lockout is suffering, some closer grip work may enhance triceps stimulus and pay big dividends for the lockout when competition wide pressing is later resumed. Rack lockout work or block pulling can allow a deadlifter with weaker back muscles and stronger legs to finally get the extra volume his back needs without overly taxing his legs by pulling so much from the floor.

Of course this whole discussion of the benefits of exercise variation can be used to explain why assistance work is so popular, and indeed it should be. But we must be clear that this argument is not overly obvious or set up to burn a straw man. There are many relatively influential lifters and coaches that preach "sticking to the basics" to such an extreme that they only recommend doing the powerlifts themselves. While there are instances (closer to a meet, coaching super-elite and well developed lifters) in which this approach is the correct one, restricting yourself to the same three competition lifts year round is not likely the best approach.

3.) ASSISTANCE MOVES TOO SIMILAR TO COMPETITION MOVES

When using variation in exercise selection, we must remember that the

whole purpose of the endeavor is to provide a directed, effective, and novel stimulus. Thus, the exercise variant must target needed areas, provide a big enough stimulus to grow muscle or improve strength, but also, be different enough from the competitive moves to actually have a varying effect.

An occasional flaw in program execution is the utilization of assistance movements that are too similar in form and function to the competitive movements. Such assistance work does not change the stimulus meaningfully enough, and thus neither delivers all the benefit of variation for its own sake nor directed variation for needed areas. For example, front squats are designed and intended to overly stress your quads. The purpose of a front squat for a powerlifter is to grow or strengthen the quads, not simply to stand up with the weight. If you turn the front squat into a competition squat lookalike by tilting forward at the chest, rising with the hips first, and using your posterior chain to straighten out at the top, you neither gain the directed benefit of quad stimulation nor the benefits of novelty from variation, as that movement is biomechanically almost indistinguishable from the competition squat, save bar position. Thus when performing front squats, the best approach is probably to do them almost completely upright and push with the quads. Over one or several mesocycles, this will lead to bigger or stronger quads that can now be integrated into the competition squat to great benefit. In simple terms, make sure your assistance work is actually different in quality to your competition lifts, and you'll reap the benefits of exercise variation in both a directed manner (the stronger quads you needed) and for its own sake (the different muscle activation patterns that spur new improvements for lack of staleness).

SUMMARY

In basic powerlifting terms, the Specificity Principle does not mean we always train with heavy singles in the competition moves. It does mean that all of powerlifting training must be specific to improving performance in the sport, which means growing and strengthening the muscles and movements involved in the sport is the overwhelming priority, with no room for much else. In any meet prep macrocycle, direct specificity (the actual competition lifts in strict technique, heavy) must be made the priority as the meet nears, with more supportive work like hypertrophy and basic strength assistance work playing an incrementally smaller role.

Key Points

- Specificity is the spectrum of how what we do in training transfers into the improved performances that we want. The greater the specificity of training, the greater the effect of training will transfer into improved performance
- Training specificity for powerlifting should address the issues of training for size, training for strength, training to improve technique, training to peak for competition, recovery, adaptation, and injury management
- Directed Adaptation is the process in which training adaptations are summated and enhanced through repeated stimulation. Training foci should be concentrated and specific for a set amount of time, rather than trying to train everything at once and become the jack of all trades, master of none
- Non-Specific training, or training not directly relating to success in powerlifting, is time and training that could have

been spent doing specific training or just time focused on recovery and/or adaptation

- Specificity does not imply that training should exactly mimic performance year round. In powerlifting athletes are not limited to just using the competition lifts for heavy singles and doubles, but rather a variety of exercises, volumes and intensities that can potentially enhance performance

SOURCES & FURTHER READING (CLICK TO READ)

Specificity Defined and Related Components

- Principles and Practice of Resistance Training
- Periodization 5th Edition Theory and Methodology of Training
- Science and Practice of Strength Training
- Essentials of Strength and Conditioning
- Training Principles: Evaluation of Modes and Methods of Resistance Training – a Coaching Perspective
- Transfer of strength and power training to sports performance

Transfer of Training Effects

- Training Transfer: Scientific Background and Insights For Practical Application

Task Specific Skeletal Muscle Hypertrophy

- Nonuniform Response of Skeletal Muscle to Heavy Resistance Training: Can Bodybuilders Induce Regional Muscle Hypertrophy
- Whole Body Muscle Hypertrophy From Resistance Training: Distribution and Total Mass
- Nonuniform Muscle Hypertrophy: Its Relation to Muscle Activation in Training Session
- The Adaptations to Strength Training: Morphological and Neurological Contributions to Increased Strength
- Regional Hypertrophy

Interference Effects of Concurrent Type Training

- Concurrent Training: A Meta-Analysis Examining Interference of Aerobic and Resistance Exercises
- Concurrent Strength and Endurance Training: From Molecules to Man

Fatigue and Performance

- Interactive Processes Link the Multiple Symptoms of Fatigue in Sport Competition
- Muscle Fatigue: What, Why and How it Influences Muscle Function
- Unraveling the Neurophysiology of Muscle Fatigue
- A Comparison of Central Aspects of Fatigue in Submaximal and Maximal Voluntary Contractions
- Principles and Practice of Resistance Training

- Periodization 5th Edition Theory and Methodology of Training
- Tapering and Peaking for Optimal Performance

Flexibility Training and Performance

- The Effects of Stretching on Performance
- Effect of Acute Static Stretch on Maximal Muscle Performance: A Systematic Review
- The Effects of Stretching on Strength Performance

Specific Adaptations to Imposed Demands

- The Adaptations to Strength Training: Morphological and Neurological Contributions to Increased Strength
- A Framework For Understanding the Training Process Leading to Elite performance
- Exercise Physiology

OVERLOAD

SCIENTIFIC DEFINITION

Overload is our next most important training principle after specificity, and is absolutely critical to the even marginal success of a powerlifting training program. One of the oldest and most research-grounded training principles, overload has a well-established, two part definition. We can say that a training stimulus (whether exercise, rep, set, or session) presents an overload when:

- a.) The stimulus is within the maximal threshold of the adaptive system, and;
- b.) The stimulus is on average greater than recent historical stimuli.

A maximal threshold for a system is the point above which the system is being disrupted enough to respond with meaningful beneficial adaptations. Disruption of homeostasis (the body's maintenance of a stable internal environment) leads to a cascade of molecular events that cause adaptive processes to activate and elicit system improvements in muscle size, force production, and a host of other factors. Within this maximal threshold (between the minimum stimulus that elicits

adaptations and the system's maximal exertion capacity), training elicits significant and meaningful adaptations. Below this threshold, the system may make adaptations, but at such a slow rate as to not be practical from a training perspective.

Once a system has been presented with a certain stimulus within its maximal threshold, it undergoes adaptation. The entire purpose of most body systems' adaptive abilities is to better resist disruption, so once the adaptations have been made, the next stimulus must be greater than the one originally presented so that it may elicit a similar disruptive effect and thus a similarly large adaptive response. Elements of variation and fatigue management make linear and consecutive overloads counterproductive in most cases, so the recommendation to make every session more overloading than the last is imprudent. However, the average session must in fact be greater than the last in order for the overload principle to be met and positive results to be maximized.

What exactly does the overload principle imply for powerlifting training?

POWERLIFTING DEFINITION

The powerlifting-specific definition of the overload principle is also split into two distinct parts, and presents as follows:

- a.) Training that maximally stimulates adaptation must meet minimum functional intensities and volumes. Training must be heavy and voluminous enough to add the most size, heavy enough (with requisite minimal volume) to add the most strength, and near limits of exertion to train technique for 1RM lifting. The exact requirements for these overload thresholds will

be discussed in detail in the section on proper execution of the overload principle.

b.) Training must get harder over time. Not every consecutive session must be heavier or more voluminous than the last, but over weeks, months, and years of training, both intensities (bar weights) and volumes (sets x reps x weight) need to elevate to continue the fastest possible performance progressions.

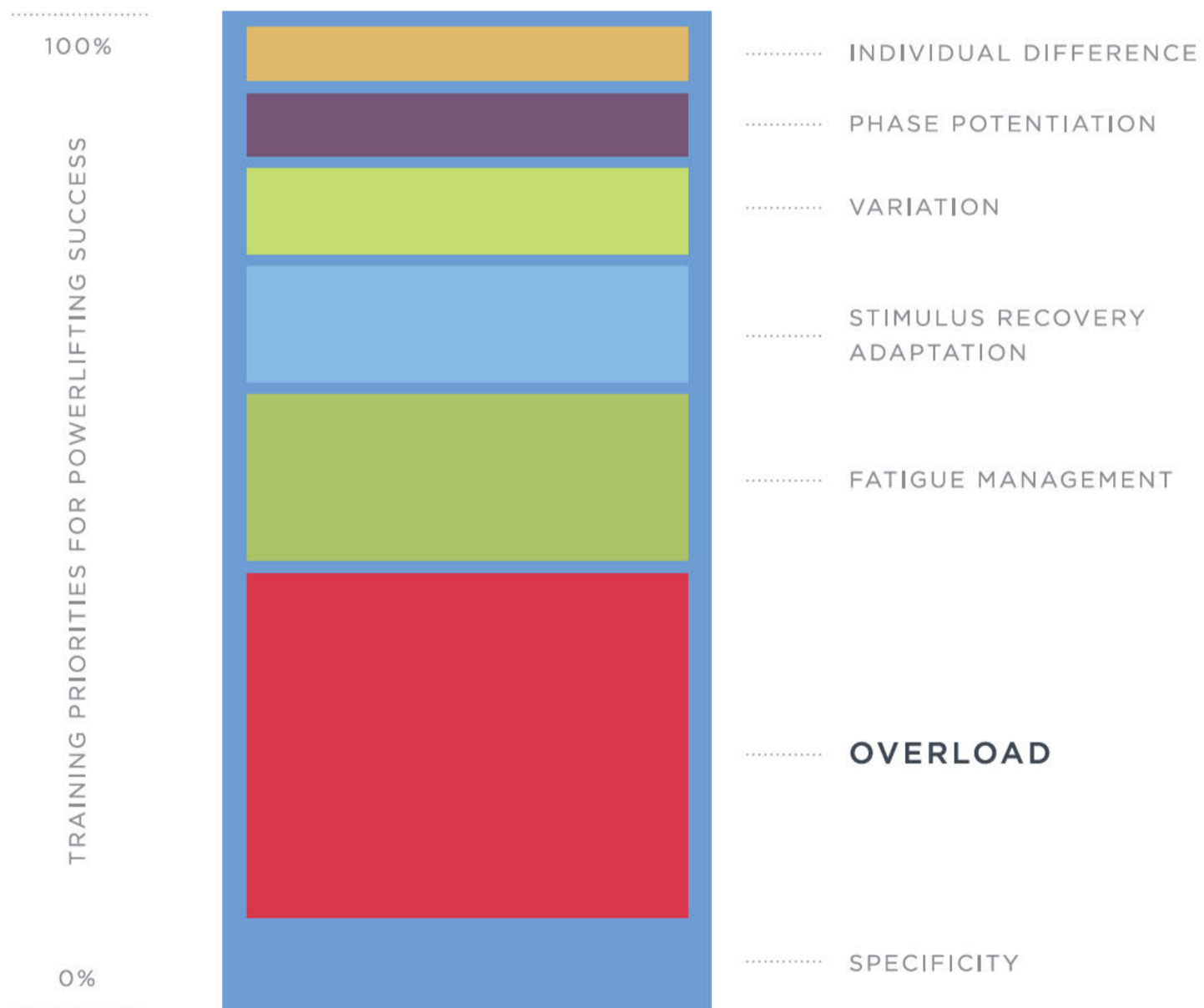
Overload in powerlifting basically means you're going to have to train heavy and hard, and regularly do workouts that you've never done or been able to do before... with either more weight, more sets and reps, or more of everything.

PRINCIPLE IMPORTANCE RANK

Overload comes second in the ranking for one reason: specificity is king. Without specificity, overload for powerlifting training could be misconstrued to be running 5 miles at 10 miles per hour when last week you ran 4 miles at 10 miles per hour and your fastest pace ever is 5 miles at 11 miles per hour. If you look closely, none of that training actually violates the overload principle and in fact concords with it quite well. The problem is that only specificity can guide us into the direction of remotely applicable training, and only then is overload relevant to improving our desired abilities, rather than just improving some random abilities.

Once the training type is specified, overload is the next most important principle. Without overload, adaptations simply don't occur. In order to squat 600lbs, there's nothing you can do with squatting 135 that will get

you there. Overload is so powerful, in fact, that together with specificity, we have the formation of the first functional training approach. If the ONLY variables you take into account in a program are specificity and overload, you can in fact make progress and get strong... not nearly as strong as you can with the other principles included, but the effect is there.



IMPLICATIONS & EXAMPLES OF PROPER APPLICATION OF OVERLOAD

1.) TRAINING AT MAXIMUM RECOVERABLE VOLUME

For every single lifter under every single circumstance, there exists a theoretical “Maximum Recoverable Volume (MRV).” To be described in more detail in the next chapter (Fatigue Management), MRV is the maximum volume of training a lifter can perform, recover from, and benefit from.

Generally, training volumes can be categorized in the following scheme:

- a.) Training that is not voluminous enough to incur any meaningful and desired adaptations
- b.) Training that is voluminous enough to incur some meaningful and desirable adaptations, but not the most that can be accrued
- c.) Training that is at the MRV, and is the most volume that lifter can benefit from.
- d.) Training that is higher in volume than the MRV but not overwhelming to recovery in the medium term and is still beneficial, though less than maximally
- e.) Training that is so high in volume that recovery is far enough behind to be a net negative on performance in the short-to-medium term.

The range between points b and d is where overload volume is being applied. So long as minimum intensity ranges are exceeded, getting

between points b and d will highly benefit the training process. Since the interval between c and d represents incrementally more work, fatigue, and injury risk, getting anywhere between b and c, and as close to c as possible, is the most reasonable goal with training volume programming. But how much volume is this?

The best way to determine the MRV is to keep climbing in volume until the next training phase (whether session, microcycle, or mesocycle) is reduced in performance due to high fatigue. If you've been squatting sets of 10 at 315lbs and adding sets of 10 each week, when you can't hit a set of 10 and fail at 7 or 8 reps at 315lbs is just past your MRV at that weight. The second best way to find out is to administer a fatigue checklist. Is the bar feeling disproportionately heavy? Is the desire to train way too low? Is sleep off track and is hunger decreased? If no, then more volume can be experimented with. But for the most part, performance itself is the best metric. If you're still handling higher volumes and intensities, you're likely still at or below your MRV, which is where you want to be.

After months and years of training while tracking volumes, intensities, and their responses to them, individual lifters can get very good at knowing how much volume they can recover from and still benefit. Now, your volume tolerance can change from training, nutrition, and lifestyle factors such as sleep quality, so there's no easy formula. MRV is also different for different intensities of training... you can recover from a whole lot more volume at 60% 1RM than you can at 95% 1RM. However, especially if you know your average volume tolerance for different weight/rep ranges, program from there can give you a very good start.

But be under no illusion, doing less than you can recover from is not the

best way to train. If you chronically under-shoot your MRV in training, you're simply leaving potential PRs right there in the gym. If you're serious about results, chase your MRV and if you like, stop just short. But don't stop a mile out for fears of over-reaching. The best athletes always have and always will walk the line between maximal benefit training and overreaching. It just happens to come with the sport.

2.) HYPERTROPHY TRAINING OVERLOAD REQUIREMENTS

In order to train for speed, you've gotta present a velocity overload (run really fast). In order to train for strength, you've gotta present a force overload (lifting heavy weights). And just the same, in order to train for hypertrophy, you also need to present an appropriate overload. But what the heck is the appropriate overload for hypertrophy? It's not nearly as intuitive as the overload for speed and strength; that is for certain.

The overload for hypertrophy has a volume and intensity component. As mentioned previously, weights lighter than around 60% 1RM for a movement do not stimulate the cellular signaling pathways for muscle growth to nearly the extent that heavier weights do, and are thus largely inappropriate for hypertrophy training. Secondly, once the condition of intensity has been met, volume is a major contributor to hypertrophic outcomes. In fact, differences in intensity past 60% 1RM (lifting at 65% vs. 85%) have much smaller repercussions on hypertrophy than differences in volume (1 set vs. 4 sets, for example). Hypertrophy continues to increase with increasing volume until the MRV for hypertrophy training is met. Hypertrophy training benefits from more volume more than strength training does, for reasons that will be addressed in part in the chapter on fatigue management. How much



volume? While some practical guides will be offered later in this book, the MRV is the real answer, and generally, it's not 3 sets of 5 once a week, but much more than that for most lifters.

So far, we've defined the first, maximal threshold component of overload for hypertrophy training. Yes, training has to be heavy enough (60%), and volumes have to be high enough to stimulate meaningful gains in muscle size. The second component of overload is that the training sessions should, on average, be increasing in difficulty.

In hypertrophy training, this means that one of three approaches must be taken:

- a.) The volume must already be high and the intensity should be going up (thus slowly inching up the volume as well by adding 5-10lbs to the bar each week)

b.) The volumes must be increasing while intensity is held constant (adding sets each week to squatting for 10 reps with 315, for example)

c.) Both volume and intensity increase slowly (squatting 315 for 3x10 in week one, and working up to 335 for 5x10 in week 4)

Various good coaches and the programs they write take one of the three approaches, and it's not yet certain which one of these is best. What is clear is that some incremental increase in volume is almost certainly a best practice, and intensity increases likely play beneficial roles as well. To put it another way, if your program calls for the following progression:

Week 1: 315 for 5x10

Week 2: 335 for 4x8

Week 3: 365 for 3x5

It is not likely to maximize potential hypertrophic responses to training because of the consistent drop in volume from week to week.

3.) STRENGTH TRAINING OVERLOAD REQUIREMENTS

While hypertrophy has a minimal intensity and puts a premium on increases in volume, strength training has a minimal volume but puts a premium on increases in intensity.

The minimal volume for strength training is lower than that for hypertrophy, primarily because strength training is, per unit volume, more fatiguing. To be covered in detail in the next chapter, heavier loads

are more fatiguing than lighter loads, even with the same volumes. Additionally, strength training requires the lifting of much more limiting loads than does hypertrophy training, and thus the total level of fatigue being carried during a strength phase must be lower, as being too fatigued would preempt the kind of heavy training that is in fact overloading. You can still bang out high reps when you're beat up, but you can only be so beat up if you're doing sets of 3 to 5 reps. There are other concerns that will be addressed in the Fatigue Management chapter (particularly for the nervous system), but for the purpose of this section, it is sufficient to point out that the volume requirement for strength is lower than it is for hypertrophy. Some practical info will be presented on such recommendations later in the book. For now, let's say that one set of 5 per bi-weekly workout is not enough, 5 sets of 5 is very much pushing it in the right directions for most lifters, and 10 sets of 5 is almost certainly too much for most.

The minimal intensity for fastest strength adaptations is usually described at around 75% 1RM. Anything less than that does not disrupt nor signal the nervous system to expand on its force-generating capacities for a given unit of muscle size. Yes, you can get bigger by training as light as 60% of 1RM, and that new size can make you stronger, but the direct strengthening of existing size only occurs best above 75% 1RM.

We now have our maximal threshold condition for the overload of strength training; volumes must be in the moderate range, and intensity should be 75% at minimum in most cases. But what about the second "progressive" condition of overload?

It turns out that by increasing volume without increasing intensity,

we can see large increases in hypertrophy. But such is not nearly the case with strength training. While volume increases are mandatory and intensity increases are optional in optimized hypertrophy training, the reverse is true for strength training. To meet the second condition of strength-training overload, our volumes may not need to change much during the mesocycle, but our intensities almost certainly need to go up.

Just like you don't get your biggest just training 3 sets of 10 all the time, you won't get your strongest unless you progressively increase intensity. This of course means that every session, week, other week, or however you structure your progression, the weights on the bar must get heavier. Starting a strength mesocycle from 75% 1RM and moving up towards (and perhaps past) 85% or your 1RM is likely a very good general approach in this regard.

Long story short; with moderate volumes, your weights in a strength phase should start out heavy (75% 1RM+), and progressively get heavier for best results.

4.) PEAKING TRAINING OVERLOAD REQUIREMENTS

To be addressed in high detail in the chapter on Phase Potentiation, peaking training is designed to accustom the body's systems to producing limit forces in a stable manner so as to prepare for the actual execution of 1RM lifts at the meet itself.

Peaking training has several major goals:

- Accustom the lifter to loads approaching 1RM

- Enhance the particular technique needed to remain stable at these loads
- Retain general strength abilities
- Reduce fatigue while maintaining existing fitness and expressing new fitness in the days and few weeks before the meet itself

While the entire plan for executing a peak can be quite complex, in this section we're mainly interested in the overload requirements for this phase. The very end of this phase is characterized by reductions in both volume and intensity, thus the overload principle takes a major back seat to fatigue management. Until this time, however, the peaking phase has distinct and important overload requirements.

Since one of the most important functions of the peaking phase is to prepare the athlete for the heaviest of loads; the heaviest of loads must be presented. In the case of the peaking phase, the overload threshold for intensity is above 85% 1RM. It is only above that threshold that the particular kind of instability that comes with maximal lifting presents itself. To be specific, when training for a 3-5 rep range in the 75%-85% range, the submaximal forces required allow some leeway with technique and particularly core (abdominal and lower back) tightness. The walkout can be less than economical, as the lifter has sufficient energy and stability to correct footing as an afterthought. In maximal lifting, any non-trivial lack of tightness or setup can immediately cost pounds of force production by misaligning joint angles and requiring the muscles to work from more poorly leveraged positions. In addition, the setup must be as economical as possible so as to minimize the amount of energy spent on it, and thus saved for the lift. In a 3-5 rep lift, this bit of energy

is largely inconsequential. In the maximal lift, it can make or break a PR attempt. There is no way to practice for the maximal lifts other than to actually use near-maximal lifts in training; above 85% 1RM, in the 1-3 repetition range per set.

The volume threshold for the peaking phase is very low; the lowest of any major phase.

This requirement stems from two reasons

- High volume training alters the nervous system to execute numerous submaximal contractions, directly interfering with its ability to execute the single, maximal contractions required for best 1RM performances.
- The weights being lifted are so heavy, fatigue must be kept very low so as to allow the lifter the capacity to execute the needed lifts. Fatigue also has effects on technique execution, which can make or break a peaking phase lift.

The volume recommendation for the peaking phase is lower even than strength phase, and will look something like only a few sets per session of 1-3 reps on the main lifts for most lifters.

As for progression, the volume of the phase will remain mostly constant, and the intensity will progress in small increments through the phase (until the taper begins). This slow progression allows the lifter to start at reasonable poundages and work up to limit weights over the weeks. It can capitalize on the technical improvements under limit weights that are learned during this phase, allowing such progressions to occur smoothly as capability to execute near-max lifts slowly improves.



5.) THE PSYCHOLOGY OF OVERLOAD

There may be something to be said for the psychological variables involved in training with the overload principle in mind. In particular, the expectation of difficulty in applying this principle consistently.

For best results in powerlifting training, overload mandates that we regularly lift weights that we've never lifted before for reps we've never lifted before. As you get stronger, this process can be downright scary. When you squat more than 405lbs, the normal gym 45lb barbell starts to bend... just sitting in the rack, as if waiting for you to make your next move. You think about how hard and crushing your last week of training was, and how you barely made it out in one piece, and then you have this weight... 10lbs more than last week, staring you down with the cold, emotionless glance of steel. It can be a very tough endeavor to

consistently come in, read your program and be OK with the idea that you're risking injury and ego, singing up for a considerable amount of discomfort, and still executing the plan. What's worse is that the kind of PRs that constitute most of powerlifting training are rep PRs, largely between 3 and 10 reps depending on the phase of training. It's easy to get psyched up for a max single, but for an 8RM that's only 10lbs more than last week?

Even still, getting psyched up for too many workouts in a row can wear down your psychological drive, so the only real choice is to fundamentally accept the idea that this type of risk, discomfort, and tenacity is simply a part of the sport, not to be worked around or avoided. And people try, some try quite hard to avoid having to progressively make training harder with unplanned deloads, only lifting when feeling great, cutting off extra volume, or replacing overloading assistance work with easier options. Those are all fine ideas, but they simply won't get you the best results. The only way to get those is to go through that cold steel glance and get the needed work done. Nothing less, nothing more.

That's how the strongest lifters have been getting stronger for decades... without Facebook or YouTube or Instagram... by slow and steady pushes out of the comfort zone and into the maximal threshold, over long periods of time.

UNDER-APPLICATION OF OVERLOAD

1.) NOT ENOUGH INTENSITY AND VOLUME

INSUFFICIENT VOLUME

In order to benefit from training the most, the application of overload instructs us to train near our Maximum Recoverable Volume (MRV). To be explained in complete detail in the chapter on Fatigue Management, MRV is essentially the highest amount of training volume that a lifter can recover from given a certain set of circumstances. In order to get the maximum benefits from training, normal training volumes need to be substantially close to that figure. In plain terms, just going in and showing off with heavy weights doesn't constitute best training practice. Yes, heavy weights must be lifted, but the volume of training must be high as well in order for gains to be made in the most rapid manner. It's not good enough just to do a set or two of the main lift per week and be done with it. Multiple sets and exercise are usually required for most lifters to maximize adaptations. If you're doing too few sets, you're actually mostly testing your abilities rather than overloading to improve them.

There are numerous currently popular programs that underload volume to a significant enough extent to merit mention. A primary example, 5-3-1 is an excellent program for beginner lifters, but the low volumes of the program are simply inappropriate for most intermediate and advanced lifters. Those who have been training for more than 2-3 years have likely developed an MRV that's much higher than the training prescription of a program like 5-3-1 and would greatly benefit from increasing their weekly volume of training by adding more sets to the existing structure.

Some Westside derivative programs are excellent for training to compete in powerlifting equipment. These programs are low volume for a very good reason: the heavier the loads, the lower the MRV tends to be for

any given session, week, or mesocycle. If you're squatting 1000+lbs in training, there are only so many sets of that you're going to be able to sustain over the course of training, and it's not that many... perhaps as low as one to three top sets per week at those intensities. The problem is not with these programs per se, but their utilization by raw lifters. Raw lifters don't experience nearly the relative intensities that equipped lifters do and can thus concomitantly recover and benefit from higher volumes. Using equipped powerlifting programs for raw training is thus usually not the best approach.

INSUFFICIENT INTENSITY

Not only does volume need to be high, but intensity as well.

The minimum functional intensities for the three main adaptations sought in powerlifting training can be summed up as follows:

Hypertrophy Minimum Intensity: 60% 1RM

Basic Strength Minimum Intensity: 75% 1RM

Peaking Minimum Intensity: 85% (developing technical prowess with near-maximal loads)

Those are average figures, so not every session needs to meet or exceed them, but most should and the average session must. If your hypertrophy assistance work for triceps is sets of 30 reps on cable pushdowns and that happens to be 40% of your 1RM, you're not getting the maximum hypertrophic effect. If your strength work has you mostly lifting 65% loads at high velocities, you're not getting the most out of it. If you never go above 85% 1RM in the weeks leading up to a powerlifting meet,

your technical mastery and neurological preparedness for maximal loads will be sub-par and you're likely to be less stable under your highest attempts and generally underperform.

Most powerlifters don't have a problem with the latter two overload thresholds (strength and peaking), but many violate overload for the intensity of hypertrophy work. True hypertrophy work is very overloading, and looks a heck more like sets of 8 in the squat than it does like sets of 25 in the leg extension. If you're doing the latter, there had better be a very good extraneous reason for it.

2.) EXCESSIVE SPEED WORK

As mentioned earlier, the sport of Powerlifting is perhaps the biggest misnomer of all sport names. Power is the product of high forces and velocities. But in powerlifting, velocity is neither judged in the scoring nor relevant to performance. No matter how fast you'd like to move the bar, maximal lifts move very slowly... their velocity is low. Because powerlifting is actually a low-velocity sport, it probably should be named "Forcelifting," as testing higher forces is the name of the game, and the lifter with the highest forces, velocity be damned, wins every time.

Since we're stuck with the name, we can't make too big a gripe about that, but we can spot some substandard training methods that conflate the demands of the sport. Speed work is one such training method, and its use in powerlifting training is greatly overvalued, though losing ground consistently since the raw revolution of the last several years.

Maximal intent to move (MIM) is a term that describes how hard a

lifter pushes or pulls the bar. With a true maximal intent, both the performance of a lift in competition and the benefits to physiology in training are maximized. A sound program should recommend that most main training lifts are moved with maximum intent. However, the bar load still mostly determines velocity, as you're only going to move 85% so fast. Speed work describes not the MIM, but rather a purposeful use of lighter weights in order to develop movement velocity, which hypothetically somehow transfers to enhanced performances with competition-heavy weights.

The problem for speed work is two-fold. Firstly, MIM accomplishes all of the neural and fiber-type alterations the speed work does, so any argument for speed work cannot rest on those benefits. Secondly, speed work knowingly decreases intensity overload, while MIM does not.

So if the performance transfer of speed work is no higher than MIM but intensity overload is violated by employing it, should we discard speed work altogether? For powerlifting, very likely. Many lifters have benefitted greatly from programs that incorporate speed days, but that is largely due to the fact that speed days both lower intensity and volume of training (almost no one does 10 sets of 5 for speed). This lowered volume and intensity assist the program effect by acting as light sessions to enhance fatigue management and recovery. More recovery can absolutely translate to better performances given other elements of proper programming are in place.

The verdict on speed work is this: you can absolutely do it as a result of doing MIM with light-day loads to manage fatigue, but it's almost certainly not worth doing for the development of high submaximal velocities or for some other form of what amounts to being its own sake.



3.) ASSISTANCE WORK THAT VIOLATES OVERLOAD

The purpose of assistance work is very straightforward. After main lift work is done, assistance work presents more volume and intensity with the goal of stimulating gains in size and/or strength. That's right, outside of rehabilitative or preventative training modalities (which are not covered under primary sport training and should be overseen or programmed by a physical therapist or athletic training), assistance lifts are done to get you bigger and/or stronger. Overload is a must for both pursuits, and its violation can interfere with the effectiveness of assistance work itself and thus the program at large. Two general issues arise with the selection of assistance work modalities, volumes, and intensities:

A.) CHOOSING HOMEOSTATIC ALLY DISRUPTIVE EXERCISES

If the purpose of assistance work is to get bigger and/or stronger, then overload is a must. Overload is satisfied most with exercises that tend to disrupt homeostasis the most... exercises that present the most overload generally cause the most beneficial adaptation.

As a general rule, the average homeostatic disruption ability per unit of work of exercises is as follows, from most to least disruptive:

- Barbell Movements
- Dumbbell Movements
- Cable Movements
- Machine Movements

In addition, compound movements tend to disrupt homeostasis better than isolation movements, so that's a consideration as well.

When choosing assistance work, so long as you don't exceed your MRV, the most homeostatically disruptive and thus overload-generating movements should be at the top of the list. Some of the best assistance work for the quads is close stance high bar squatting, which beats leg extensions almost every time. One of the best assistance moves for the chest is wide grip benching, which beats the pec deck machine almost every time, and the one of the best assistance moves for the hamstring is the stiff-legged deadlift, which beats the seated leg curl machine almost every time.

If you're nearing MRV and still need targeted assistance moves (near MRV but your triceps are toast, need more chest work still, for example), you can use the isolation moves and the less homeostatically disruptive moves with better results (due to not exceeding MRV) than the compound barbell and dumbbell basics, but that's a rare case. The first-glance recommendation for assistance work should almost always be with the tried and true homeostatically disruptive moves.

B.) AVOIDING OVERLOAD-SUPPRESSING MODALITIES

While some assistance moves that are not the most disrupting still have some use due to their lower effects on MRV and fatigue, still other moves have no discernable use in powerlifting training, and, bluntly, are almost always a waste of time.

Unstable training (either via Bosu ball or another unstable surface or via vibrating or oscillating bars) greatly reduces overload to the point of dipping far below the threshold for any hypothetical adaptations. Your nervous system focuses on making sure you don't fall rather than on summing huge forces that produce strong lifts and high overloads. Additionally, these modalities don't seem to confer any benefits to maximal lifting, and seemingly only prepare you to excel at... using the modalities themselves.

The best thing about a Tsunami Bar? It wobbles up and down. That's about it. No beneficial training effect to mention, and a whopper of an overload killer!



4.) POOR BEST-EFFORT TRACKING

Overload is of utmost importance to the training process. In order for training adaptations to be maximized, overload must occur in both volume and intensity. In order to present an overload, we must be sure that the average current effort is both within the maximal threshold and greater than recent past efforts.

Planning an effort within the maximal intensity threshold isn't terribly difficult. If a weight feels very heavy, it's probably within the threshold. With the knowledge of the basic minimum intensities and a cellphone calculator, a double-check takes almost no time at all.

Planning volumes is a bit tougher, but if you have been training long enough, you know about how many total sets and reps it takes to get the job done.

On the other hand, meeting the “recent previous stimuli” condition of overload requires a more intimate knowledge and record-keeping of recent past volumes and intensities. How many sets of squats were done in the peak microcycle of the last mesocycle? Was it 4 or 5? If memory is wrong, a quite drastic and meaningful failure to present volume overload may occur. Did you squat 350 the last time you went heavy or was it 355? Did that bar weigh 45lbs or 55? And assistance moves? Forget about it! You and the training partners just pile the plates on the leg press until you can’t get 8 reps anymore...who knows how many sets or how much weight that was?!

As you can begin to see, a lack of tracking best efforts can present some problems to meeting overload. If your best in the squat was actually 15lbs higher than you thought, your next 2 or 3 workouts might be lacking in the second overload condition as you use weights that are too light. Especially on assistance moves, it’s absolutely worth it to track best efforts so that training can be planned to produce an overload. If effort tracking is a common practice, it becomes difficult to make sure that a steady overload is being presented.

Tracking is almost always a good idea, but tracking weights doesn’t mean you have to present an overload literally every time you’re not deloading. Some more experienced lifters might have a slew of injuries which need quite a bit of working around and managing. Planning to overload might be replaced with a sporadic deload if the injury is not cooperating on that particular day. Still other times, a planned deload might be replaced with an overloading session if the injury site is feeling good that day. For lifters training close to their career limits of achievement, days on which high fatigue is present may call for deloads, as true overloads demand more and more ideal circumstances to be

attainable. It's not every day you can squat 900+, so if you're supposed to do that but you feel very beat up, a deload is probably better than missing the weight several times in a row and risking injury. This kind of training by feel is not the best possible scenario, but sometimes it's the only realistic one.

Training "by feel" should be reserved for advanced athletes undergoing injury management or attempting to control unexpected fatigue. Most everyone else should stick to the plan. You might not always "feel" your best, but most of those times, an overload is quite possible if the rest of your program is reasonably constructed. If training by feel, a considerable amount of intrapersonal honesty comes in handy. Much "training by feel" results in moderate volumes and intensities at best because training is hard and you're not likely to every feel like actually pushing yourself far enough. You've gotta admit when it's really an injury concern or unexpected fatigue rather than just sneaky laziness. If you can avoid it, don't train by feel, and to the extent that you have to, be honest with yourself.

OVER-APPLICATION OF OVERLOAD

When the overload principle is taken too far and applied to excessively, the training process can be significantly hampered. Because an over-application of overload often results in an uncontrolled accumulation of fatigue, many of the ideas discussed here will be revisited in the later chapter on Fatigue Management. Though in this section, more acute negatives of too much overload are given more attention, versus the more chronic negatives of too much overload that will be the focus of under-application of fatigue management later.

1.) TRAINING TO FAILURE TOO OFTEN

Training to failure has one advantage, but two disadvantages to the powerlifter, and on the net balance is not a recommended training tool.

Advantage: Training to failure might slightly increase the amount of muscle grown from any single training session, and might have similar effects on strength, though the net balance of the research on this is still unclear as of this writing.

Disadvantage 1: For the same amount of volume, training to failure is incredibly fatiguing. While it only increases muscle growth in a session by a small margin, its effect on fatigue is disproportionately high. This means that the chances of having a good next training session (or even next exercise in the same session) by recovering on time and performing well are much reduced.

Disadvantage 2: Training to failure, especially with heavy loads, likely increases injury risks. This occurs because movement stability is highly compromised at or near muscular failure. This instability with heavy loads can cause an increased chance for acute injury. Additionally, missing a squat (and a bench, to a lesser extent) can be a downright disaster, even with the right spotters and safety systems.

On the net balance, training to failure seems to be a possibly useful tool at certain times for the bodybuilder, especially if lighter weights and machines are used to enhance safety. For the powerlifter, training to failure is of much limited use and does not garner high recommendation.

2.) MAKING EACH WORKOUT HARDER THAN THE NEXT ON PRINCIPLE

As the volume and intensity of training increase, so does the fatigue. Volume is an especially high contributor to fatigue, and a high enough fatigue level, among other things, will make the powerlifter less able to lift as heavy as they are capable. This presents a distinct problem, as the application of overload seems to itself cause the later inability to present an overload.

In order to continue to be able to present an overload in most workouts, some workouts must be intentionally non-overloading so as fatigue can dissipate. Formally known as the principle of Fatigue Management, the precise way in which fatigue is kept in check via training is going to take the whole next chapter to cover. For the purposes of this section, it's sufficient to state that in any logically designed plan, not all workouts will be successively overloading, and that some workouts will be intentionally non-overloading in order to manage fatigue.

This structure can take the form of every other workout being a lighter or less voluminous day (Westside, for example), or of intensity increasing through the week only if volume is decreasing to counterbalance fatigue (undulating periodization, various "Eastern-European squat routines" such as Smolov, and the like). These programs are not violating overload simply because they are not presenting it in EACH workout. But if the larger program is viewed, it presents steady overload within the timeframe of weeks.

If you attempt to make each successive workout more overloading than the next as a rule, you'll quickly sum up enough fatigue that this

very structure of training will become self-extinguishing and thus unsustainable.

3.) PERFORMING NON-PROGRAMMED “INSANITY” WORKOUTS

Every now and again, your best training partners show up on the same training day, and everyone is feeling good. Your lifts are moving fast, so the group decides to abandon the current workout (or simply continue after it's complete) and do an “insanity day” where very pronounced increases in volume and/or intensity occur.

Such changes can include, but are not limited to:

- Multiple sets of high rep walking lunges
- Drop sets of squats
- Maxing out when not planned
- Going “rep for rep” with a training partner
- Using the verbatim weights of a stronger training partner

What must be admitted off hand is that such workouts are definitely fun as well as very overloading and absolutely effective to incur adaptations. But a problem arises; where do you go from there?

If a workout is miles harder than the ones you typically consider challenging to recover from, it's going to leave you quite less able to get your normal sessions in during the following week. Additionally, NONE of those sessions will now be overloading, at it might be until the next mesocycle that you're recovered enough and have lost the adaptive

resistance enough to once again begin to benefit from “normal” (read: sustainable) hard workouts. A crude analogy to this would be something like having the most delicious and sought-after item in a taste-testing of a good chef’s work first. After you bite into that exquisite piece of sushi, crème brulee or steak tartar, the rest of the meal will simply not be as enticing. Not nearly as enticing and enjoyable as it could have been had you saved the best for last.

And that’s the real problem with “insanity workouts.” Even if they fit the general plan (I’m not so sure what high rep lunges are really going to benefit for a powerlifter), they don’t save the best for last, and can render a good timeframe of future attempts at overload ineffective. Because the body’s systems only have a finite window of adaptation, “insanity” workouts can often match or exceed that window (in which case most energy is spent simply recovering from the workout and not adapting). Thus the benefit of the workout is capped, but its effect on making future overload difficult is not nearly so. This method violates part 2 of the overload principle definition, and should thus be mostly avoided. If you’re dying to do one of these workouts, save it for your last workout before a deload. This will mitigate most of the effects on fatigue and adaptive resistance.

SUMMARY

With all the technicalities and physiological definitions aside, the overload principle is remarkably easy to define in common terms. Lift hard, and over time, lift harder. Make sure your volumes and intensities are within their maximal thresholds, and take baby steps to increase them over time. There are 50 million ways to avoid applying the overload

principle, and all of them are easier. But most powerlifters don't have a problem with this principle in any grand sense because let's be honest... the process of lifting harder and heavier is why most of us are in this sport to begin with.

An often bigger challenge is for powerlifters to resist going too hard at the wrong times, and to deal with the fatigue that comes with overload training. Luckily, that's the very topic of our next chapter.

Key Points

- Overload is the degree of homeostatic disruption caused by training. In order to drive adaptations, the training must significantly stress and strain the underlying physiology
- Overload can be generated through training variables such as volume, intensity, frequency, exercise selection, and proximity to muscle failure
- The maximum recoverable volume is the highest range of total training the athlete can tolerate while still being to recover and make positive adaptations
- Powerlifters should generally be training within their maximum recoverable volume, however should also be aware that adjusting any of their training modalities will come at the expense of recovery and/or the other modalities. Ex: adding hours of additional mobility work while keeping the same training load will come at the expense of time spent recovering
- Powerlifters should seek to optimize their maximum recoverable volume by prioritizing highly specific training and minimizing, if not removing, nonspecific training

SOURCES & FURTHER READING

Overload Defined

- Principles and Practice of Resistance Training
- Science and Practice of Strength Training
- Periodization 5th Edition Theory and Methodology of Training
- Training principles: evaluation of modes and methods of resistance training – a coaching perspective

The Concept of MRV

- Principles and Practice of Resistance Training
- Peaking and Tapering for Optimal Performance
- Resistance exercise overtraining and overreaching. Neuroendocrine responses
- Fundamentals of resistance training: progression and exercise prescription
- Resistance exercise volume affects myofibrillar protein synthesis and anabolic signalling molecule phosphorylation in young men
- Exercise type and volume alter signaling pathways regulating skeletal muscle glucose uptake and protein synthesis

Dose Response of Training Factors Influencing Strength

- Dose Response of Training Factors Influencing Strength
Periodization 5th Edition Theory and Methodology of Training
- Principles and Practice of Resistance Training
- Strength
- Applications of the Dose-Response For Muscular Strength

Development: A Review of Meta-Analytic Efficacy and Reliability For Designing Training Prescription

- Quantitative Analysis of Single vs. Multiple-Set Programs In Resistance Training
- Muscular Adaptations in Low-Versus High-Load Resistance Training: A Meta-Analysis
- The Role of Resistance Exercise Intensity on Muscle Fibre Adaptations
- Effects of Low- Versus High-Load Resistance Training on Muscle Strength and Hypertrophy in Well-Trained Men

Dose Response of Training Factors Influencing Hypertrophy

- Dose Response of Training Factors Influencing Hypertrophy
- Single vs. Multiple Sets of Resistance Exercise For Muscle Hypertrophy: A Meta-Analysis
- The Mechanisms of Muscle Hypertrophy and Their Application to Resistance Training
- Is There a Minimum Intensity Threshold For Resistance Training-Induced Hypertrophic Adaptations
- Effect of Repetition Duration During Resistance Training on Muscle Hypertrophy: A Systematic Review and Meta-Analysis
- Does Exercise-Induced Muscle Damage Play a Role in Skeletal Muscle Hypertrophy
- Effects of Low- Versus High-Load Resistance Training on Muscle Strength and Hypertrophy in Well-Trained Men
- Muscular Adaptations in Low-Versus High-Load Resistance Training: A Meta-Analysis
- The Role of Resistance Exercise Intensity on Muscle Fibre Adaptations

FATIGUE MANAGEMENT

SCIENTIFIC DEFINITION

Because training must present an overload in order to be maximally effective, proper training regularly disrupts homeostasis. The disruption of homeostasis negatively affects 4 different classes of physiological activity that pertain to training:

- 1.) Fuel Stores
- 2.) The Nervous System
- 3.) Chemical Messengers
- 4.) Tissue Structure

So long as training is overloading and sufficiently frequent to provide meaningful results, not all disruptions are healed and not all fatigue is thus dissipated between successive training sessions. Minimum frequency will be addressed more specifically in the SRA chapter to come, but for now just imagine that if you train once a month, it doesn't really matter how hard you train, you'll still recover fully between sessions. Because not all fatigue is dissipated between sessions if you train with any sort of effective training frequency, and each session

adds more overload, eventually fatigue can interfere with performance, adaptation, and even injury risk. Let's take a look at the specifics for each of the four factors and how they contribute to this rising fatigue, which sport physiologists term "cumulative fatigue."

1.) FUEL STORES

Fuel stores can be broken down into 3 primary categories:

- Phosphagens (ATP and Creatine Phosphate)
- Glucose/Glycogen (the stored form of glucose mostly found in skeletal muscle)
- Fat (mostly stored in adipose cells under the skin)

When lifting heavy weights for reps of 10 and below, the energy provided to fuel this effort comes directly from ATP provided by a roughly even mix of the phosphagen system and glycolysis. Since the phosphagen system (including creatine phosphate's role) recovers almost all of its capacity within minutes, it's not a major player in cumulative fatigue. Fat does not provide much direct energy for heavy training, but does play a role in recovery. However unless you run out of body fat, you're not going to experience a limiting factor with this nutrient (would be a pretty good problem to have, no?) The glycolytic system both directly provides energy for such high intensity training and is a major contributor to providing energy for the recovery of the phosphagen system between sets. Thus, it's an overwhelmingly powerful determinant in the performance of most powerlifting training. While blood glucose is a source of substrate for glycolysis (which uses up glucose to form

ATP and fuel muscle contraction), the predominant source of glucose for taxing training is actually muscle glycogen. Glycogen is a tightly packed, branched carbohydrate that is essentially made of thousands of glucose molecules connected to one another. Both the liver and muscle tissue have the ability to store glycogen, but the muscle stores an order of magnitude more, and its stores are much more directly related to performance, as liver stores are mainly used to maintain safe blood glucose levels for operation of the nervous system.

Muscle glycogen is constructed when carbs that are eaten in the diet break down into glucose and are let into the muscle cell via insulin and other gateway-opening molecules such as GLUT-4. Glycogen is used highly during taxing training, and must be replenished with a diet adequate in carbs in the hours and days between training sessions. If and when glycogen levels are not adequately replenished and stored glycogen levels dwindle down.

Some distinct negatives follow:

- Diminished training intensity (inability to generate high forces, especially in reps over 3)
- Diminished training volume (inability to complete multiple sets of heavy training)
- Increased perception of work effort (everything begins to feel crazy hard and heavy)
- Direct signaling to turn down anabolic regulators in the cell (leading to potential muscle loss)

The biggest factor in glycogen depletion is the total volume of training,

and the intensity is a much smaller factor. It's the total work that counts (sets x reps x weight), and the more volume you do, the more glycogen you deplete. Replenishing glycogen occurs through eating enough carbs in the diet, but this can be tough to do, especially because:

- Carbs might be limited while dieting down to a weightclass
- Damage (Delayed Onset Muscle Soreness, DOMS) directly interferes with glucose uptake and glycogen synthesis

Thus, when you're training your hardest and possibly dieting, especially high volume programs (the ones that generally work best, especially to add muscle) glycogen levels can dwindle low enough to present serious problems for training intensity, volume, and adaptations. Not only will you not be able to do the work needed to get better, the low glycogen is itself turning muscle growth OFF!

In a normal training and diet situation, no one session depletes glycogen enough for a detectable drop in performance by itself. Impactful reductions of glycogen usually take weeks of powerlifting training to accumulate, but they only take days to resolve. Repleting glycogen fully can be accomplished via:

- Increase of dietary carbohydrate
- Reduced training volume
- Reduced DOMS

While glycogen restoration only takes a few days at most to accomplish, the next source of fatigue can take longer, up to several weeks in fact.

2.) THE NERVOUS SYSTEM

This includes all cells and circuits in the nervous system, for example:

- Central Nervous System (CNS) Neurons
- CNS Glial (support) Cells
- Peripheral Nervous System (PNS) Neurons (the nerves that link muscles to the spinal cord, for example)

While the cells of the skeletal system actually provide the force for lifting, the cells of the nervous system activate and coordinate the function of the skeletal muscle cells. Training, especially of the voluminous and heavy variety, tasks the neurons of the motor system with repeated, sometime maximal levels of activity. During this strenuous activity, homeostasis of nerve cells becomes disrupted. One major way in which this occurs is in the generated imbalance of ions and messenger molecules between and within nerve cells. For example, acetylcholine (Ach) is the primary neurotransmitter between motor neurons and their muscle cell targets. As multiple high frequency stimulations of the nerve continue, Ach that carries the signal of activation from nerve to muscle may become depleted. Many other such neurotransmitters are found within the CNS (brain and spinal cord), and some of them take from days to weeks to fully restore, helped by glial cells in the CNS.

Lifting that is overloading thus has a disruptive effect on the nervous system, both PNS and CNS, and such disruptions contribute to cumulative fatigue.

Sufficiently fatigued nervous system cells and circuits can have the following effects:

- Lowering neural drive to muscles, reducing force output and thus strength
- Poorly coordinated firing patterns, resulting in bar movement instability and technique breakdowns at heavier loads
- Reducing the learning efficiency of the CNS, thus leading to poorer acquisition of new techniques

While training volume is the primary determinant of nervous system fatigue, rising training intensity has an incrementally higher effect on nervous system fatigue, even when volume is held constant. Thus, doing 10 sets of 1 rep at 90% of your 1RM is significantly more fatiguing to the nervous system than is doing one set of 14 reps at 65% of your 1RM, even if the volumes of work for the efforts are almost identical, as is their effect on other systems that accumulate fatigue, such as glycogen depletion, for example.

In order to reduce fatigue for the nervous system, training volume must absolutely come down, but intensity decreases likely also play a role. Nervous system recovery rates tend to be slower than glycogen repletion, and can take between days and weeks of less voluminous and lighter training to fully recover.

3.) CHEMICAL MESSENGERS

This category includes:

- Autocrine Messenger Molecules (AMPk, mTOR,...)

- Paracrine Messenger Molecules (Prostaglandins)
- Endocrine Messenger Molecules (Testosterone, Cortisol, ...)

Intra- and inter-cellular messenger molecules play an integral role in the adaptive process. In response to various stimuli and under certain conditions, anabolic signaling pathways are activated, and positive adaptations occur. Under levels of fatigue and other conditions, anabolic pathways are turned down and catabolic ones turned up, leading to a reduction in the adaptive rate or even of a recess of strength and size adaptations themselves.

Though numerous pathways and the molecules that comprise them are elevated as fatigue accumulates, three major categories of messenger molecules at three different levels of physiology have particularly large associations with fatigue. First, we look inside the muscle cell itself, to the autocrine messengers of mTOR and AMPk.

AUTOCRINE: mTOR & AMPk

Though numerous pathways in the muscle cell itself are responsive to training and fatigue, the mTOR (mammalian/mechanistic target of rapamycin) and AMPk (adenosine monophosphate kinase) pathways are probably the best studied, and also some of the most powerful. mTOR is activated by anabolic stimuli. It activates when amino acids from your diet enter the cell, when your glycogen is fully stocked, and when heavy resistance training is performed, among other factors. It's the primary "anabolic switch" of the cell, and it communicates instructions to build more muscle and recover from training.



AMPk, on the other hand, is activated with higher volume (rather than high intensity) training and all forms of cardio, a hypocaloric and low-glycogen environment, and causes the muscle cell to adapt more to being endurance-based and catabolizes muscle protein for energy. When training volumes and fatigue are low, mTOR activity usually outpaces AMPk activity, and the result is a net increase in positive adaptations like muscle mass. However, if high volume training continues for too long and fatigue accumulates, AMPk activation increases while mTOR activity declines. To make matters worse, high AMPk activity actually directly blunts mTOR activity, and it's likely not the other way around. Thus, high levels of fatigue create an environment where AMPk activity outweighs mTOR activity, and of course the net result can be as bad as a net decrease in positive adaptations, including muscle size and strength.

PARACRINE: PROSTAGLANDINS & OTHER PARACRINE FACTORS

Though the research on paracrine factors is not as voluminous, it seems clear that they are differentially produced during higher and higher levels of fatigue, and that these effects can take weeks to decline if fatigue is brought down. Prostaglandins and other inflammatory cytokines have been shown to be associated with DOMS and are associated with recovery from training. Fatigue seems to disrupt this system, and the disruptions can be detected for long after the fatigue state began, taking weeks in some cases to abate.

ENDOCRINE: TESTOSTERONE & CORTISOL

Testosterone grows muscle, heals nerves faster, increases healing of most tissues, reduces fat gains, creates a psychologically better training state, and about 50 other training benefits outside the scope of this book. There's one reason why guys take steroids: because they function like (or often are) testosterone. Cortisol, on the other hand is a hormone that increases fuel utilization and availability in cells, in part by breaking down muscle tissue. It's very catabolic hormone that directly counteracts testosterone in many of its functions.

Of all the research presented in this book, the first research on the relationship of testosterone and cortisol on training is some of the oldest. Scandinavian countries were some of the first to notice that as athletes trained consistently (for weeks to months) with high volumes and few breaks, their levels of testosterone would gradually decline and their levels of cortisol would gradually rise. At the same time, these athletes were experiencing higher and higher levels of fatigue and declining gains in performance, and later, declines in absolute performance itself. Interestingly, the sport scientists studying this

phenomenon recommended replacing the lowered testosterone with injections, and thus the birth (in part) of anabolic steroid use in sport! Steroid use aside, it was very clear (and much clearer now with much more research) that prolonged high volume training leads to declines in testosterone and increases in cortisol... NOT a beneficial hormonal environment for positive adaptations.

While intensity does not greatly affect chemical messengers associated with fatigue, volume does, and in a big way. Especially, it's consistently high volume with little deviation that sums up these factors to net-negative levels, so the primary way to bring them down is to dedicate time to low-volume training. Many of these chemical messengers take weeks to rise to counterproductive levels and they take weeks of lower volume training to fall back down. Because powerlifters spend most of the time in their strength phases (sets of 3-5 reps) with moderate volumes, this class of fatigue products is not the most concerning. However, powerlifters that add lots of bodybuilding volume to their main programs or go through dedicated hypertrophy phases will be affected.

4.) TISSUE STRUCTURES

The structures physically damaged by training include:

- Muscle cell structures and proteins
- Muscle fascia (the lining covering muscles)
- Tendons (connecting muscles to bones)
- Ligaments (connecting bones to each other)
- Bones

As heavy training occurs, the very forces generated by the muscles in resistance of the weight can cause direct damage to the body. Every single training session leads to small microtears in the muscle, but most of these heal over the course of the week and almost all heal over the course of an intentionally easier deload week. However, long periods (weeks and months) of heavy training will lead to microtears in fascia, tendons and ligaments, and even microfractures in bones. By themselves, these microtears and fractures are harmless, as they don't compromise the structural integrity of the tissue at large. But, if they are left chronically unhealed, future tears and fractures can connect existing ones together and form larger areas of weakness that can and do lead to structural failure and injury, anywhere from a mild sprain or strain to torn muscles, fascia, tendons, and in some rare cases, ligaments and bones. While muscle heals relatively quickly, fascia and tendon heal much slower, on the order of weeks. But because they accumulate damage slowly, problems usually do not present themselves until months of fatigue have been accumulated. Ligament and bone have even longer timescales than tendons.

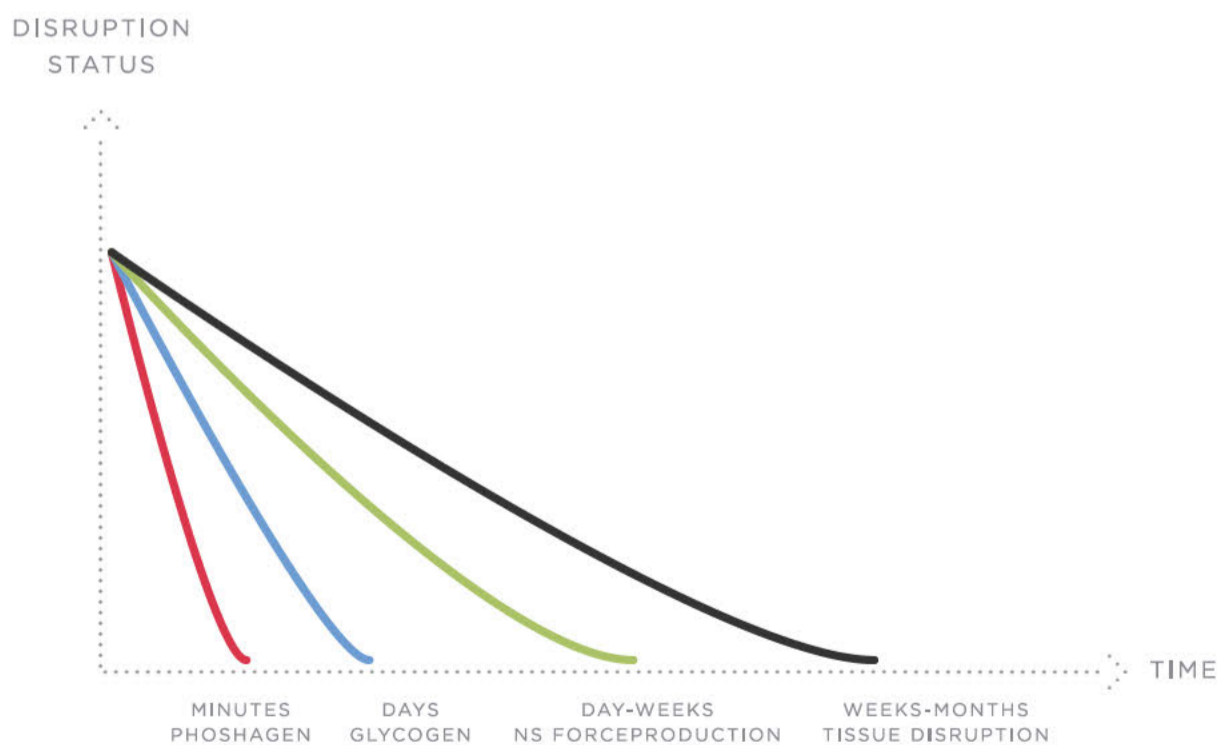


Figure 2: Recovery Rates of Systems from Maximal Training

What the discussion on the particular contributors and effects of fatigue means is that proper powerlifting training should seek to manage fatigue by occasionally lowering it over multiple timescales. Because not letting it rise at all means no overload and no adaptations and doing nothing about it means no adaptations and possibly injury, fatigue must be allowed to rise and be lowered at intermittent times via:

- Light Sessions and Non-Training Days for glycogen restoration
- Deload Weeks for nervous system fatigue and some cellular messengers and muscle tissue damage
- Low-Volume Phases for cell messengers that function on longer timescales, such as testosterone and cortisol
- Active Rest Phases for healing of connective tissues such as fascia, tendon, ligament, and bone, and possibly some psychological fatigue factors as well

Details of these practices will be presented in a later section on the proper application of the fatigue management principle.

POWERLIFTING DEFINITION

In powerlifting terms, the principle of Fatigue Management states that while we train hard and overload to accrue adaptations, those very beneficial adaptations that make us fit also fatigue us. In the short term and at low levels, fatigue is just a part of the training process, and is quite unavoidable as it comes as a package deal with the fitness gains of overloading in training. But if fatigue rises to high levels, it interferes

with performance, adaptation, and tissue integrity, none of which are conducive to best training outcomes. Thus, fatigue should be allowed to rise with normal hard training, but periodically be brought down by easier training to sustainable and non-interfering levels, so that hard training can commence once again and promote another round of beneficial adaptations to enhance size, strength, and overall powerlifting performance.

Various levels of cumulative fatigue correspond with physiological states that, lucky for us, have distinct names and convenient definitions. At any point in the training process, a lifter is carrying only one of these 3 levels/categories of fatigue severity:

A.) NORMAL TRAINING AT OR BELOW MRV

If you're doing anything between not training at all (and like most normal everyday people, carrying almost no cumulative fatigue) and training right up to your MRV, then you can be classified as being in "adequate recovery." Your fatigue is low enough that it's not interfering with either adaptation or performance, and your injury risk is not elevated. There is almost no need to fatigue manage in this state, as it's full-steam ahead!

B.) OVERREACHING (FUNCTIONAL & NON-FUNCTIONAL)

Overreaching results from training for some time between points c and d from our discussion on MRV in the Overload chapter. This can be done both accidentally and on purpose. If the way you got to passing your MRV is by not recovering enough (for example, you're not getting enough sleep this week), then your fatigue begins to rise to levels that present a problem. This is termed "non-functional overreaching," since your training stimulus did not increase to make it happen, but your

recovery just went down. Thus, this type of overreaching comes without the benefits of increased adaptations, because it's the hard training that gets you adaptations, not a lack of recovery. If it was actually the fatigue and not the hard training that increased it that lead to gains, we could all just break up with our significant others while taking on double shifts at work and gains would explode!

Functional overreaching is when you intentionally push your training to just over your body's ability to recover, and then pull it back to benefit from the gains from the harder training as your body gets a chance to recover. It's inherently short-term and comes as a result of over-working, not under-recovering. If you have no idea about fatigue management and you increase training, feel fatigued, back off, and improve, you actually did just perform functional overreaching, just unplanned! Functional overreaching works because when you train more, you gain more, and fatigue is not harmful unless it lingers for too long. In fact, temporary hardship followed by later gains is termed Supercompensation, and some research shows that it doesn't just happen in the recovery between two training sessions, but can also occur over the course of several weeks, if a couple of those weeks are just beyond MRV and the next one or two are way below it. Normal training actually involves small cycles of overreaching with every training session. The muscle fibers of your chest are overreached for several days after your training session, and then they heal. So you never quite stay at MRV, but rather fluctuate just over and under it, promoting both the adaptation of going over it and the recovery of staying under it. This can stretch out to the mesocycle timescale, where the last week of 4 weeks of hard training may be, as a week, technically over MRV (overreaching). The deload week that follows reduces fatigue by being far below MRV, and viola, adaptations are made!

Intentional week-long overreaching is a beneficial process, but must be very carefully used, especially with regards to timing. If overreaching occurs for too long (in most powerlifting training, over 2-3 weeks), overtraining may result.

C.) OVERTRAINING

When most people say they are “overtrained,” they really mean they are overreached. Overtraining is a much more deleterious and serious occurrence. It happens when your body holds on to too much cumulative fatigue for too long, and your very ability to reduce fatigue becomes impaired. Sounds pretty messed up huh? It is. There are two main classes of overtraining: net-neutral and net-negative overtraining.

NET-NEUTRAL OVERTRAINING

If you catch the overtrained state early enough, there is a good chance that you can recover performance back to original levels. It's difficult to make precise recommendations here, but within the first month may be a rough guide. It may take as long as two months to recover past performance and begin to improve again, but it doesn't have lasting negative effects. The main reason it takes so long to recover performances is that weeks (perhaps a whole month) of very light and low volume training (somewhere in the vicinity of half the MRV) are required to reduce that much fatigue. And then, another several weeks (perhaps a month or more) is needed to re-establish previous fitness levels, only after which new net gains in performance can be made. Net-Neutral Overtraining does not leave lasting negative impacts, but it absolutely wastes up to several months of otherwise potentially productive training time. It's definitely something you don't want, but it's not the worst type of overtraining.

NET-NEGATIVE OVERTRAINING

Net-Negative Overtraining is the kind that leaves long term marks. If the overtraining state is very severe, prolonged, or both, recovery back to previous levels of performance may take several months to a year! Sometimes, previous best performance is never recovered, especially if the overtraining occurs close to the athlete's career end.

Even if recovered, performance and training can be wrought with long-term injuries. Those that have overtrained to this extent are often plagued with joint problems, scar tissue development (and the tearing of the latter during hard training), and chronic inflammation. Yes, you might get back to where you were and even better, but now you've got more injuries and special conditions to deal with. The best advice here: it's better to avoid this state of affairs.

Scary as Net-Negative Overtraining is, it's profoundly rare in powerlifting. Because of the lower volume, higher-intensity nature of powerlifting training as compared to combat sports, endurance sports, or team sports, the over-reached lifter is much more likely to get hurt before they actually overtrain, and especially overtrain far enough to get into the net-negative realm. The sports with the highest levels of net-negative overtraining are ones in which so much volume is done, multiple daily sessions are performed, usually combining conditioning work, weight room work, and technical/tactical work. Powerlifting relies on chronically low fatigue levels so that the heavy weights of training can actually be successfully lifted, thus it's unlikely to lead to net-negative overtraining. But it certainly pays to know about this state and watch out just in case. For every doubt that this state can be reached, there's a kid somewhere running a "Bulgarian volume program" after only 2 months of training.

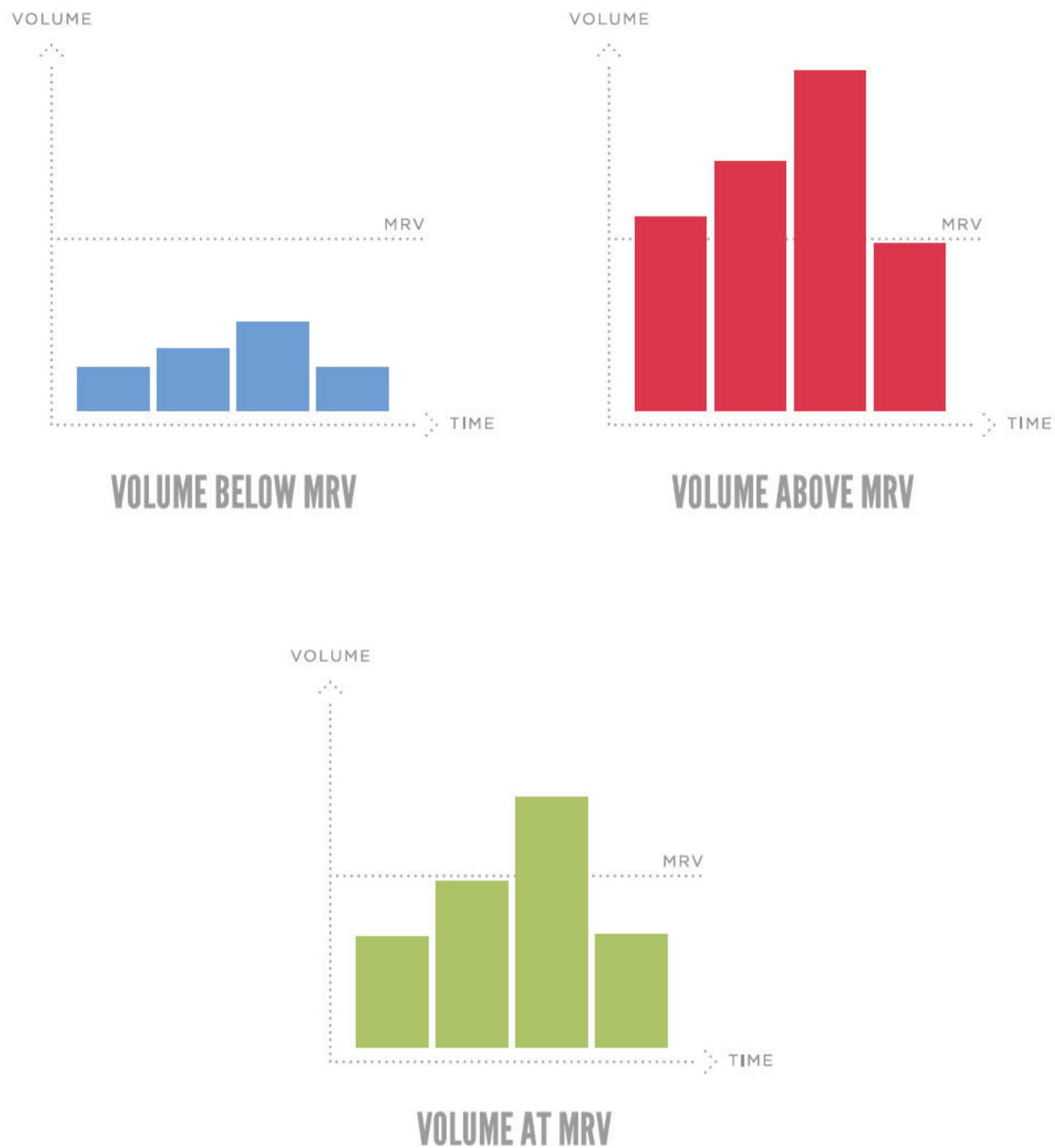


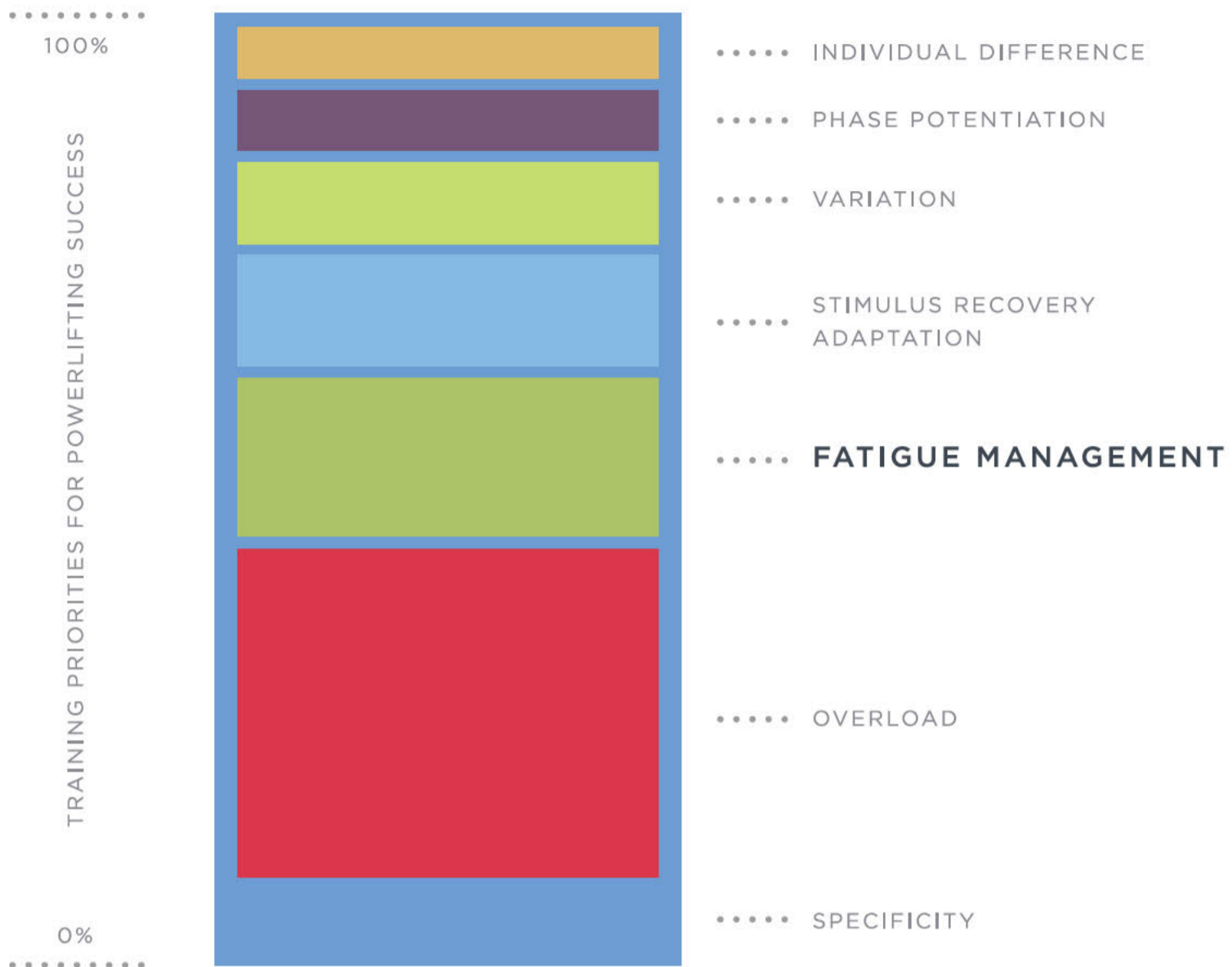
Figure 3: Meeting MRV over the Mesocycle

On the left hand side we have training that never approaches MRV and is thus not stimulative enough for maximal gains in performance. On the right hand side we have training that starts out already higher than MRV and would thus lead to an unsustainable accumulation of fatigue. In the middle is the most likely effective structure of training, whereby training is very close to the MRV and MRV is only intentionally superseded right before a deload.

PRINCIPLE IMPORTANCE RANK

Fatigue management is our 3rd most highly ranked priority for training. It's not as important as Specificity, because we first need to know what it is we're going to be fatigued from! It's not as highly ranked as Overload because hard training is a MUST for powerlifting success not in the sense that "not doing it will eventually catch up to you," but in the literal sense that if you don't apply overload, you simply won't be a powerlifter. You'll be a person of average strength who shows up to meets and confuses people with absurdly mediocre performances.

Other than those two principles, fatigue management is by far the most important. If you apply NO fatigue management at all, you're either training so easily that you're not making hardly any gains, or so hard that you'll either stop getting better, get worse, get hurt, or all three, probably in that order. Fatigue Management allows you to train hard sustainably, which, together with Specificity and Overload, form the first complete set of powerlifting principles. If you only know and apply those three principles, you're going to have a long and productive career in the sport. There are lots of lifters, and some very good ones, that don't go beyond these three core principles. But how many are there that don't manage fatigue? Well, none that have working limbs anymore! Of course it pays to apply all the other principles as well, especially if you want to be the best you can be, not just "good." But if you don't apply any one of these three core principles, your involvement with the sport will either be wholly uneventful, short-lived, or both.



IMPLICATIONS & EXAMPLES OF PROPER APPLICATION OF PRINCIPLE FATIGUE MANAGEMENT

1.) MAXIMUM RECOVERABLE VOLUME

The proper implementation of the fatigue management principle is very simple at its core, but can get quite complicated if we want to understand and engineer our best and most meticulous attempts at managing fatigue. Interestingly, the overload principle is our best segway into the discussion of how to apply the principle of fatigue management in an effective manner.

The first part of the overload principle tells us that we have to train within a 'maximal threshold' above the minimum of which adaptations are stimulated the most effectively. While training above this threshold produces the adaptations we desire, it also produces fatigue. If we train way below this threshold, the little fatigue we accumulate is dissipated during the normal rest days between session and fatigue management is pointless. At this point training is pointless again because training that sums no fatigue will almost certainly sum no adaptations. We must accept it as a given that all proper overloaded training will come with cumulative fatigue.

The second part of the overload principle states that in order for the best rate of gains to occur, successive stimuli need to be more difficult and disruptive to physiology than recent ones. This means that not only will fatigue be elevated with every session, but that if we graph fatigue against time (see below), we see that fatigue rises faster and faster with every microcycle. Eventually, such fatigue will interfere with a host of physiological abilities and outcomes, the first of which is performance.

This is where we can give a very precise definition to MRV for the first time. The MRV of a time period is the maximum tolerable training volume of the body, such that any lower volumes are not maximally overloading and any higher volumes lead to a decrease in performance. What do we mean by performance? Actually, we mean four different things based on each of the four phases of powerlifting training:

a.) Hypertrophy Phase MRV: The volume above which muscle size decreases.

b.) Strength Phase MRV: The volume above which basic strength decreases.

c.) Peaking Phase MRV: The volume above which maximal force expression with stable technique decreases.

d.) Active Recovery Phase MRV: The volume above which fastest recovery rates decrease.

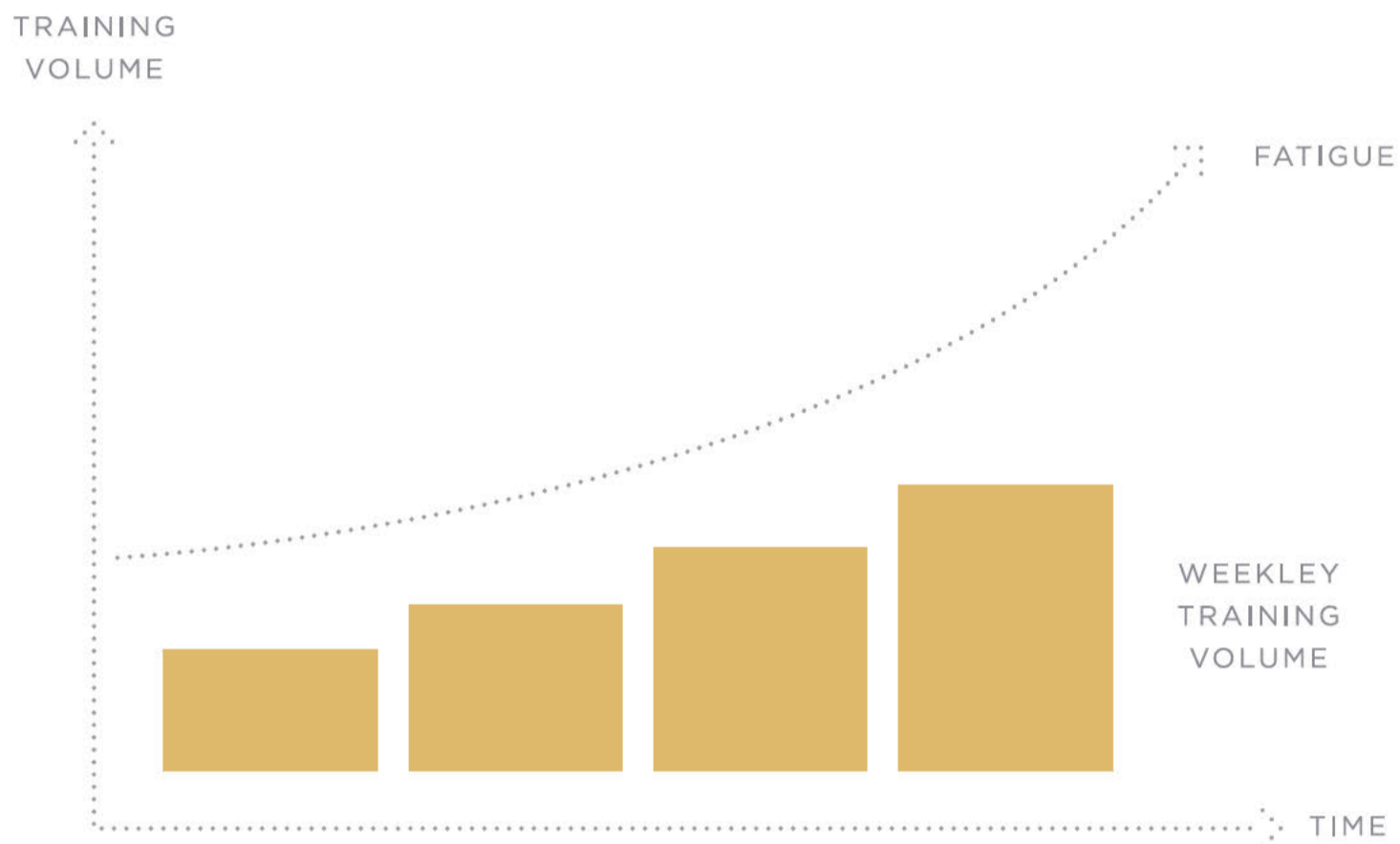


Figure 4: Fatigue Accumulation with Overload Training

The MRVs of the different phases are, on average, meaningfully different from one another.

a.) The hypertrophy phase MRV is by far the highest volume of all of the phases. You can be beat to crap, have nervous system fatigue like crazy, be low on energy, and still be able to produce enough volume above 60%1RM to signal additional muscle growth. Now, when chemical messenger alterations speed up, even hypertrophy grinds to a halt.

Every training session activates mTOR and AMPk. If the training is done right, much more mTOR activation occurs with each session than AMPk and the net result is muscle growth. However, as fatigue accumulates over weeks of training, AMPk activity with each session begins to rise, eventually so much that it overshadows mTOR activity and the net stimulus can be muscle loss. A very related process occurs with cortisol and testosterone, and likely the paracrine factors as well. Yes, hypertrophy eventually succumbs to fatigue and volumes need to decline, but the MRV of hypertrophy training is definitely higher than it is for the other phases.

Being able to tell when your MRV for hypertrophy is reached or surpassed is very difficult in practice, as most of us don't have access to radioactive leucine labeling to directly measure muscle growth. However, there are some decent proxies for "in the trenches" estimates. You've probably surpassed your hypertrophy MRV when you"

- Can't maintain your usual reps with 60-75% 1RM weights
- No longer get very good pumps from training
- Get dull, achy, and tired the next day after training instead of sore
- Feel depleted and unenergetic during workouts, struggling to meet minimum work efforts

b.) The strength phase MRV requires that strength performance is maintained. Thus, we have surpassed the MRV of the strength phase as soon as we can no longer generate our highest forces and lift the weights needed to provide a strength overload. In order to keep strength unaffected, the nervous system must not be overly fatigued, nor can

glycogen stores dip too low, testosterone levels too low, etc... Thus, the kind of fatigue levels and volumes that are appropriate for the hypertrophy phase are absolutely too high for the strength phase, and thus the strength phase MRV is lower.

The way to tell your strength MRV is easy. When you can't match your recent performances in sets of 3-6 reps, your strength performance has declined and you're at or just past your MRV. If you did 405 for 5,5,5 reps the first week, then did 415 for 5,5,5 the second week, but could only get 425 for 3,2,2 reps, you are no longer as strong as you were and your MRV has been passed.

c.) The MRV for the peaking phase is a bit more difficult to estimate, but in many ways it's the most intuitive. It's far lower than the MRV for hypertrophy and strength phases, because your fatigue must be very low for you to be strong enough and have good enough nervous system coordination to lift your biggest weights. If you can hit your heavy sets of 3 like expected and with good technique, you're probably at or below MRV, but if you raise your volume and begin missing reps and having technical breakdowns, you've likely surpassed it.

d.) The MRV for the active recovery phase is simply the most volume you can do and still recover at the best rate. Since recovery is very hard to measure directly, we have to use research-discovered volume guidelines most of the time to estimate our MRVs for this phase. Suffice it to say, the MRV of the active recovery phase may be as little as 1/4 the volume of the hypertrophy phase.

MRV OVER THE MESOCYCLE

Because performances usually (or rather, should) peak with every mesocycle, the MRV can also be defined by mesocycle. That is, your MRV in any one training session is a rather meaningless concept, because some light sessions can recover you from almost anything. MRV as a concept is best reserved for the mesocycle, as that's the most realistic way to both estimate and apply it. This does not mean that every single week of the mesocycle will have training programmed exactly at the MRV. Because intentional overreaching has distinct benefits, we're going to intentionally surpass MRV towards the end of most mesocycles of training. If we're to have a recovery and adaptive expression from this overreach, we need to follow it with a deload that has a much lower MRV. In order to have an efficient accumulation-to-deload ratio, and also apply the overload principle properly (starting at the bottom of the maximal threshold and working our way up over the weeks) the overreaching week should be preceded with weeks that are lower than MRV, but come closer and closer. This makes training effective as well as sustainable over the long term, preventing us from deloading every other week by always trying to train for MRV.

Since our training is almost at MRV for the first part of the accumulation, at MRV in the middle, and over MRV right before the deload (and far under during the deload), our average MRV is defined as the MRV for the whole mesocycle, and is usually about the same volume as the middle-end microcycles of our typical mesocycle. From now on when we refer to MRV, we'll be referring to this average per-mesocycle figure.

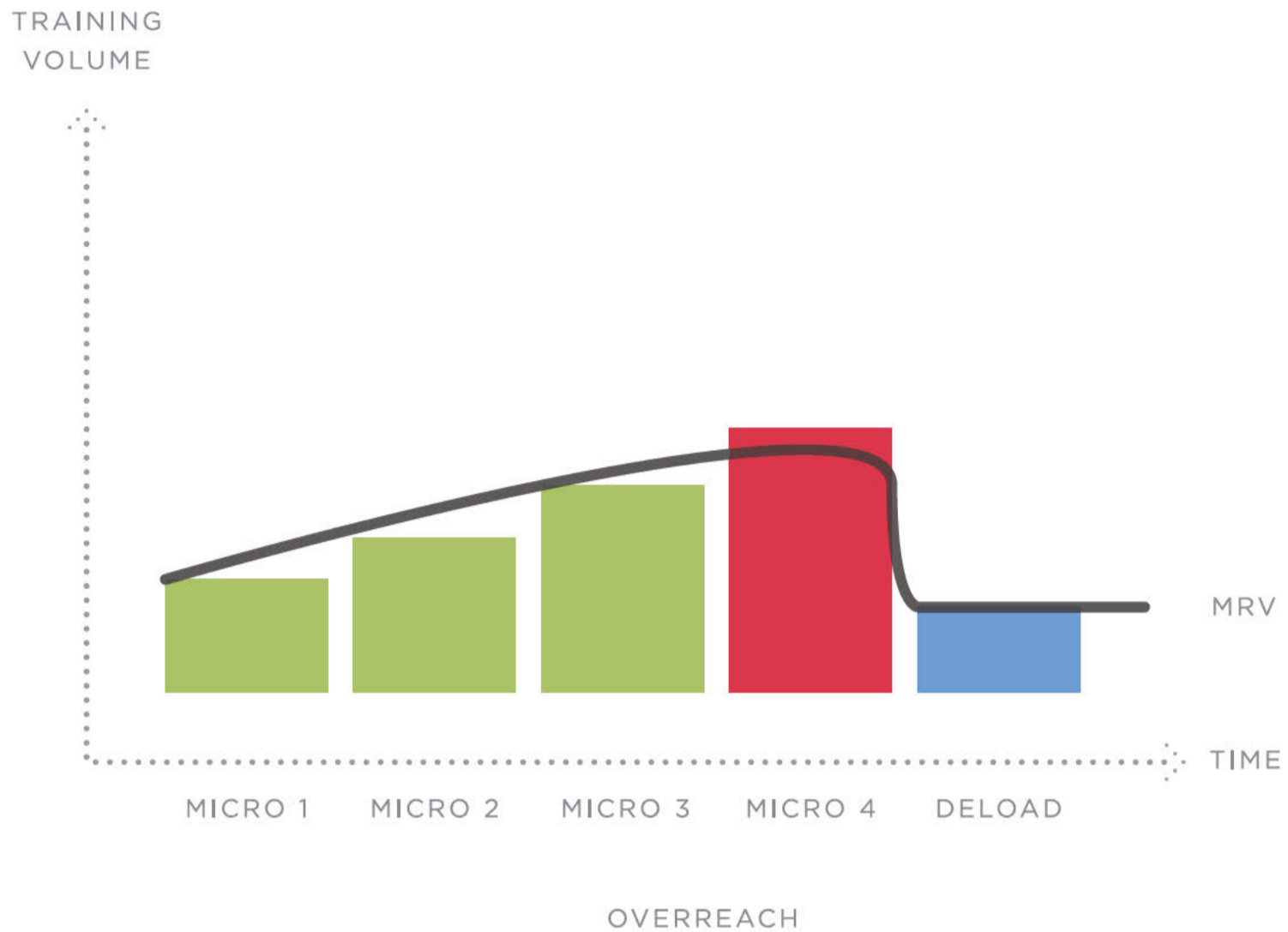


Figure 5: MRV Changes Within the Mesocycle

MRV starts low due to new exercises and need for room to expand through overload threshold, then rises until it flatlines and falls at week 4, then falls drastically during deload to prepare for next whole meso.

MRV BY SITUATION DIFFERENCES WITHIN ATHLETES

While the MRV is a theoretical construct that has a set value for each type of training phase, many variables can alter the MRV for a single particular individual. These variables generally fall into two categories; those that expand work capacity, and those that expand recovery. The recovery side is absolutely necessary for MRV to improve, because too much of a work capacity increase will just make you that much more

fatigued and quickly pass your MRV. However, recovery enhancement is not sufficient, as an increase in training volume must follow in most cases to make best use of the newly enhanced recovery abilities.

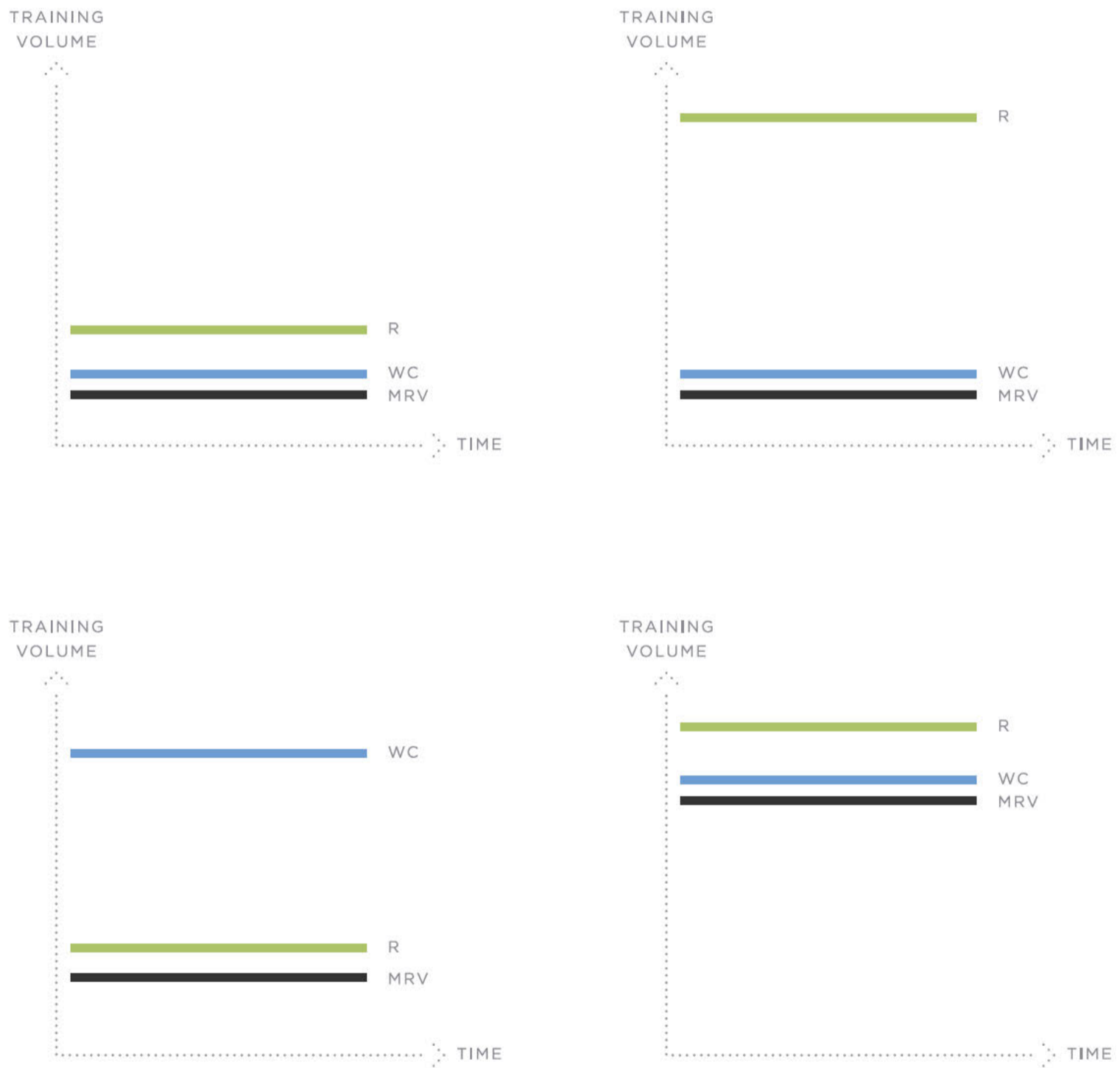


Figure 6: MRV, Work Capacity, and Recovery

In the figure above, R stands for Recovery, WC stands for Work Capacity and MRV for Maximum Recoverable Volume.

Most real-world changes affect both sides of the MRV increase. Proper amounts of sleep and good nutrition both allow you to train harder (thus increasing how much volume you can perform at any given intensity) and recover faster and adapt more completely, thus raising your MRV from both sides. Drugs (anabolic steroids, for example) also allow the lifter to both stimulate and recover in an enhanced fashion. Life stress and other physical activities may not impede hard training as much, but do come with a high price for recovery, so reducing them can raise the MRV from the recovery side. Using a high volume work capacity/hypertrophy phase before a strength phase can enhance your strength phase work capacity, but it doesn't do nearly as much for recovery. Both sides need to be elevated to bring up the MRV.

The implication here is very straightforward. If you want to have a higher MRV and be able to benefit from higher volumes of training (which are always better than lower volumes so long as you can recover from them), you've gotta make sure you do everything you have to both hit it hard in the gym and recover between sessions. This means that as your training gets more serious, your recovery modalities need to get more serious as well. Very few of the best lifters miss out on too much sleep or food, and they usually do a good job staying low-stress.

Not only can your recovery strategies improve over time, simply training for long periods (months, years) raises your MRV by way of work capacity improvements. Thus, another quick takeaway is to avoid doing the routines of elite lifters verbatim... you might not yet have the MRV to keep up.

MRV DIFFERENCES BETWEEN ATHLETES

The same circumstances that cause one individual to have different MRVs through their training career also lead to the development of differences in MRV between different athletes. Two different lifters might get different amounts of sleep and rest. One lifter might eat more or eat better than another, or be using more or better drugs. The crazy volumes of the mythical Bulgarian routines became much more understandable once it was revealed that Bulgarian national team lifters lived at a training compound where their food, drugs, sleep, and massage were all provided for them at arm's length, without any stressors save the weight room to speak of. This is a good thing to keep in mind before starting a super high intensity, volume, and frequency routine inspired by Bulgarian methods.

Of course on top of all of those same differences we see both within and between lifters, we have the factor of genetics. Work capacity, recovery capacity, and MRV differ drastically between various lifters, often for genetic reasons and those having nothing to do with external lifestyle factors. Some lifters can get three hours of sleep and smash workouts, while still others miss one hour out of eight and start to overreach. Of course you don't choose your genetics, so there is no point to lingering on this topic, but it's worth noting that doing exactly the same number of working sets as your training partner for every exercise faces theoretical problems right from the get-go. If we're all different at least to some extent, perhaps at least our training volumes should reflect this if we want to maximize our training effect and lifting potential.

MRV & RELATIVE INTENSITY (PROXIMITY TO FAILURE)

Countless variables determine MRV. The phase of training, the work capacity of the athlete, the recovery ability of the athlete, and other factors play a role. But one training variable that we have yet to discuss alters MRV in a profound way that merits its own discussion.

Relative intensity (as defined in the first chapter) can also be understood as the proximity to failure achieved by any rep effort. If you did a set of 3 reps, and you could have done 5 with a gun to your head but physiologically could have done no more than 5 reps, we can say that you stopped 2 reps short of failure. We can thus say that your failure proximity was higher than if you only did 2 reps with the same weight or one rep with the same weight.

Failure proximity has a very high effect on fatigue, such that with the same volume and intensity in a program, the one with the sets taken to failure is going to be more fatiguing than the one not taken to failure. Thus, if we take your 5RM and make you grind out all 5 reps at the same time in one set, you're going to sum more fatigue than if you did all the reps as singles with 3 minutes in between sets. The fatigue of just one set is so small that the difference is barely noticeable, but with a whole training session's worth of sets, training to failure can produce a noticeably higher level of fatigue for any given volume.

What this last point means is that failure training lowers the MRV. Training consistently to failure and still trying to recover enough to be able to present a weekly overload requires much lower volumes of training. High Intensity Training (HIT), which is based on training to failure for each working set, by no coincidence, programs a very low

volume approach. Because volume is so highly linked to muscle growth and strength improvements, such an approach to training has been shown inferior for both outcomes. No, intentionally lowering the MRV is not a good idea.

Failure training is not conducive to a high MRV, but for the same workload as non-failure training, it actually tends to produce slightly better size (and possibly strength) increases. The further away working sets are from failure, the less effective they are in causing positive adaptation, as noted earlier in the discussion on overload. With those two pieces of information combined, the best training is likely done close to failure (enough to be within the maximal threshold of the individual) but not at failure, as that produces such a disproportionate amount of fatigue as to lower the MRV substantially and pay the price of lower volume training.

If anywhere, failure training may be beneficial at the end of an accumulation phase of a mesocycle. Firstly, the deload is coming up next anyway so cumulative fatigue won't interfere with the next week's training. Secondly, the overload presented in the preceding weeks of the mesocycle has been steadily growing, and it's going to take some of the most extreme approaches to elicit an adaptive response. Lastly, training far beyond the MRV in the final week may elicit a supercompensation effect during the deload. In fact, training to failure (or not quite but very close to it for safety concerns) may be tailor-made for the final microcycle of accumulation training, but it's anything but tailor made for almost all other applications in powerlifting.

2.) TRAINING VARIABLES THAT CAN ALTER FATIGUE ACCUMULATION & DISSIPATION

The rate at which fatigue accumulates and dissipates is a slightly different topic than the MRV. When you start training at your MRV or close to it, how long can you train there before fatigue begins to accumulate and lower your MRV? Once you're deloading from your MRV, how long does it take to drop that fatigue? It's not a question of just how much food you eat or how good your genetics are because other details about the lifter and training plan matter as well. Some of the more prominent ones include; lift type, proximity to peak, body size, strength, fiber type, and technique. Gender may also be a possible consideration, but mostly due to the aforementioned reasons clustering with gender.

A.) LIFT TYPE

As mentioned in the Overload chapter, machine movements and isolation moves tend to cause less homeostatic disruption than free weight and compound movements. This means that barbell movements will almost always sum up fatigue faster at any given set, rep, and intensity scheme than machine moves. This is not a negative, because they sum up a concomitant amount of fitness as well, and perhaps even out of proportion to their fatigue effects, which makes them ideal training tools in most scenarios. The point to take note of is that if you really need to keep fatigue down for whatever reason and you're ok with perhaps not optimally adapting in that phase of training, machines might be a good idea.

Isolation moves are less fatiguing because they almost always lack the proclivity to generate very high training volumes. Because a true

calculation of volume involved weight, sets, reps and distance (to calculate total work done), compound movements with their longer ranges of motion and their heavier weights can simply get you more work quicker. In addition, isolation exercises work a much smaller amount of musculature. The less muscle that is homeostatically disrupted (and the less nervous system activity it takes to activate that small amount of muscle), the less fatigue there is. Thus, 5x10 in the biceps curl is never going to disrupt like 5x10 in the bent-over row, at least because so much less muscle mass is used.

We have an idea of which lifts will be more fatiguing than others; those with longer ranges of motion, proclivity to be exert the highest forces and those with more involved musculature. If we rank the powerlifts according to these guidelines, we find the following pattern:

Most fatiguing: Deadlift

Intermediate ROM (just short of squat in most cases), heaviest weights, by far most muscle used.

Intermediately Fatiguing: Squat

Longest ROM, intermediate weights and muscle used.

Least Fatiguing: Bench Press

Shortest ROM, lightest weights, least muscle used.

There are two quick implications from this information, both of which will be explained in much greater detail in the later chapters on SRA

and Phase Potentiation. Firstly, because for any set/rep scheme benches both accumulate and drop fatigue faster than deadlifts, it's likely that higher frequency programming will be much more helpful to benching than to deadlifting, with squatting falling somewhere in between the two. Secondly, when dropping fatigue to peak for meet performance, it's likely a good move to begin lowering the training load for deadlifts first, squats second, and benches last to give adequate (but not too much) time for fatigue to dissipate while adaptations are retained. There are several other tentative differences between lift type and fatigue characteristics that we'll mention in the discussion of other factors below.

B.) PROXIMITY TO CAREER PEAK

As the training process continues for years on end and physiological adaptations occur, the boundaries of system capabilities start to make their presence known more regularly. One reason for this is that recovery systems don't always keep pace with the adaptation of performance systems. The heart and liver clear lactate from the blood when the muscles use glycolysis and produce it during heavy efforts. The bigger your muscles are and the harder your nervous system pushes them, (both of which increase with advancement of training) the more lactic acid they put out. But the heart and liver don't change as much with training, so you're left with largely the same system to recover lactic acid as you always had, but now with much more lactic acid to recover. Just the same way, the immune system (which is critical to recovering muscles between bouts of exercise) does not meaningfully change over the years of training while the damage it has to clean up increases. Same goes for the GI tract, which has to provide nutrition to an ever-needy body with largely unchanged capabilities.



The further you push your body's performance and the further back recovery systems fall, the quicker fatigue both sums and the slower it falls, even with your now very high MRVs.

Very experienced lifters often get criticized for training with lower frequencies, but the consideration of “proximity to peak” is an important one in understanding why that practice may be somewhat warranted.

C.) BODY SIZE

This one is brutally simple: bigger structures can lift more weight and have more tissue to disrupt. No matter how hard you work your biceps, they recover in a couple of days. Try the same sets and reps with your quads and you might not walk for a week and a half. This observation applies to 3 different classes of phenomena:

- Lifts involving more muscle will take on more fatigue (DL vs SQ vs BP)
- The same lifter that has grown in size over the years will accumulate fatigue faster and dissipate it slower as he/she grows.
- Different lifters of different sizes have different fatigue dynamics. Bigger lifters usually need lower frequencies and longer tapers to dissipate fatigue.

In addition to muscle size, body length plays a role as well. For every squat 5'6 Mike Israetel does, 6'2 Chad Wesley Smith does more work, even if the sets, weight, and reps are identical. Work is force multiplied by distance of bar path, and longer bar paths for taller and lankier lifters both sum fatigue faster and dissipate it slower. A great example of this is the case of Kiril Sarychev's bench press training. Kiril goes heavy in the bench only about every week and a half. This super low frequency of overload makes no sense until you consider that Kiril:

- Is working out with sets of 5 at over 600lbs
- Has arms and pecs the size of very good lifters' quads and glutes (weighs a lean 396lbs!)
- Is 6'8, so he moves the bench bar about as far with each rep as your average 198 class sumo deadlifter does during a pull.

Thus, it makes perfect sense that he should bench heavy only every week and a half, which is about how often high level 198 deadlifters do heavy pulls!

D.) STRENGTH

The more force you can exert, the more homeostatic damage you can cause. In very plain terms, stronger lifters can beat themselves up more and will thus both sum fatigue more quickly and wait longer for it to dissipate. Interestingly enough, relative intensity plays a role too, as weights lifted closer and closer to the 1RM cause more and more fatigue for the same volume. Equipped lifters train with such heavy weights (in excess of 100% of their 1RM), that the Westside system designed for equipped lifting only programmed one heavy session for upper and lower body each during the week. It took a whole week for even the best lifters on the most drugs to recover enough to train that heavy again. On the opposite extreme, “squat everyday” programs have been touted as highly effective by numerous lifters, and indeed they are quite effective especially in short “concentrated loading” periods of several weeks at a time. But not-the-strongest lifters have been noted to have MUCH more success with these programs than those who are at the top of the strength world. There is quite a polarity there, with most of the strongest lifters actually doing the lowest frequency programs (with the Lilliebridges being the ultimate example).

For lifters going through their career paths and gaining strength, either less frequent training must be done with time or the variation in volume-load (undulation, as it’s called by some) within the microcycle must become more pronounced to meet the need for recovery, even at similar total volumes.

E.) FIBER TYPE

The human skeletal muscle system is made up of a combination of slower twitch muscle fibers and faster twitch muscle fibers. Faster twitch fibers

contract at faster velocities, respond better to heavy resistance training (grow more), and generate higher forces. Slower twitch fibers contract at slower velocities, respond more poorly to heavy resistance training (grow less), and generate lower forces. But because they generate lower forces, are more well vascularized, and for several other reasons, slower twitch fibers take on less homeostatic damage than faster twitch fibers and heal much quicker.

Muscle groups with a higher proportion of faster twitch fibers take longer to heal, and those with a higher proportion of slower twitch fibers heal more quickly. The muscles of the upper body tend to be faster twitch (on average) than those of the lower body (specifically the quads and glutes), which may explain why the squat is a bit more fatigue resistant than we would come to expect based solely on weight lifted and ROM. Interestingly, the hamstrings are notoriously fast-twitch dominant in most people, which may explain, in addition to the great use of upper body musculature as well, why the deadlift is so fatiguing.

In addition to lift or body part specificity in fiber type, different individuals have varied fiber type averages. If we take all of the muscles of the human skeletal muscle system, one individual may be 60% faster twitch and 40% slower twitch, while another might have the opposite ratio. Those individuals with faster fibers will tend to be able to generate and hold onto more fatigue, while those with slower fiber types have a gigantic work capacity and recovery ability, so will be able to dissipate fatigue rapidly as well as have very high MRVs. Though in a bit of irony, those same slower twitch individuals tend to experience less success in their results because of the poor adaptive nature of their dominant fibers to heavy resistance training.



F.) GENDER

Females have two unique physiological advantages in fatigue dissipation just because they are female.

- Female musculature tends to be more highly vascularized and thus may recover faster.
- Females are more rarely found at the extremes of fiber type ratio. In a sport such as powerlifting that attracts the fast-twitch extremes, most females will be clustered closer to an even mix of fast and slow fibers than the males, though of course it comes down to the fiber type of each individual male or female. This means that females will gain a slight

advantage in the proclivity to generate less homeostatic damage and recover faster than males.

Those factors are likely to play a role in the ability of females to both sum fatigue slower and dissipate it faster than males, but by far the dominant differences arise from the fact that, on average, female lifters tend to be smaller, have shorter ranges of motion, and not be quite as strong as their male counterparts.

G.) TECHNIQUE

For two lifters moving the same load, the lifter with better technique will expend less energy and expose his/her body to lower forces. One of the reasons not yet mentioned for the deadlift being as fatiguing as it is the fact that it's poorly leveraged lift. If only we could get the bar path completely vertical and in our center of gravity like a squat or a trap bar deadlift! The muscles of the spine and posterior chain must work that much harder to support a rigid posture while leaning over, and that likely taxes them so much as to contribute to a higher total fatigue from deadlifting. Poor leverages, especially due to the movement of the center of pressure (bar plus lifter) away from the summed center of rotation of all of the joints can necessitate a maximal contraction of the supporting muscles (and beyond maximal, if eccentric action of the erectors occurs when saving a forward-tipped squat, for example).

Because the deviation from efficient movement causes greater energy utilization and greatly taxes the muscular and nervous systems, it likely adds to cumulative fatigue. As lifters gain experience in the lifts and sharpen their technique, they can expect to have improvements in fatigue management abilities. On the other hand, letting your technique

slip just to grind out a few more reps may be a very costly move to your fatigue state. By training with good technique, not only does fatigue rise slower and drop faster, but your maximum recoverable volume may rise as well, which is of course quite the additional benefit.

3.) TRAINING-BASED FATIGUE MANAGEMENT STRATEGIES

Because this is a book about powerlifting training, strategies that can be used to reduce fatigue outside of the gym (such as food, rest, drugs, etc...) will not be the focus. Some introductory reading about external strategies for fatigue reduction [can be found here](#).

Examining the fatigue management strategies based on training variations, we will find that there are 4 distinct approaches worthy of individual discussion: rest days, light sessions, deloads, and active rest periods. These approaches are stratified by timescale, and very roughly (with lots of overlap) correspond to the four primary mechanisms of fatigue, namely disruptions to fuel stores, the nervous system, chemical messengers, and tissue structures.

REST/OFF DAYS

Rest days are perhaps the most universal and widely accepted fatigue management approach. Rest days allow for the training volume to be essentially zero and allow recovery processes to dissipate fatigue to catch up greatly and prepare the body for another productive microcycle. Interestingly, the function of rest days is also based on their psychological advantages, not just their physiological ones.

Because research shows that in many instances a lighter training session (particularly low in volume) may actually attenuate physiological fatigue

more effectively than a day off, it would be a good question to ask why those athletes that want the best possible outcomes even bother with off days. There are two reasons for this.

- Rest day effect on fatigue reduction is likely almost identical to that of a light session in most circumstances. Any difference is quite small, and this is important because rest days offer an advantage (described next) that is likely to be larger than this small disadvantage.
- Rest days have a powerful role in the reduction of psychological fatigue. Stressors are cumulative, and psychological fatigue (what people normally mean when they say they're "stressed out") adds right into the cumulative fatigue effect, even though it is not caused by tissue disruption or any physical trauma. The very act of packing your bag, mixing your supplements, actually going to the gym, warming up, and going through even an absurdly easy workout is stressful. If you train as hard as you're supposed to in order to present an overload, all of these acts may be associated with a mild fight-or-flight stress response. Last week you almost died squatting, so picking up your weightlifting shoes and putting them in your bag is going to have some disruptive psychological effects just by itself. Even the very stress of commuting, be it walking, biking, taking public transport, and especially driving will in many cases outweigh the slight advantage of light sessions over total rest days.

In sum total, rest days are an indispensable part of the fatigue management arsenal. Their effects particularly on psychological fatigue make them a staple in literally every single notable powerlifting program ever. How many rest days to take? There are two opposing constraints to consider.

Before considering the constraints that hem in the number of rest days a maximally effective program would have, we must be clear that we're limiting our discussion to programs that seek optimality. If your program is restricted to only 3 days per week due to scheduling constraints outside of the sport, then so be it. And that's just fine, but it has to be granted that any more off days than optimal would have to be for some reason external to the training process. Outside of external limits, we have two constraints on off-day number; minimum psychological fatigue reduction needs and constraints on concentrated loading in relationship to overload.

MINIMUM PSYCHOLOGICAL FATIGUE REDUCTION NEEDS

Ideally, lifters would need no off days. But as described above, psychological fatigue makes them advantageous. One day per week is the likely minimum, as it has been noted that 7 day programs are almost entirely absent from top approaches. While 6 day programs (and thus only one rest day) are theoretically tolerable and have produced top results numerous times, the authors of this book have experienced (through both their own training and those of their clients, which in total sums to several thousand people) that two days off per week seems to be noticeably more effective. This is particularly true when drug-free athletes are involved and when the off days are presented back-to-back. This sequential arrangement of rest days seems to promote a very high degree of psychological fatigue reduction, and also has the added effect of helping lifters actually miss the gym! If you're at the gym all the time for both hard and easy training, the very act of being there can begin to be stale (in fact in the old literature, "staleness" was a term for cumulative fatigue). Having one, or seemingly even better, two days off in a row can prove very motivating for a productive return for another overloading microcycle.

CONCENTRATED LOADING IN RELATIONSHIP TO OVERLOAD

It's a given that in any one week or microcycle of training, there is a certain amount of overload training that will occur. In order for this training to be the hardest possible (and thus most overloading given the other features of the program), the most possible recovery time must be programmed between sessions. More recovery time means a better chance to present overload in the next session. If you Squat heavy Monday, bench Heavy Tuesday and deadlift heavy Wednesday, you simply won't perform as well in the bench and deadlift as if you had done them on Wednesday and Friday, respectively. Thus, using only this constraint, we can conclude that the best program is the one that spreads its overloading sessions rather evenly throughout the microcycle.

In any program with meaningful volume, using only the concentrated loading consideration would leave us without any rest day to speak of, as every day would likely fill up with either an overload session or additional volume or recovery work. The best approach seems to be somewhere between the two. At least one rest day should be taken, possibly two. Outside of those rest days, the overload pattern of the microcycle should be spread fairly evenly.

There is some evidence to suggest that too even of an overload spread may itself not be best, and for that we turn to the discussion of light sessions in the next section.

Rest days not only reduce psychological fatigue (which of course is another kind of nervous system perturbation), but they also restore substrates, primarily glycogen. Chemical messengers are largely

unaltered in the timeframe of the rest day and will need a longer phase of fatigue reduction (to be described later) to restore to normal activity. Some healing of muscle damage occurs during rest, but very little other connective tissue damage is healed, as tissues like tendon and bone take much longer to measurably recuperate.

LIGHT SESSIONS

In a later chapter, the SRA principle will be discussed in depth. Until then, it will suffice to mention that hard training presents a stimulus (via overload) and that lighter training and rest are the most conducive states for recovery and adaptation. Hard training during recovery times can interfere with the level of adaptation gained. Thus, it pays to have training sessions during the microcycle that are overloading, and training sessions during the microcycle that promote recovery.

Light sessions offer a very advantageous combination of features:

- Promote recovery and adaptation
- Allow for skill practice in the lifts without adding fatigue
- Largely prevent the slight deterioration of fitness that occurs with each multi-day rest period, which can sum to meaningful differences in performance in the long run

Light sessions work. But what are they? How are they defined, exactly? Rest days are self-explanatory and need no definition, but there is quite a bit of confusion about what light sessions really are. In effect, a “light session” is one that does not present an overload and thus does not sum any additional fatigue. A light session has to be far enough below the MRV to allow for considerable fatigue dissipation, while high enough in volume and intensity to prevent too much fitness loss.

Too much volume and intensity, and the only result is a conservation of fatigue rather than a reduction or elevation. This is perhaps the worse of the three possibilities, as an elevation of fatigue is at least performed by an overload volume that also garners adaptations. “Middle of the road” light sessions (and as we shall see, the same kind of deloads) end up just wasting time, as they are neither reducing fatigue nor creating adaptations. Too little volume, and the light session turns into a rest day with a gym trip. Not enough volume is presented to slow down adaptive decay (use it or lose it, to be addressed in formal discussion in the Phase Potentiation chapter), so the light session becomes mostly pointless.

Between volume and intensity, volume usually has the biggest effect on fatigue, and every light session must at the very least be of lower volume than the normal training sessions. While volume has the biggest effect on fatigue, intensity has the biggest effect on conserving adaptations. Thus if adaptive conservation with fatigue reduction is the goal (and it is), “light sessions” must in most circumstances in actuality be low-volume sessions that are still heavy enough to conserve adaptations. The main exception to this structure is during a peaking phase where percentages of 1RM in training exceed 90%. At such very high intensities, intensity itself becomes a major fatiguing variable, and thus light sessions during a peaking phase will reflect this. In essence, the following recommendations emerge for light sessions:

Hypertrophy Phase Light Sessions:

Volume: 50% of overload day

Intensity: 90% of overload day

Strength Phase Light Sessions:

Volume: 70% of overload day

Intensity: 70% of overload day

Peaking Phase Light Sessions:

Volume: 90% of overload day

Intensity: 50% of overload day

As the training weights get heavier the MRV gets lower and intensity becomes a bigger and bigger contributor to fatigue. For this reason, the above pattern emerges and light sessions become actual “light” days in the literal sense only as the training weights get heavier. Two distinct mistakes can be made in creating a light session. By far the most common mistake is to reduce intensity while increasing volume. Yes, that technically makes the day “lighter” in weights used, but the volume increase causes so much fatigue that this kind of light session may in fact sum more fatigue than a normal training day, especially in the strength and peaking phases. For example, if your normal training day is 5x5 at 100lbs and your deload is 5x10 at 60lbs, your volume of training on the light session is actually higher than it is on the normal day. Because the intensity is lower, fatigue on this light session won’t be higher than on the normal day, but probably about the same. This results both in a lack of stimulus and a lack of fatigue reduction, the worst of both worlds. In a peaking phase the volumes are even lower and thus high rep light weight training can create even more fatigue than normal training.



The other mistake that can be made is to insufficiently drop intensity. During strength and peaking phases, intensity does become a significant contributor to fatigue, and manipulating volume isn't good enough. Hitting squats for 3x3 instead of 3x5 may not be enough of a fatigue reduction tool to matter when the weights are well over 80% 1RM. This mistake is quite rare in powerlifting, but should still be cautioned against.

WHEN TO USE LIGHT SESSIONS

The use of light sessions in training is by no means mandatory, as is the use of all of the other fatigue management modalities including rest days, deloads, and active rest periods. Light sessions can be used 1-2 times per week, with their more expanded use more prominent in strength and peaking phases when low fatigue is a much more important factor in effective programming. In hypertrophy training, the use of light sessions has no strong theoretical backing.

In strength and peaking phases, one or two light sessions can be placed at the end of a microcycle, so as to recover fatigue dramatically for the next big overload presentation in the next microcycle while giving the lifter more technical practice with the lifts.

In terms of their effects on sources of cumulative fatigue, light sessions are almost identical to rest days, with their biggest effect being on glycogen and nervous system recovery, with minimal effects on chemical messengers and tissue structure healing.

DELOADS

Fatigue due to the depletion of glycogen only takes several rest days or light sessions to recover. However, nervous system fatigue, the disruption of chemical messengers and microtears to muscle and fascia are not meaningfully reduced within several days of lower volume and intensity training. Luckily, this type of fatigue also takes longer to elevate to levels that disrupt performance and adaptation. If an overload is being applied, fatigue from nervous system, chemical messenger, and tissue damage can begin to affect performance and adaptation. At this point a longer and more dedicated phase of fatigue reduction must be employed so as to allow another several weeks of hard training. The deload performs exactly that function.

The deload functions on the same principles of reducing volume and intensity to lower fatigue as the light session. This means that deloads must be easy enough to drop meaningful amounts of fatigue but stimulative enough to conserve most adaptations. An additional concern with deloads is their length, as nervous system, chemical messenger and tissue damage simply take longer to heal no matter how little stress

is provided. For this reason, the average deload will take an entire microcycle to execute, which of course is part of its very definition. In practical terms the deload will take about one week to perform.

The recommendations of volume and intensities for deloads are very similar to those of light sessions, but with one notable difference. Deloads must have an average lower intensity than light sessions because tissue damage will not heal nearly as quickly or completely with higher intensities, even if the volume is very low. Because recently-healed tears are still structurally weak, there is good reason to at least make the latter part of the deload very low intensity so as not to provide even momentary forces high enough to re-tear the healing structures. Granted those modifiers, a working recommendation for deload structure can look like the following:

Hypertrophy Phase Deloads

First Half of Microcycle:

Volume: 50% of overload day

Intensity: 90% of overload day

Second Half of Microcycle:

Volume: 50% of overload day

Intensity: 50% of overload day

Strength Phase Deloads

First Half of Microcycle:

Volume: 70% of overload day

Intensity: 70% of overload day

Second Half of Microcycle:

Volume: 50% of overload day

Intensity: 50% of overload day

Peaking Phase Deloads:

First Half of Microcycle:

Volume: 90% of overload day

Intensity: 50% of overload day

Second Half of Microcycle:

Volume: 50% of overload day

Intensity: 50% of overload day

During the final peaking mesocycle before the meet, such deloads do not apply and a taper must be constructed instead, with more details on that in the Phase Potentiation chapter.

Does proper deloading need to be carried out with exactly those percentages? Absolutely not. Those are simply best “educated guess” averages from both literature and coaching experience of the authors. A variety of deload paradigms can be effective, and it’s important to just make sure the essentials are met. That is, some meaningful reductions in both volume and intensity must occur to truly bring down fatigue enough to be worth a week away from overloading training.

WHEN TO USE DELOADS

Because deloads reduce a significant enough portion of fatigue (almost all of it, actually) to allow for weeks of overloading training after, they are perfectly suited to be placed at the end of each mesocycle, which

can last between 3 and 5 weeks of accumulation in most cases. Deloads prepare the lifter for another mesocycle (month or so) of overloading training just like rest days and light sessions prepare the lifter for another microcycle (week or so) of overloading training.

After the execution of a proper deload, the lifter should be fully restocked with glycogen (assuming an iso- or hyper-caloric diet), the nervous system should be almost completely healed, chemical messengers (especially cortisol and testosterone) should be back to at least sustainable levels, and normal microtears to muscle and fascia should be completely healed. This puts the lifter in a great spot for another productive mesocycle, but is not the whole picture of fatigue management just yet. To fully reduce fatigue back to a true zero-level, we'll need something stronger.

ACTIVE REST PERIODS

After a whole macrocycle (several months to a year) of hard training, the nervous system, especially the CNS, may have recovered only 90%-95% with each deload, and the cracks are starting to show. Chemical messengers may be chronically elevated a bit too much for optimal performance and adaptation. Lastly and perhaps most importantly, microtears and fractures to tendon, ligament, and bone have been increasing in size and number. This last concern is especially important as it's the most likely source of traumatic injury if unchecked.

Deloads are a very effective mesocycle-length fatigue reduction tool, but for the macrocycle, a more pronounced approach is needed. An active rest phase is just that, and it has the same sorts of differences between itself and deloads that deloads have with light sessions: longer

and less intense. While a deload is only a week long, an active rest for powerlifting should usually average around two weeks in length. Much less and most lifters will not be recovered enough for a whole new macrocycle of training. Much more and most lifters are long recovered and may be losing adaptations for no reason. In addition, while deloading has at least a moderate intensity period in its first part, no such feature exists in an active rest phase, which is characterized by low volume and intensity through its duration. Thus, recommendations for the active rest phase are:

Volume: 50% of overload day

Intensity: 50% of overload day

WHEN TO USE ACTIVE REST PHASES

The ideal time to use active rest phases is right after a big meet, probably between once and twice a year depending on the lifter. Bigger, stronger, and more experienced lifters will accumulate more extreme tissue damage and will thus be more likely to require twice-a-year active rests. The two weeks after a meet are almost ideal for active rest phases, as the next meet is far away and strategic losses in fitness (which will occur during the active rest) are tolerable. It's certainly fine to take a whole week away from the gym right after the meet and take the next week to perform active rest, but the full two weeks of active rest is likely the better choice by a small margin, especially if the lifter is not in psychological need of relief from the gym. Active rest can be a very good time to focus on technical work, rehab, and mobility, simply because those qualities are very difficult to improve concurrently with heavy training. This will be explained further in the discussion over under-application of fatigue management later on.

From a psychological perspective, active rest phases are perhaps the toughest of all fatigue reduction strategies. Two whole weeks of 50%/50% training is just a very long time for most powerlifters to do without so much as a hint of overload in the gym. By the end of the active rest phase, most lifters are practically institutionally insane, but that's a great thing! It's great because the active rests literally reduces all fatigue back to zero and gets the lifter ready for what may be a year of hard training. How motivated should you be to start a whole yearlong journey? Well, insane is a good start!

4.) AUTOREGULATED VS. PROACTIVE FATIGUE MANAGEMENT

The whole purpose of fatigue management is to regularly drop fatigue down to levels that do not interfere with the presentation of an overload (performance) and the manifestation of adaptations from that overload training. So far, we've only discussed programmed or proactive forms of fatigue management. We know that glycogen stores fall over the course of days, so we have rest days and light sessions. We know that nervous system fatigue sums up over weeks, so we have planned deloads, and we know that chemical messenger disruption and tissue damage sum over months, and for that we have planned active rests. So far, so good.

However, all of these fatigue management strategies rely on at least a reasonably accurate prediction of fatigue accumulation. If your training depletes your glycogen within the 5 days of your training during a week, then the two days of rest after are perfectly timed to restore glycogen levels. But what if your glycogen levels get too low at day 3? What if after the usual two days of rest they are still not high enough to allow for best overload presentation next week? Not all weeks are the same.

After all, the real world is rife with details and potential complications. Maybe you had to move some furniture for a friend and your glycogen utilization was elevated? Maybe you went through a stressful time and your eating was not up to par? Perhaps your sleep was off and your nervous system fatigue is too high to start another week or even month of hard training? Sometimes your pec might feel tender with tissue damage from a rep that was too unstable. Do you just plow through the next week as planned? On the other hand, what if your fatigue is lower than expected? A good problem to have, but a missed opportunity if you just stick to the plan and change nothing. Why train only 4 weeks on end when you could have done 5 and successfully overloaded for one extra week? Might not be much in the grand scheme, but 3 extra weeks of training per year might be another 5-10lbs on your yearly total. Lift for 5 years and that's a meaningful number, perhaps putting you in the number 1 spot at your next meet, or the number 2 if you didn't take the chance to train extra when you were plenty healed for the task.

To address this class of conundrums, lifters can make use of a strategy called "autoregulation." Autoregulation of fatigue management requires the lifter to keep tabs on fatigue levels. The most straightforward way to do this is with performance indicators, but other methods such as morning resting heart rate, desire to train, hunger, and sex drive can be and have been used with success. To use performance as an example, if you are supposed to finish your last week of accumulation (right before deloading) with 5x5 at 200kg and you finish the workout with an easy 2-3 reps left in the tank on each set, is it really time for a deload? We have two inputs to consider before we can calculate the best course of action in each scenario.

ACCUMULATION:DELOAD RATIO

If you autoregulate by training an extra week here and there, awesome. This will run into our next input, but for the accumulation:deload (A:D) ratio, training more simply improves it, meaning we spend more of the year getting even better than what was planned. However, taking extra off days, light sessions and deloads too often can reduce the sum total accumulation:deload ratio, essentially shrinking the amount of time during the year that you actually spend improving. In extreme cases (to be discussed in detail on the faulty application of fatigue management later) this can result in a pattern of training way above MRV for a couple of weeks, getting too fatigued, taking an unplanned deload or succession of light sessions, and repeating the process. The end result is simply less time spent productively training, which is not a desired outcome and thus poses a limitation to the use of autoregulation.

TRAINING PLAN INTERFERENCE

The next limitation to the use of autoregulation is the possible interference of this process with the larger training plan. If you need 8 weeks of strength training to work up to the weights you plan to hit, and your hypertrophy phase was expanded by two weeks because your fatigue was still in check, you now only have 6 weeks to strength train. Yeah, you're the biggest you've ever been, but that new muscle no longer has sufficient time to be trained for maximal utilization by the nervous system, so your performance at the coming meet may simply not reflect your new muscularity, while the scale and the weightclasses might! Because powerlifting meets occur on distinct dates and training for them should be planned well in advance, certain phases of training don't have an infinite leeway in alteration, and a considerable amount of structure needs to be conserved for best results. This presents another

limit for autoregulation, except usually in the opposite direction as the one imposed by the accumulation:deload ratio problem.

How do we make sure to benefit from autoregulation while remaining within the aforementioned constraints?

RECOMMENDATIONS

a.) Stay in Touch with Abilities, Expectations (MRV)

If you don't know your MRV, you're going to either under- or over-accumulate fatigue on a regular basis, throwing off both the A:D ratio and the training plan. Thus the biggest recommendation for autoregulation is to do the best possible job you can of finding out your average MRV and sticking to it! If you think you can recover from 10x10 squats where in reality 6x10 is your usual best, you'll be doing a whole lot of messing up the A:D ratio. On the other hand, if you think you can recover at most from 6x10 squats but your true MRV is 10x10, you're going to be extending your mesocycles by possibly weeks at a time and seriously disrupting your training plan. The MRV estimate is of course imperfect as both work capacity and recovery fluctuate, but at least a good running average is a start. Don't train by feel and you won't have to fatigue manage by feel.

b.) Alter Sets and Weights Marginally for too Little Fatigue

If you're doing a good job of tracking your MRV and training right near it, you'll still run into situations where you feel less fatigued than you should. In this case, the best recommendation that does not interfere with the training plan is to increase the number of sets you perform, or even the weight on the bar. If you plan an accumulation phase of 4 weeks and week 2 is a breeze, go up 15lbs instead of 10lbs on some

week 3 movements, or add a set or two to them. That's going to get you the same effect as adding a whole week of training, but won't alter your training plan structure one bit. This kind of adjustment requires a very low level of ego and a very high level of connection with your own abilities. Such are the domains of the experienced lifter and the rewards of years of intelligent training... do your best with them no matter your training age.

c.) Use Extra Light Sessions, not Deloads for too Much Fatigue

Using our example from b.), if too much fatigue has begun to accumulate and week 2 begins much harder than it should, the best course of action to reduce fatigue without reducing the A:D ratio is to take the rest of that week as light sessions. Light sessions are on average better at conserving adaptations than deload weeks, and they sure as heck don't take as long. They are perfect for use in just this kind of application; when fatigue is just a little too high for that point in the mesocycle. This strategic use of light sessions requires honesty, low ego, and personal knowledge of abilities, but it pays huge dividends by allowing the lifter to keep fatigue low enough to still get most of the training of that mesocycle around the MRV, instead of having to drop down a whole week to recover.

In summary, a plan is needed, on top of which autoregulation can play an important role. Autoregulation is best done through small increases in volumes and intensities when training is too far below the actual MRV. For training that eeks a bit too high over the actual MRV, autoregulation can reduce fatigue mostly through light sessions later in the week, avoiding whole unplanned deloads that reduce the A:D ratio. If you need unplanned deloads too often, chances are you're misestimating your mesocycle-scale MRV. Lastly, because autoregulation requires a low ego

(to prevent from adding volume and weight too liberally) and a close connection to one's abilities (to know when to back off or go harder), its use should be paired to training experience. Beginner lifters (who should also have a coach in most cases) should stick to much more rigid programming, as both their abilities to autoregulate and their needs (they don't accumulate much fatigue and they will progress even if they under-train some) are not high. As lifters gain more experience and time in the rack and on the platform, autoregulation can enter a more expanded use. A tiny caveat is that while autoregulation becomes a more realistic option for advanced lifters, their more intimate knowledge of their MRV will in all likelihood relegate their use of autoregulation to a modifier of their programming rather than the dominant feature.

UNDER-APPLICATION OF FATIGUE MANAGEMENT

1.) CHRONICALLY OVERDOING VOLUME

From our discussion earlier on the overload principle, we made use of the following table, which is instrumental to the topic of chronic volume excess as well.

In this table, training volume can be split into 5 categories:

- a.) Training that is not voluminous enough to incur any meaningful and desired adaptations.
- b.) Training that is voluminous enough to incur some meaningful and desirable adaptations, but not the most that can be accrued.
- c.) Training that is at the MRV, and is the most volume that lifter can benefit from.

d.) Training that is higher in volume than the MRV but not overwhelming to recovery in the medium term and is still beneficial, though less than maximally.

e.) Training that is so high in volume, that recovery is impeded highly enough to be a net neutral effect on performance and adaptation, or a net negative.

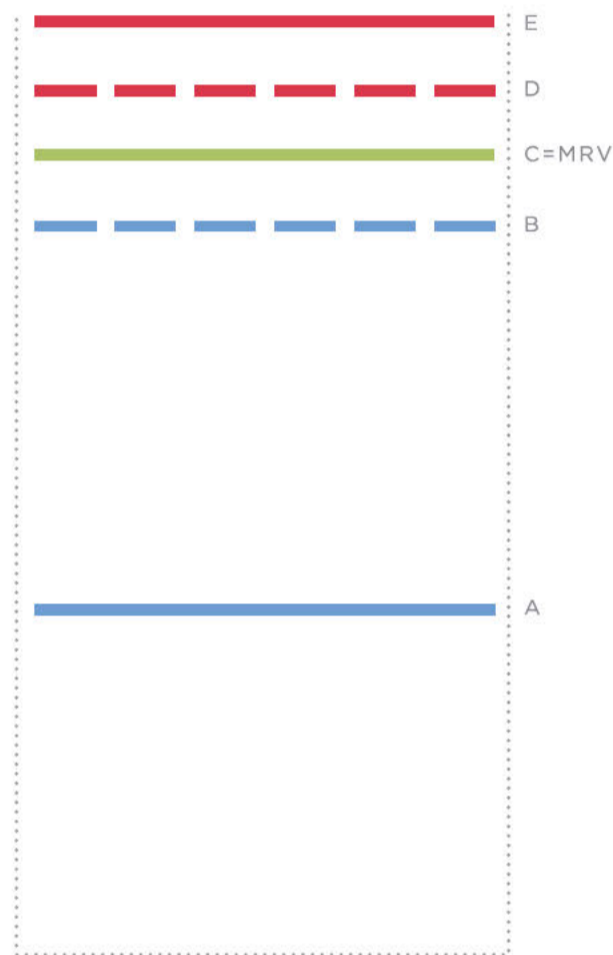


Figure 7: Training Volume and MRV

Training more is absolutely more productive until category C in the table above is surpassed. This category is the MRV, your body's maximum ability to recover and benefit from training. Once this category is surpassed, training more and more actually adds no more value if

continued for extended (weeks) period of time. Fatigue management allows the powerlifter to approach category c, pass it, and enter category d, as functional overreaching has shown to have some benefits. However, this is intentionally a short-term process, lasting perhaps the last week of a mesocycle until a deload is employed to bring down fatigue.

An under-application of fatigue management results in volumes that exceed point d too often or perhaps even most of the time. This inevitably leads to performance stalling, poor or negative adaptations, possibility of performance regression and potential overtraining if carried out for too long.

There are at least 3 notable paths to chronically over-using volume past the MRV:

'HARDCORE' MENTALITY

You're a powerlifter. Powerlifting is a hardcore sport, period. It's your job to regularly put yourself in the path of weights that are heavy enough to literally kill you. If you weren't powerlifting, you'd probably be a pirate, assassin, or samurai. You know, something like that! On a serious note, powerlifters have a "hardcore" mentality of accepting challenges, not quitting easily, and willingly accepting pain and hardship to make progress. This mentality serves us extremely well to get through hard workouts, get in the right amount of food, and step up to the challenge of PRs on the platform. However, if taken too far, this mentality can lead to a jettisoning of logic. yes, it's a good idea to try hard and go to crazy in training, but only because we know the psychotic effort leads to improvement. If we've willingly surpassed our MRV, doing more work

is no longer getting us any better. At this point each lifter has to make a decision about what is more important; getting better at powerlifting or feeling more “hardcore” about their approach to it. Each reader can decide for themselves.

COPYING ROUTINES OF THE GREATS

This will come as a shock to most readers, but only one of you is actually Ed Coan. I know, I know, it sounds crazy but please keep reading.

Routines of past and current greats are absolutely awesome tools to help a lifter learn about proper programming and gain insight into his/her training. The structure of the routines can carry great insight, but it's unlikely that the total volume does. In fact, just about the only thing the total volume tells you is how well that lifter him/herself could recover during that specific time in his/her career. Some lifters had a very impressive and extreme ability to recover from high volumes, but almost all of them would be the first to tell you that the only important variable about volume is what you can recover from, not them. So if you directly copy the routines of the greats, you risk doing so much work that you pass your MRV by light-years, and end up stalling or worse. If you really think you can hang with anyone, try Bill Kazmaier's old powerlifting split (no refunds, exchanges, or lawsuits for rhabdomyolysis). When programming for yourself or adjusting an existing program from a great lifter, start with a much lower volume than they use, and ease in. Increasing volume when you're recovered is MUCH easier and safer than decreasing volume when you're already beat up.



TRYING TO KEEP UP WITH THE JONESES

This mistake is so blatant that the most we'll mention of it should serve as a kick in the butt to remind you not to fall for it. And all of the authors of this book and just about every powerlifter on the planet has fallen or will fall for this error.

Parlaying our discussion on copying routines of the greats, the only volume that matters is your personal MRV. You have different genetics than others. Your diet is different. Your sleep is different. Your family situation is different. Your drugs might be different or nonexistent (and some others use them). With all those differences, why in the world would you try to emulate the same training volume as someone else?

“THAT %\$#%* ON INSTAGRAM CAN DO 5 SETS OF 10 IN THE SQUAT? SO CAN I.”

We've all been there. But that doesn't mean it's a good place to be. The only reason we powerlift is to get stronger. The only best way to get stronger is to use your own MRV in training. Using someone else's is wrong by definition. Here's an uncommon tidbit... fast-twitch-dominant individuals (those with a lot of fast-twitch muscle fibers) are genetically predisposed to better powerlifting performance. But, the faster twitch you are, the more homeostatic damage your training exerts, and the slower you recover. Here's another fact: those with smaller muscles and less strength can recover better from many kinds of training because they literally don't have the strength to cause as much damage and don't have the same muscle size to have to fix. Less damage, less fixing, and viola; higher weekly volumes. A marathon runner may be able to train with the same volume as a very good powerlifter, and perhaps even more. Does that mean they are better at powerlifting? Absolutely not. It just means they are crappy at stimulating and amazing at recovering.

If you're chasing arbitrary high volumes that a training partner, Instagram enemy, or random big guy in the gym is doing, there is a non-trivial chance that you actually have better genetics and are simply misusing your gifts. Yes, more volume tolerance is better for almost all, but you get there by recovering better, not by attempting to overtrain for a hobby. Stick to your own MRV and try to improve it, but keep that journey personal. After all, you're going to be the only guy up on the platform anyway when your attempt is called.

“WELL, IF MY TRAINING PARTNER CAN DO IT, I CAN DO IT.”

2.) CHRONICALLY GOING TOO HEAVY

Nearly all powerlifters love training heavy. And the ones that don't will leave the sport fairly quickly because constant heavy training is such a big part of powerlifting. While training somewhat heavy is critical to powerlifting success, there is such a thing as going too heavy, too often. There are at least 3 problems with going too heavy too often, which we will define as executing more than 8 weeks of training at your beyond 90%1RM leading up to a meet, and any training beyond 90% if the meet is far away and lighter training is planned in the interim.

INSUFFICIENT VOLUME FOR STRENGTH ADAPTATIONS

Yes, training to get strong means you need to go heavy (75% 1RM+) consistently, and lifting light weights simply won't get you there. But not only does training need to be heavy, that heavy stimulus needs to be presented over, and over, and over in high enough amounts to fully turn on the body's systems for generating strength adaptations. Imagine you enter a room that has 10 light switches on one side, and only one light switch on the other. The 10 switches are connected to 100 Watt bulbs and the one switch is connected to a 200 Watt bulb. You're told that your goal is to make the room as bright as possible, but you can only turn on the switches on one side of the room, and that's it; choose your side. 1000 total Watts is sure as heck brighter than 200 Watts, and the 10 smaller bulbs are the logical choice. Just the same way, a 90%

lift generates more strength stimulus than a 75% lift, but you can do so much more 75% lifting than you can 90% lifting that it turns out 75% is the better way to maximize the strength stimulus. How many reps in a session do you really have at, let's say 95% 1RM? 5, maybe 8 if you're a max-out freak? How many do you have at 80%? 40? Maybe 50? Because volume is such a big part of the message, super-heavy lifting just doesn't match up to the more moderate variety that allows us a heavy enough stimulus to make strength gains, but also one that can be applied in a high enough volume to give us the most progress.

SUSTAINABILITY

Fine, you're convinced that lifting super heavy in one session doesn't give us nearly the volume we need. But what about coming in twice a day? What about those high frequency programs of daily maxing? They run into a different and arguably more serious problem; cumulative fatigue gets out of control.

Per any given volume, the more intense the lift (closer to 1RM), the more fatigue it generates, particularly in the nervous system. If you have a max squat of 500lbs, getting to 4000lbs total volume might be done in the following ways:

4 sets of 10 at 100lbs (20%1RM)

4 sets of 5 at 200lbs (40%1RM)

5 sets of 2 at 400lbs (80%1RM)

9 singles at 450lbs (90%1RM)

The research says that fatigue accumulates higher and higher with each heavier weight at the same volume. But just look at those numbers above... how hard is it to do 4 sets of 10 at 100lbs if you squat 500? I mean, it's a joke! A very good warmup, if anything. Will you get sore? Heck no. Tired? Nope. Be able to come in the next day and do the same thing? You bet. 5 doubles at 400lbs is the more realistic comparison, as that meets our minimum intensity for strength alterations. But is 5 sets of 2 at 400lbs really that hard if you squat 500? It's tough for sure, but nothing you probably can't replicate twice or three times per week for a long time on end. Now the 9 singles at 450lbs... that is some serious work. That's not a workout you just walk away from. In fact, given all of the principles of this book, that's not even a workout I'd recommend you try. It will crush you and leave you beat up for at least a week, if not longer.

All that punishment, and for the same volume. Yes, you'll get stronger doing the last workout with 90% than you will the second to last with 80%, but maybe about 20% stronger... and here's the kicker... you can repeat that 80% workout at least twice as often as you can the 90% without accumulating too much fatigue to continue. So you're missing out on maybe double the stimulus or more for a measly 20% difference in potential gains from one session. Not seemingly the best idea.

In the real world of powerlifting results, most of the lifters that have gone too heavy for too long will give you all sorts of stories about how it got them tired, burnt out, or even hurt. Supposedly Westside guys train all the time at 90%+, but it turns out literally one half of their weekly workouts are at something like 60% during their speed days. Westside is a sustainable program for most, and guess what the average intensity turns out to be? Yep, about 75%.

Training for max lifts all the time is a violation of fatigue management in both acute (one workout) and chronic (a month or more of workouts) timescales. Why then do so many lifters gravitate towards programs that facilitate constant maxing and otherwise 90%+ training? Well, like a bad teen movie, it all starts in high school.

SHOWING OFF VS. TRAINING

Whenever lifters wanna laugh, they exchange stories of how they trained in high school. This is a particularly hilarious topic because people who went to school in Florida or Alaska, Japan or France did the same damn thing in the high school weight room; they maxed out.



That's the high school training method; max out all the time, do a bit of "accessory work" (curls and... well that's it), and call it a day, simply to come back in a day or two and repeat the process.

At some point, hopefully not too long after high school, we figure out with or without hints by more experienced lifters that maxing out so often is really just about showing off. It turns out TRAINING is not nearly as glamorous as maxing, but it has one overwhelming benefit; it gets you better results. Because super heavy training can't sum up the needed volumes to get us the best results, it's really just an extension of the high school show-off mentality into the modern training world. Yes, it's much more fun to go heavy, yes it's what the sport is all about, but no, it just doesn't get you the results that slightly lighter but more sustainable higher volume training does.

If you want the best results, you've gotta train like a grown up and pound in that heavy-but-reasonable volume. Save the max training for the peaking phase when it's best suited to get your new stronger body ready to the heavy weights of the meet.

3.) NOT TAKING DELOADS OR ACTIVE REST PERIODS

The section of this chapter on proper application of Fatigue Management defines and discusses rest days, light sessions, deloads and active rest periods. Their application is necessary to bring fatigue down to non-interference levels as it rises during the overloading training process. There are only two ways around having to use these strategies in your training:

a.) You never provide enough of an overload for fatigue to accumulate

Some guys really pride themselves on “never having to deload.” “I don’t need to deload, brother. My training’s always hard and heavy.” When you look into their program, 9 times out of 10 their idea of “hard and heavy” seems more like “easy and light.” The most common mistake in powerlifting is to under-load volume. Yeah, these guys go heavy, but 2 heavy singles a week does not constitute proper, stimulating powerlifting training. In fact, with the little assistance work they do on top of that, they never really accumulate enough fatigue to even need to bring it down by deloading or taking an active rest. Let’s put it this way... if you can just go back to full-tilt training the next week after your meet, you didn’t train hard enough for your meet and your idea of “full-tilt” is vastly out of touch.

b.) You auto-regulate the old fashioned way: get burnt out or hurt for several weeks at a time by pushing it too hard for too long

If you do in fact train hard enough but still don’t deload, you’re going to overreach after more than about 8 weeks of proper overload largely no matter any other circumstances. Hopefully you either pull a small muscle and are forced to lighten the volume and intensity for a week or two or simply burn out and start skipping workouts or taking light workouts instead. Then when the fatigue has dropped, you’ll just crank it back up again and keep plowing. Is this optimal? Heck no, you’ll just be spinning your wheels or even regressing for about 3 weeks out of every 8. 3 weeks you could have spent getting better. Of course if you don’t get a minor injury or burn out for a bit, you’re risking overtraining itself, which is not something you wanna mess around with.

Do you have to take light sessions? No. Many routines don't have them programmed. But deloads? Mandatory, and active rest for at least a week after each meet is a very good idea.

4.) DELOADS THAT ARE TOO OVERLOADING

The very purpose of training modifications to bring down fatigue is to... bring down fatigue. Crazy as this sounds, sometimes lifters will design their fatigue reduction phases in such a way that's not particularly conducive to fatigue reduction.

The single biggest contributor to fatigue is volume. It greatly outweighs intensity in its disruption of homeostasis, and is thus the critical variable in fatigue management. In fact, deloading by only bringing down volume and not changing intensity much is a common practice in the short-term fatigue management plans of many effective programs.

Because volume is such an important fatiguing variable, it must be brought down in most any meaningful fatigue reduction period, and especially in the longer periods, such as deloads. An all-too-common mistake in deload design by many lifters is to drop the intensity and not the volume, which is an unfortunately poor approach to fatigue management. Taken literally "de-loading" means taking weight off the bar. Lifters will do this, but then find that lifting very light weights doesn't really feel like training. Since powerlifters usually love to train, they'll increase the reps and possibly even the sets to "get a pump" or "get some blood flow in the area" or "insert favorite rationalization here." The training becomes a bit tougher but more fun, and because the weight was lower, the "deload" was considered a success.

While this method of deloading does let the body recover somewhat from intensity-specific fatigue (mainly the nervous system), it falls very short of being an effective fatigue management tool. Because the intensity is low, adaptations are not well-conserved and strength and possibly size can decline during the deload. In addition, because of the high volume, cumulative fatigue at the end of the deload may be higher than before it! Kind of the worst of both worlds.

When deloading, it's best to avoid tricks to make the process tougher by adding volume or perhaps even doing other, more challenging exercises that get you sore and make you feel like you're getting an adaptive benefit. Deloads are specifically for fatigue management, not other training and certainly not for short-term adaptations. If your deload is tough, you're not dropping the fatigue you should be and that's likely going to negatively affect your next training cycle. Keep deloading easy to keep it effective. As for the pent-up violence that develops from easy training through the week? Try to buy and play more violent video games. It's a tough world, for sure.

OVER-APPLICATION OF FATIGUE MANAGEMENT

1.) NEVER PUSHING IT HARD ENOUGH

Fatigue accumulation is scary. All kinds of unwanted effects can occur if you push it too hard for too long... poor training, poor results, and even injury. Some lifters get so weary of fatigue that they bias their training too far in the opposite direction so that fatigue never really accumulates much. There are three ways in which this occurs, and all three lead to underwhelming and disappointing results.

A.) NOT ENOUGH VOLUME

An absolutely great way to insure that fatigue never accumulates to meaningfully interfering levels is to keep volume chronically low. This is actually quite common, as it has a seductive pseudo-benefit. The benefit of chronic low volume is that you never really carry that much fatigue and the result is that you can always perform relatively well. You're never too depleted, tired, unmotivated, or beat up and you can have some very impressive high intensity sessions. This can leave the lifter thinking that his program is well designed, which is unfortunately the opposite of the truth. In reality, it's the debilitating volume that gets you both the fatigue and the adaptations. If your volume is so low as to avoid most fatigue, it also avoids most adaptations. yes, you end up always feeling great, but you never get that much better. Training becomes a long term succession of what essentially amount to show-off sessions instead of meaningful training that causes adaptations.

B.) NOT ENOUGH INTENSITY

Not a serious error to dwell on for too long, mostly because powerlifters rarely commit this error. Powerlifters generally love to lift heavy and on average have much more of a problem with going too heavy than not heavy enough.

That being said, some recent philosophies on powerlifting training that have been garnering media attention lean a bit too much away from the heavy side. The claim is that lots of volume with very light weights (50% range, even) can make you just as strong as lifting heavy, and improves your technique and allows you higher volumes all the while, so is in fact even better than strictly heavy training. While percentages as low as 60%1RM can promote hypertrophy which can later be enhanced

to produce strength improvements, it would be a very theoretically difficult argument to make the case for 50% 1RM even being optimal for hypertrophy, much less anything else outside of fatigue reduction. If you train light all the time, you'll certainly not risk as much fatigue and injury, but you can say goodbye to the best results as well.

While most powerlifters don't shy away from heavy weights on the main moves, assistance work tends to suffer much more commonly from this error. If intensity is not above 60%1RM for that exercise, it's likely not going to do much, even if that exercise is cable pushdowns or face pulls. At the end of the day and outside of intentional fatigue management, you either train something hard and heavy enough to make the best gains, or you don't train it at all and opt for more recovery for your other training. The grey area of very light training, even if it's just for assistance work, is best avoided.

C.) TOO FAR FROM FAILURE PROXIMITY

Training to failure is not a sustainable method of training. But, the closer you go to failure, the more effective each set is for stimulating adaptations. The proximity with which you approach failure is termed the relative intensity of the set, and it has an understood and positive relationship with adaptations so long as fatigue is kept in check. If you stop 1 rep short of failure every training session, the cumulative fatigue will likely rise far too quickly for sustainable training. On the other hand, if you stop each set 8 reps short of failure, you'll never be able to train hard enough to make gains.

Stopping too far short of failure actually interferes with hypertrophy, strength, and peaking training. Hypertrophy training has been shown

to be maximized in effect closer to failure, so the loss there is rather straightforward. But in strength training, how many times can you really squat or deadlift your 85%1RM? Maybe 5 or so? That number may be 10 reps for 75% 1RM? So if you stop 8 reps short of failure on 75%1RM, it's literally going to make you do sets of 2... and for a long time to get the needed volume. At 85% and anything higher (which cuts off much of the strength phase and the whole peaking phase), anything over 4 reps from failure would leave you doing singles, and with peaking phases over 90%, no reps at all! Thus, staying away from failure proximity at all costs is not the best way to train, but staying closer to failure while avoiding failure itself likely is.

2.) TOO FREQUENT DELOADING

If you train far in excess of your MRV in the first week of a mesocycle, you're going to accumulate a lot of fatigue. If you continue on that path in your second week, there is a good chance that either the third week will be the worst training week of your life, or you'll choose to deload and hit it hard again in week 4. Most lifters catch on at this point, and at the very least will deload in the third week, with many of them re-thinking their training and then lowering their training volume down to sustainable levels in week 4 to allow for a longer continual training progression.

Some lifters on the other hand, and for whatever reason, don't back off after the deload week and plow per usual, full steam ahead. This results in a repeat of the previous experience and leaves them yet again in need of a deload after only another two weeks of training. If this process continues, we can say that the accumulation-to-deload ratio is 2:1. For

every 2 weeks of productive training, 1 week of deloading is needed. What that ends up doing is literally slicing off 1/3 of the training year's potential gains. Throw in some meet taper and active recovery phases in there, and you're practically training hard only about half of the year.

Instead of going so hard each week that you need a deload every 2, it's likely better to just go hard enough to get within the maximal overload threshold in week one and make slow progressions week to week.

In practice, this often results in a 3:1 or 4:1 accumulation-to-deload paradigm, and thus a much larger fraction of your time through the year is spent on actually improving rather than recovering an irresponsible accumulation of fatigue.

3.) FATIGUE MANAGEMENT THAT IS TOO EASY

While reducing the training stimulus to allow for fatigue to dissipate is an indispensable part of the training process, even pre-programmed efforts to manage fatigue can be taken too far. This results in two distinct problems and is caused by distinct three fatigue management errors.

A.) ELEVATED LOSSES OF FITNESS

By making fatigue-reduction periods too easy or completely off, we may experience more pronounced losses in fitness. The goal of fatigue reduction periods is always and everywhere two-fold; fatigue reduction and fitness retention. By training with at least some minimal volume and intensity during the fatigue-reduction period, we conserve more adaptations (strength, size, and technique) than if we train way too easy

or took the time off instead. Because any dropped fitness must use up training time to be re-established, such improper fatigue management leads to a reduced rate of improvement compared to what's possible with sufficiently simulative periods of fatigue reduction.

B.) LOWERED DROPS OF FATIGUE

For reasons that are not entirely clear enough to warrant discussion, training sufficiently hard during fatigue reduction periods (as opposed to barely training at all or just taking the time off) has been shown to lead to more fatigue reduction. If this sounds counterintuitive, it is, but it's also been overwhelmingly confirmed in research from around the world on multiple sports. Light training works better than "barely anything" training or total off time to actually reduce fatigue itself. This is a very good reason to avoid taking much time completely off as well as paying attention to minimum intensities during fatigue reduction periods.

CAUSES

I: UNPLANNED OFF DAYS

A big culprit in causing fitness losses and inadequate fatigue drops is the use of unplanned off days. While much better than simply grinding through a crappy and possibly injury-threatening workout, days on which fatigue is very high don't have to be taken completely off. In most circumstances, a light session will accomplish even more fatigue reduction than an off day, but will conserve fitness better as well. And if you're too beat up to even do a light session... you need a doctor, not a powerlifting coach.



II: FULL OFF-WEEKS REPLACE DELOADS

In the same vein and with the same mechanisms as the unplanned off day, a deload week that is taken completely off will neither reduce fatigue nor retain fitness as well as a proper deload week of training. If you're too psychologically fried to even show up to the gym, it's likely that you're way too overreached from your training if not worse, and you likely need to reconsider your current volumes and intensities. In the worst case, you can take the first half of the deload week off and then train light the last half, which will give you some needed time away from the gym but still accomplish a good deal of the fitness retention and fatigue dissipation of the deload week.

III: UNDIRECTED ACTIVE REST

After a meet or series of meets, the physiology can be holding quite a bit of fatigue, especially of the chemical messenger alteration and tissue

disruption kind. This can call for an extended version of the deload, called the active rest. A period of 2-4 weeks, the active rest keeps the volume and intensity reduced by a wide margin to allow full healing of the slowest-healing of systems to help set the lifter up for another year (or several) of productive and injury-low or injury-free training.

While the active rest will not allow opportunities to get any bigger or stronger, it can allow for the development of several abilities that can serve to improve powerlifting results later in the macrocycle.

Technical Work: During the period of light training, new techniques can be experimented with or older techniques can be better refined and ingrained through practice with lighter loads. Everyone knows that lighter load practice is the way to learn and solidify technique, but when the heck are you supposed to do that? You're too busy most of the year using heavy loads to actually get strong, and if you spent all your time taking weight off the bar to make technical adjustments or experiment with new ones, you wouldn't have any time to actually improve! By altering, learning, and practicing techniques during your active rest, you can take those new techniques into your next macrocycle of hard training, or you can figure out that they are not for you, and discard them without ever missing out on any quality training.

Flexibility Work: Mobility is the intersection of technique, strength and flexibility. Since you can't work on strength during your active rest phase, working on your flexibility pays great dividends later as you load up the bar and discover that your mobility has improved! Because flexibility work is not very taxing, a lot of it can be done during this phase and flipped to maintenance mode once you get back to hard training, which will conserve most of your gains in flexibility and thus

greatly expand your mobility. A big side benefit of flexibility training during your active rest phase is that it prevents you from being super tight on your return back to hard training, which can be a huge pain in the butt! This can be especially effective if you keep up some smaller level or flexibility work in your regular training once active rest is over to keep the gains in flexibility from your active rest maintained.

Rehabilitative Work: In a perfect world, powerlifting training would be an injury-free process. Also, puppies and kitties would drive our taxis and water our lawns. In any case, that's certainly not the reality. We're left with dry lawns, and more importantly, bumps, bruises, sprains and strains to deal with. Because rehabbing during hard training is arguably a self-defeating process (how are you supposed to heal while simultaneously producing maximal forces?), it's best reserved for the active rest phase, which is very well spent by getting really proactive with rehabilitative modalities. Working the kinks out of that shoulder, letting the elbow get some blood in it without 400lbs of load to follow, and finally doing something about that strained calf are tailor-made for the active rest phase.

By taking an active rest simply as an extension of your normal training (only lighter and less voluminous), there is potential to miss out on technical, flexibility, and rehab work. Just like every other phase, the active rest phase should be goal-directed. Yes, you can get pretty burned out on powerlifting and just want to do some light bodybuilding moves on your active rest, but that won't give you the best long term advantage when compared to working on the above factors/modalities. Serious dedication to the sport means that even when you're on a break such as an active rest, the very nature of the break sets you up maximally for future success.

SUMMARY

If you've managed to physically survive long enough to have read the whole Fatigue Management chapter, you'll know that this principle of training has a lot of details and complexities to it. That being as it is, it's still a pretty easy principle to sum up in basic terms for powerlifting.

Fatigue management is the act of keeping fatigue down to levels at which it does not negatively affect performance and improvement. Fatigue is unavoidable so long as an overload is being presented in training, and it can be reduced at regular intervals with the use of rest days, light sessions, deloads, and active rest periods. However, the best start to proper fatigue management is to have a reasonable estimate of your MRV for the different intensities of training (size vs. strength vs. peaking) so that you can consistently present the biggest overload that you can still recover and make gains from. MRV is not static and can be altered by an increase or decrease in work capacity and by an increase or decrease in recovery ability, so it's a variable that needs constant monitoring for best results to occur.

Key Points

- Training causes both fitness and fatigue. In order for new gains in fitness to be expressed, training fatigue must be alleviated periodically to promote recovery and adaptation. This systematic process of alleviating acute and chronic fatigue is called fatigue management
- Fatigue from hard training usually comes as a result of four primary factors: Energy substrate depletion (primarily stored carbohydrate), nervous system disruptions, disruptions in chemical messengers (intercellular signaling, hormones,

autocrine and paracrine systems), and damage inflicted to tissue (muscle, tendons, bones etc..)

- Fatigue management should be approached on an individual basis. What works for some may not work for everyone. Powerlifters should choose their training volumes and fatigue management strategies to meet their own personal needs
- Some of the simplest and most effective ways to manage fatigue include taking off days, taking light days, taking deload periods, and implementing active rest phases after strenuous training periods

SOURCES & FURTHER READING

Concept of Fatigue Management

- Fatigue Management In the Preparation of Olympic Athletes
- Principles and Practice of Resistance Training
- Periodization 5th Edition Theory and Methodology of Training
- Peaking and Tapering for Optimal Performance
- A framework for Understanding the Training Process Leading to Elite Performance

Sources of Fatigue

- Fatigue During High-Intensity Intermittent Exercise: Application to Bodybuilding
- Mechanisms of Muscle Fatigue in Intense Exercise

- Recent Advances in the Understanding of Skeletal Muscle Fatigue
- Exercise and Fatigue
- Physiological and Psychological Fatigue in Extreme Conditions: Overtraining and Elite Athletes
- Overtraining Syndrome in the Athlete: Current Clinical Practice

Acute & Chronic Fatigue Monitoring

- Fatigue Management in the Preparation of Olympic Athletes
- Science and Practice of Strength Training
- Monitoring of Performance and Training in Prowing
- Monitoring Training Load to Understand Fatigue in Athletes



CHAPTER SIX

STIMULUS RECOVERY ADAPTATION

SCIENTIFIC DEFINITION

Stimulus-Recovery-Adaptation (SRA) describes the sequence of processes that occur during and after training; the very processes that cause improvement and increases in size and strength. It is a sport-science derivation of the much older General Adaptation Syndrome (GAS) originally described by Swedish physiologist Hans Selye. Every training session and the period after it and before the next session can be described entirely by SRA. Please see the graph below.

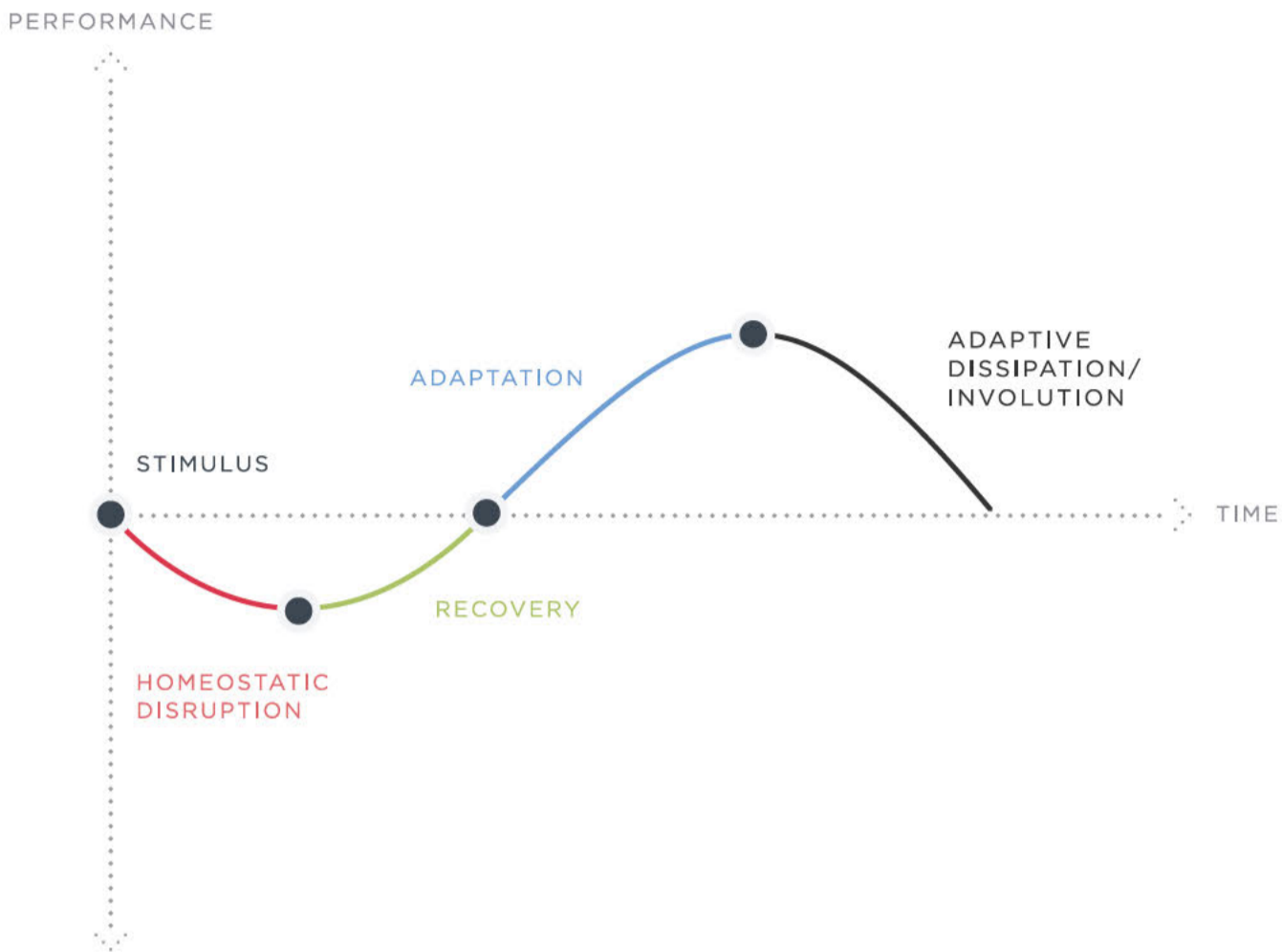


Figure 8: Stimulus-Recovery-Adaptation Curve

STIMULUS

The stimulus is the period of time during which training itself actually occurs. Varied mechanical and molecular systems are disturbed during this time, causing both a depression of performance and a signaling cascade that prepares those disturbed systems for recovery and adaptation. Depending on the nature of the disruption, performance can continue to decline further and further hours and days after the stimulus itself. Functional muscle size is reduced for days after hard training as the immune system and satellite cells repair damaged muscle fibers, during which time they are partially unresponsive to activation and use. Similar processes occur in the nervous system, so that whole-movement performance can actually get worse over several hours and days after an overloading training session before it begins to recover.

Within the adaptive limits of the body, stimuli that disrupt the most and depress performance for longest also tend to produce the most elevated adaptations, but the whole SRA cycle then takes longer to complete, which is a feature that will be further explored in later sections of this chapter.

RECOVERY

Immediately after the stimulus is presented, recovery systems begin to heal homeostatic disruptions and attempt to return performance of the system back to normal levels. If the disruption is large, it may be hours or days before some system performances even bottom out and begin their rise back to baseline levels. It is very important to note that during this time, further overloads can and will disrupt performance even further. If the additional disruption is within the system's long-term ability to overcome, then an even bigger adaptive spike can be created once recovery is complete, which is the principle behind overreaching. If, however, one or a series of overloads is presented during recovery and their magnitude is too great for systems to overcome, an incomplete recovery with little or no adaptation can be the result.

Outside of the occasional use of functional/planned overreaching, the implication is that overload training should be followed by periods of rest or non-overloading training in order to prevent interference with recovery.

ADAPTATION

As recovery occurs, so does adaptation. Adaptation is technically measured as the degree of performance gain above the starting baseline at which the stimulus occurred. In fact, adaptation can be occurring

as soon as the stimulus has concluded or just after, and proceeds concurrently with recovery, but usually concludes after recovery as it is a more physiologically expensive and complicated process to make new tissue structures or re-arrange current ones for ability improvements. It is almost always easier to regain older performances than it is to establish new ones.

During the time that adaptation is occurring, overloads can directly interfere with the adaptive process and curb the sum-total degree of adaptation gained from stimulus. This is a very important consideration, as it implies that outside of functional overreaching, training and rest must be structured in an organized fashion.

Particularly, the combination of stimulus, recovery, and adaptation creates the necessity of what can be called the “session-rest-session” paradigm. Instead of just training randomly through the week or clustering way too much training way too close together and then taking the week off, the SRA principle creates the need to perform a calculated stimulus (training session) and allow sufficient time away from overloading disruptions (recovery and adaptation) before the next stimulus (training session) is presented. Put another way, the goal of training becomes to arrange a program such that the next training session occurs at the adaptive peak of the generated SRA curve of the previous session, and so on and so forth. This allows for the fastest rates of improvement as adaptations build on one-another, without training too early to disrupt further adaptations or too late so as to lose gains needlessly.

PERFORMANCE

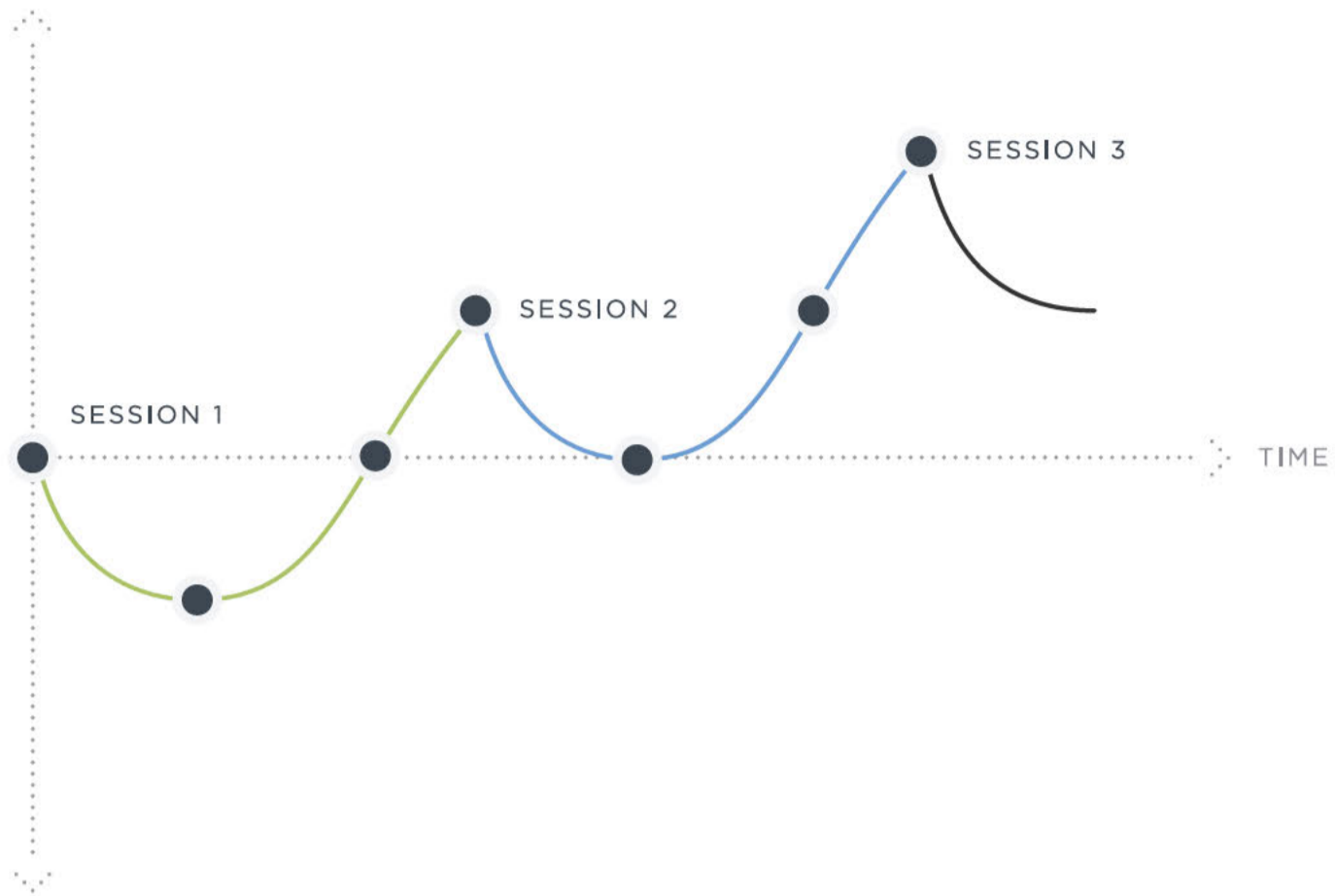


Figure 9: Arranging Peak-to-Peak SRA Curves

SYSTEM-SPECIFIC SRA CURVES

Each time a stimulus is presented and an overload disrupts homeostasis, an SRA curve (as illustrated above) is generated. In reality, one SRA curve is simply an averaging of the multiple SRA curves that are generated with each session. Every time an overload occurs, each system experiences its own SRA curve, and on a different timescale. During powerlifting training, each hard session produces at least 4 distinct SRA curves noteworthy for this discussion, with each curve having different average durations: nervous system technical ability, hypertrophy, nervous system force output, and fiber alignment/connective tissue integrity curves.

A.) NERVOUS SYSTEM: TECHNICAL ABILITY CURVE

During a training session, the nervous system gets lots of practice on the technical execution of the lifts. Both central and peripheral nervous systems are involved in producing the sequence of muscle contractions and relaxations that cause the bones to move in the exact pattern desired. The more practice a session allows for, the more stimulus there is for technical improvement, but also the more fatigue is generated and the more the technique breaks down. At the end of a training session and for hours after, technical execution is worse than it was before the session. Within hours of the last session, however, recovery and adaptation produce a net improvement in technical ability. In most human movements (and definitely such relatively simple movements as the powerlifts), the adaptive processes that govern technique rarely need longer than a day to complete, and often much less time than that. We thus see a ubiquity of multi-day technical training within a week in almost all sports, and oftentimes multi-session training within the same day.

If we were only seeking to improve lifting technique, we could train multiple times per day almost every single day of the week. If we just wanted to hold onto technique, several sessions a week would suffice, especially if the technique is well established. But of course we're not only concerned with technique training in powerlifting, as hypertrophy and neural force production at the very least are equivalent if not more important concerns.

TECHNIQUE

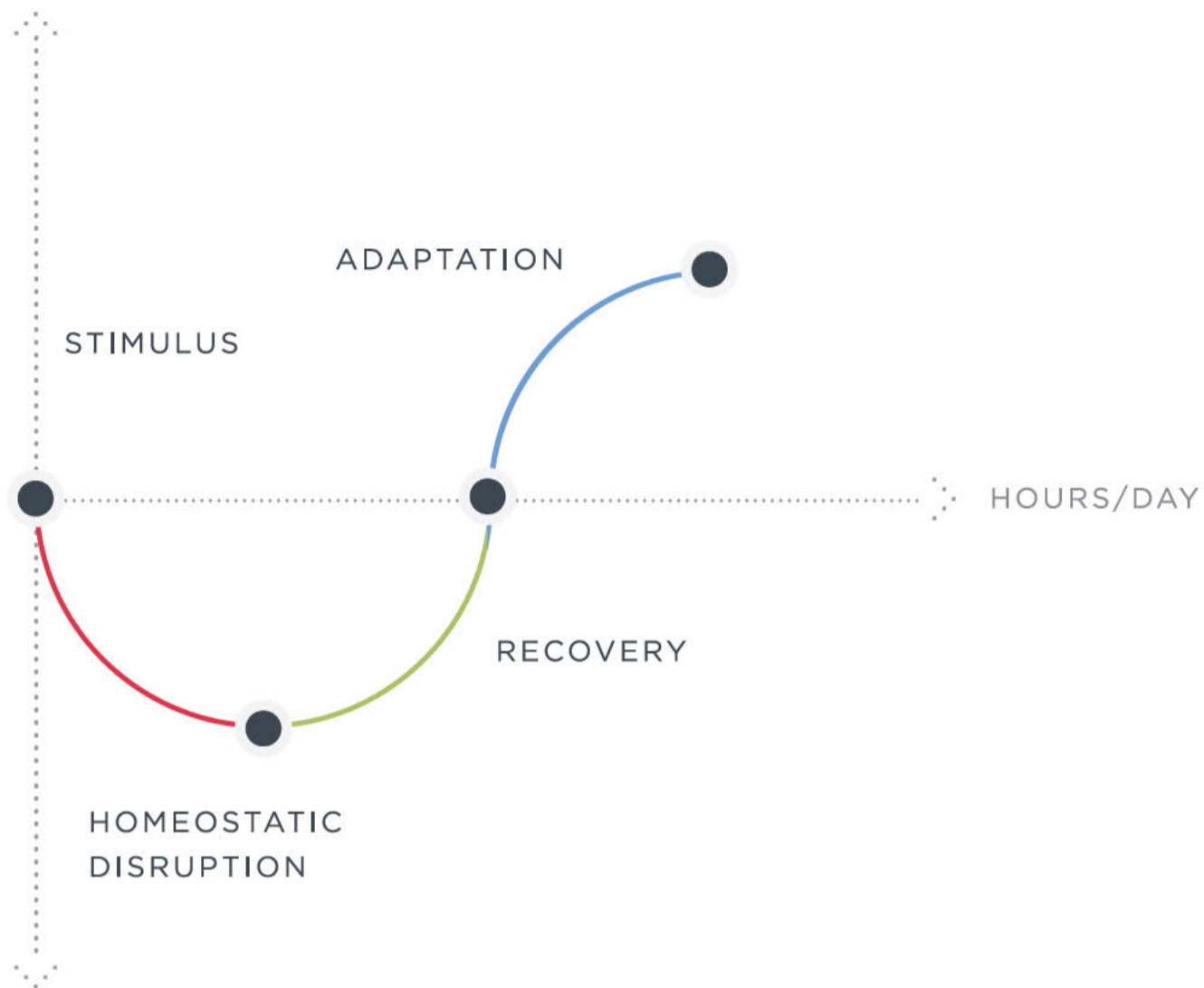


Figure 10: Technique SRA Curve

B.) MUSCLE HYPERTROPHY CURVE

Because the most fundamental underlying physiological effector of strength is muscle size, its SRA dynamics are of very keen interest to the construction of a powerlifting program. During an overloading session, muscle catabolism actually rises and size is lost! After a session, however, the FSR curve (fractional synthetic rate of muscle growth; the measured rate of muscle addition in the body) rises to positive and stays elevated for what usually amounts to several days, and at least a day in most cases.

Along with direct addition of muscle tissue, the pennation angle of muscle fibers also changes from training. The pennation angle of a muscle fiber is its angle relative to the tendon on which it pulls. Different exercises have different optimal pennation angles, so every time a new exercise is introduced, pennation angles begin to change in a process that can take weeks to complete. During the actual training session, pennation angle actually reverses its trend, but recovers and makes new gains afterwards. Pennation angle SRA curves generally run a similar time course to hypertrophic adaptations.

The length of the SRA curve for muscle hypertrophy varies greatly based on the degree of homeostatic disruption, the fiber type of the muscles, the level of training of the individual, their muscle size, the muscle group trained and several other factors. However, this curve is usually measured in days, and if our only goal was to train for muscle size, we would overload somewhere between 2 and 4 times per week. Not ironically, smaller beginner lifters for whom technical and hypertrophic adaptations make the biggest difference are the same lifters to seemingly benefit the most from the highest frequency programming. More experienced lifters have more stable technique and are more resistant to muscle growth, and must thus rely more on the next two factors for improvements to their powerlifting abilities.

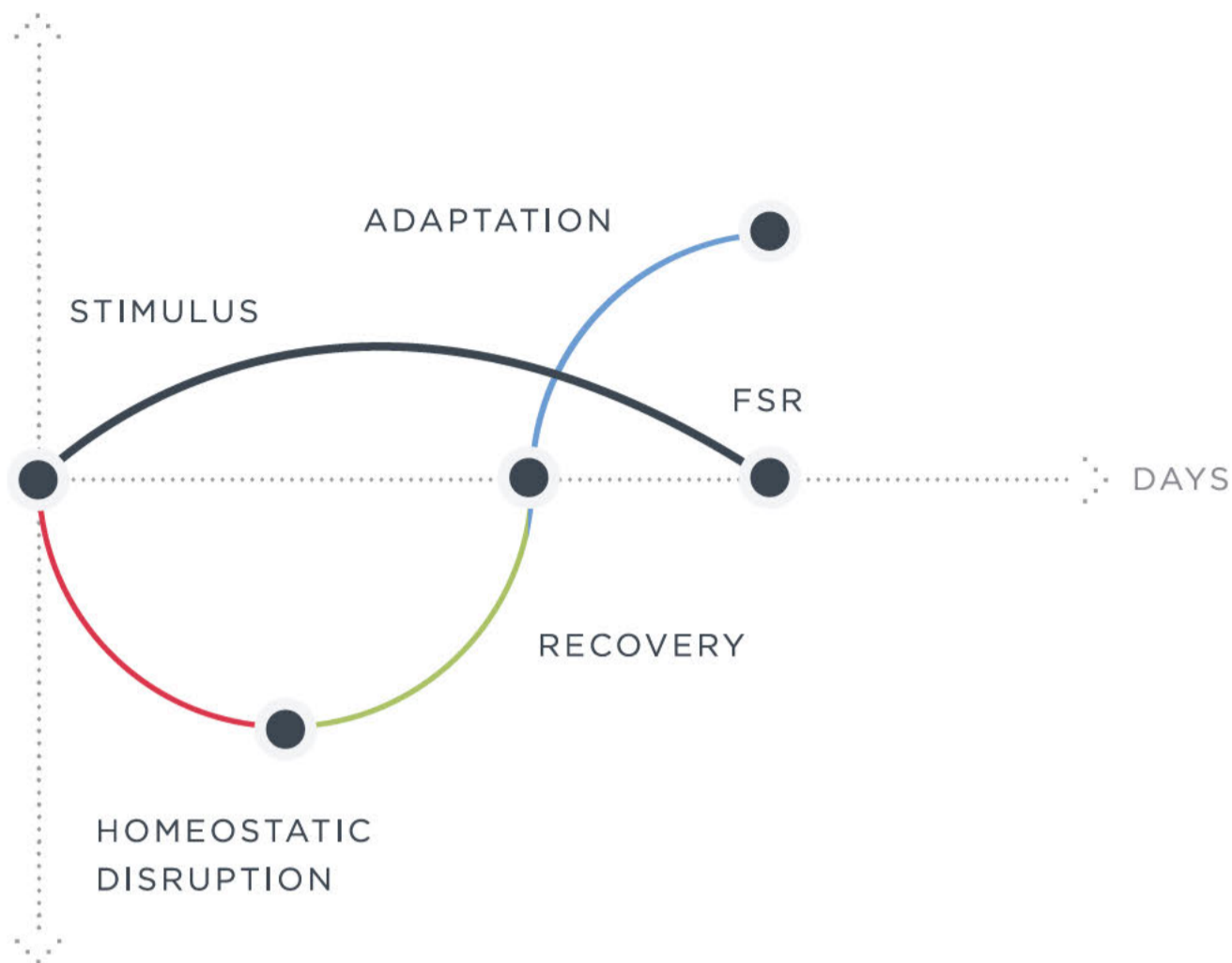


Figure 11a: Fractional Synthetic Rates and SRA

C.) NERVOUS SYSTEM FORCE OUTPUT CURVE

The nervous system has two functions of interest to us here, the one already mentioned is the coordination of muscle contraction and relaxation in a particular sequence so as to produce a certain movement pattern. This essentially can be said as the determining of the direction of body and thus barbell movement. The other function to be addressed is the magnitude of that movement. More specifically, how much force production the nervous system can signal the muscles to create. This is a property that can be trained, and it has been shown that experienced lifters of the same size as novice lifters can generate higher forces with the same muscle mass, owing in large part to the activity and

trainability of the nervous system. Every time this ability of the nervous system experiences overload (through high force contractions of the muscle and lots of them), it follows the SRA curve through short term depression, recovery, and adaptation. In the average case, the SRA curve for nervous-system mediated force output takes about a week to peak in adaptation, but the degree of variance seems high with bigger, stronger, more experienced lifters having SRA curves that are considerably longer, to the tune of two weeks at the higher volumes and intensities of training.

If our only goal was to exclusively improve nervous system force production ability, we may present an overload only once per week or even more rarely. In fact, equipped lifters that present overloads greater than 100% of their raw 1RM do exactly that! The Westside system calls for overload training exactly once per week for each muscle group, which makes very good sense, given that the lifters there already have a good technical proficiency with lifts and the muscle to support them (sometimes bolstered by anabolics which can maintain muscle mass at low training volumes).

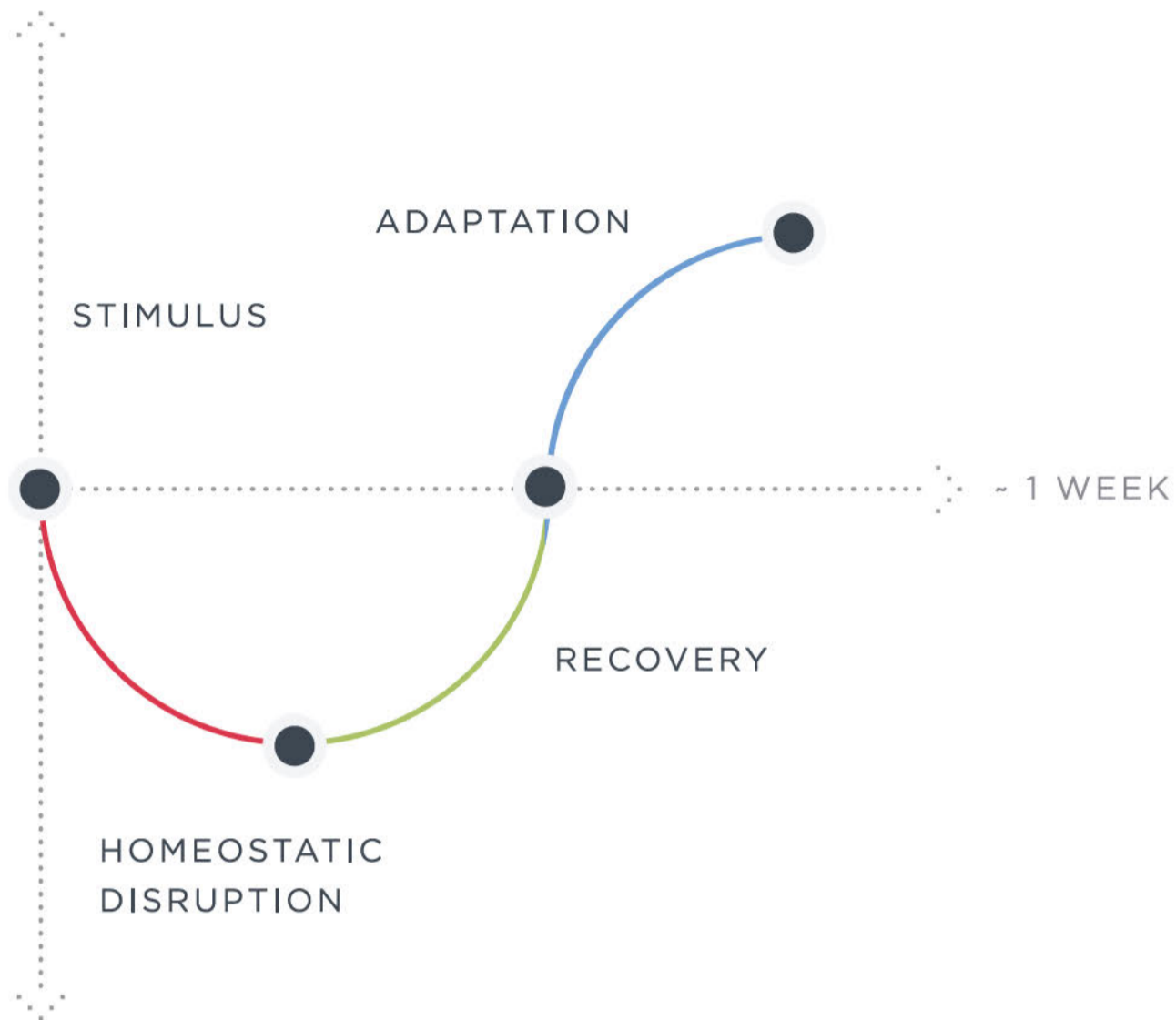


Figure 11b: NS Force Production SRA Curve

D.) CONNECTIVE TISSUE INTEGRITY CURVE

As heavy training occurs, connective tissues take on damage. This damage stimulates adaptive processes, but the recovery time is incredibly long due in part to the poorly vascularized anatomy of tendon, ligament, and bone. The stimuli of structural changes to connective tissue can depress the integrity of these tissues for weeks and months at a time before recovery even has a chance to break even. Progressively harder and harder training further and further degrades especially tendons, and only periods of lighter (hypertrophy or active rest) training can allow recovery and supercompensation to occur at best rates. If we

only trained for connective tissue adaptation, we might alternate weeks of insanely heavy loading with weeks of almost no loading at all. The ultimate illustration of SRA curve length in this case is the healing time of a stress fracture, for which months of limited activity are required.

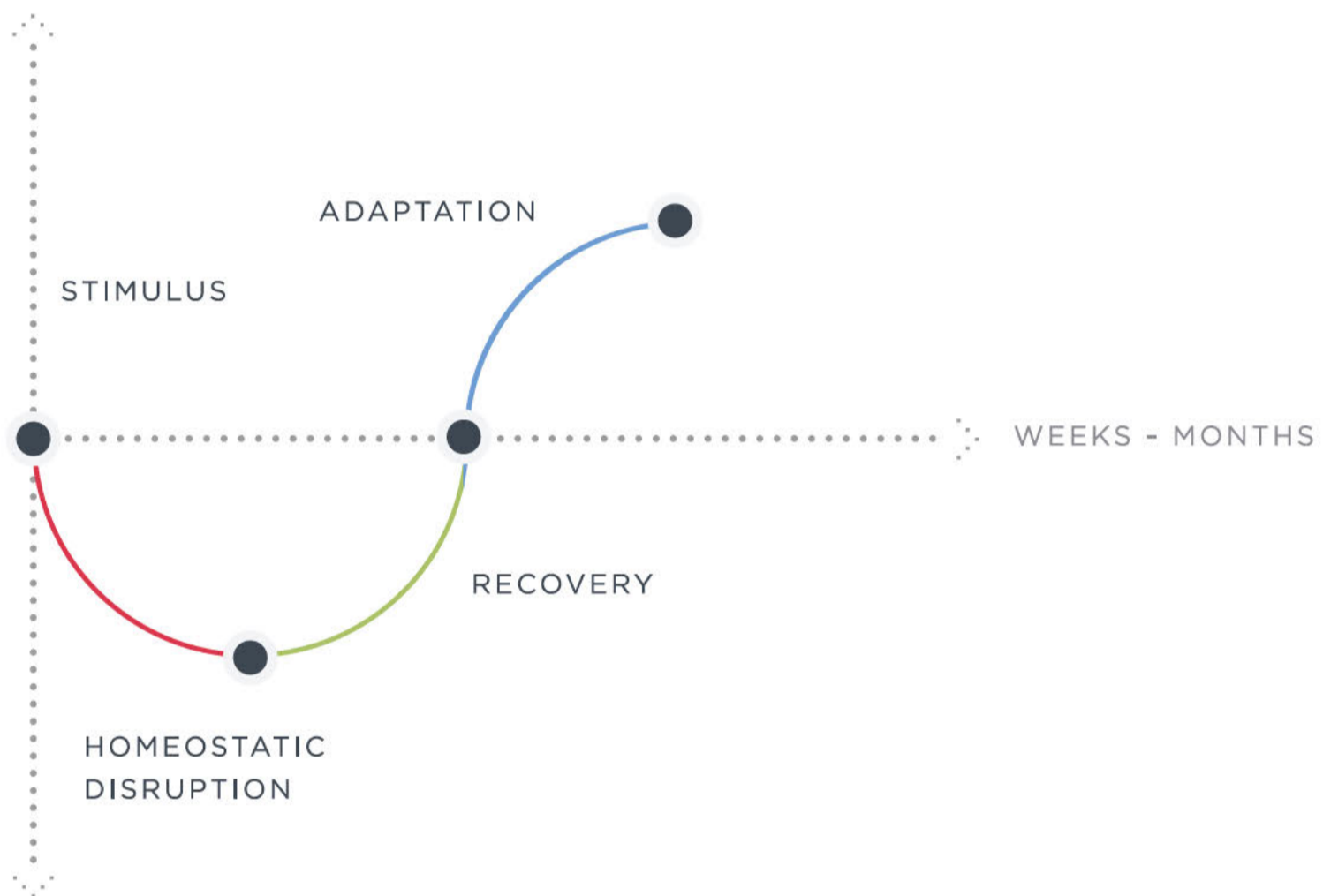


Figure 11c: Connective Tissue Integrity SRA Curve

RELATIVE MAGNITUDES OF SRA CURVES & TRAINING FREQUENCY

Every weight training session always generates individual SRA curves for each specific category from the four list above. Every training session causes some technical improvement, hypertrophy, nervous system force production improvement, and connective tissue strengthening. But different forms of training lead to the elevation of magnitudes of certain systems more than others, in the following way:

Light Session Technique Practice: technical neural adaptations receive the highest amplitude change in their generated SRA curve, thus experiencing both greater fatigue and greater adaptation.

Hypertrophy Training: high volume training in the hypertrophy intensity range stimulates muscle growth SRA curves to rise the most, with other systems less affected.

Strength Training: elevates force-production Nervous System (NS) curves the most, other qualities to a lesser extent.

Peaking Training: training with low volumes at 90%+ intensity elevates technical and force-producing curves considerably, but probably elevates connective tissue reconstruction curves the most.

In order to train for simply one system while ignoring all others, what we need to do is line up the next training session at the adaptive peak of the last training session's SRA curve:

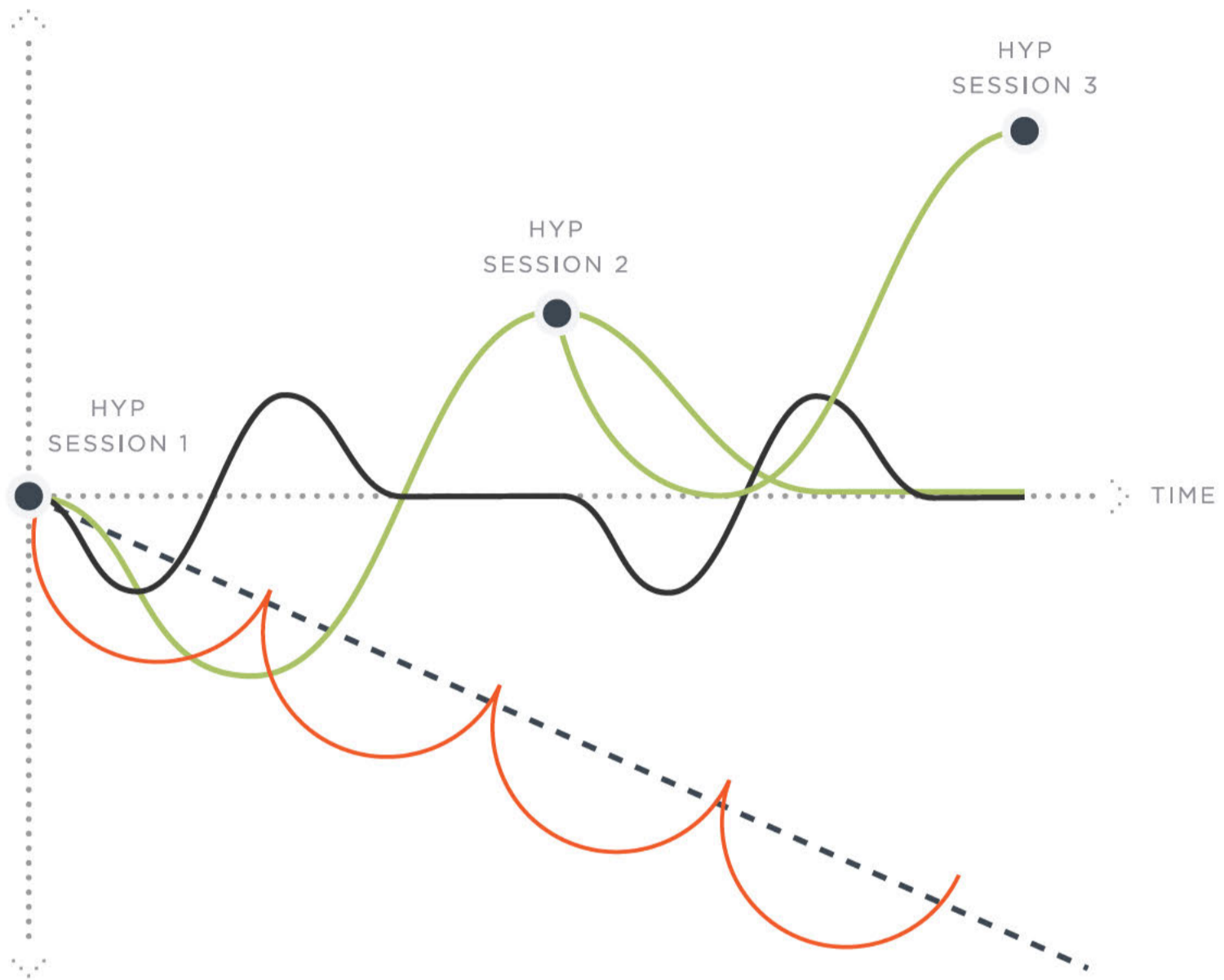


Figure 12: Timing Training to one SRA Curve

Now, if we were to train for the expression of all of the above systems to be even, we could simply average the durations it takes all of the 4 system-specific SRA curves to reach a peak and time our training to those peaks:

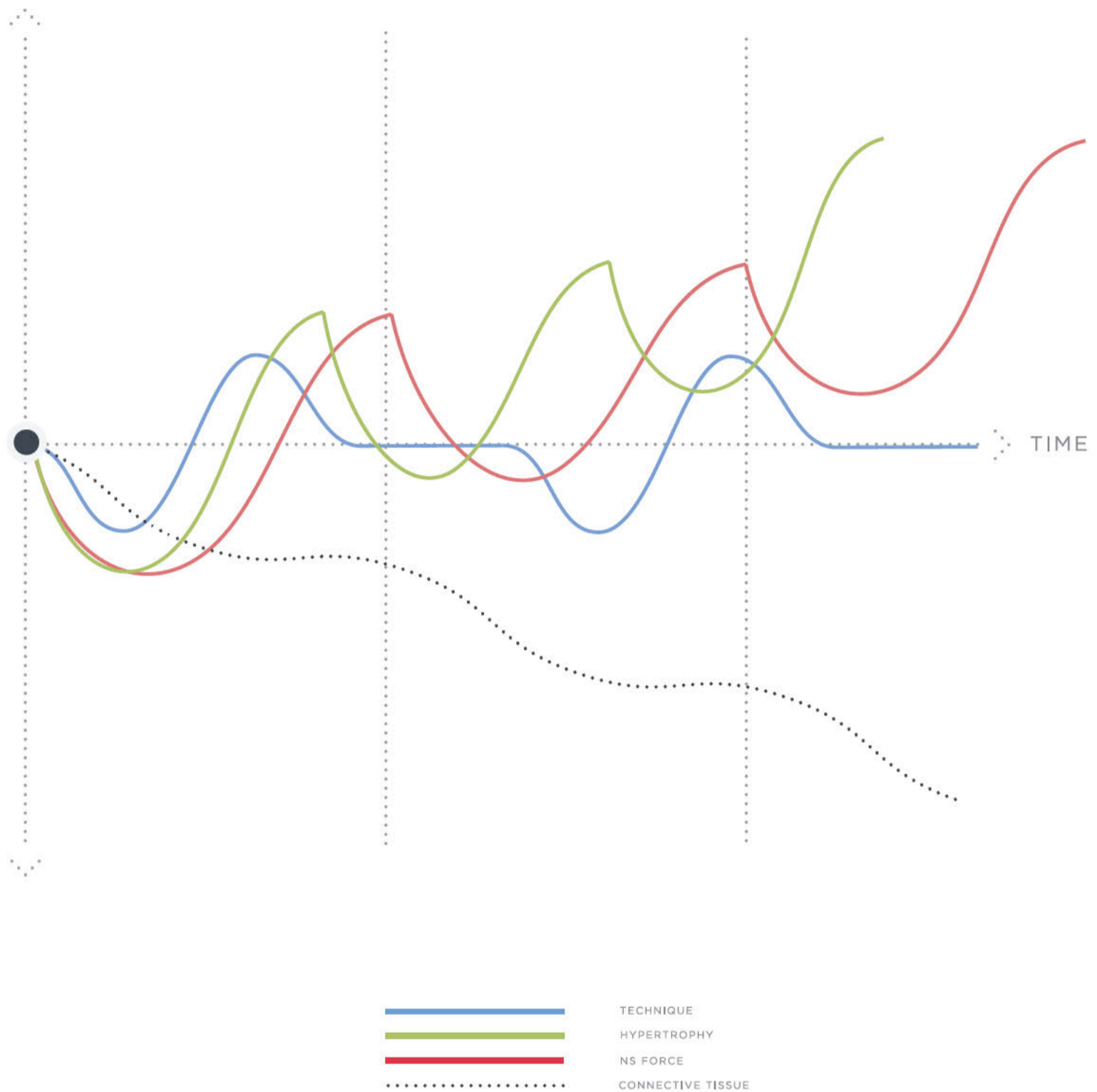


Figure 13: Timing Training to an SRA Average

For the average intermediate lifter, that might result in something like training each lift/bodypart once every 3-5 days or so. This would result in the decent general development of all systems, but would violate phase potentiation (see Phase Potentiation chapter for in-depth

discussion) and thus not be the best approach. Rather, we can structure training in such a way that all systems are trained, but certain systems are prioritized based on the needs of the training phase. Thus, we can bias our frequency to more accurately reflect our phase-specific training needs.

For training to maximize technical development and retention, we can shift our frequency of training to one that is shorter than the all-system-average SRA curve, which might be anywhere from daily to 4x a week training for most lifters:

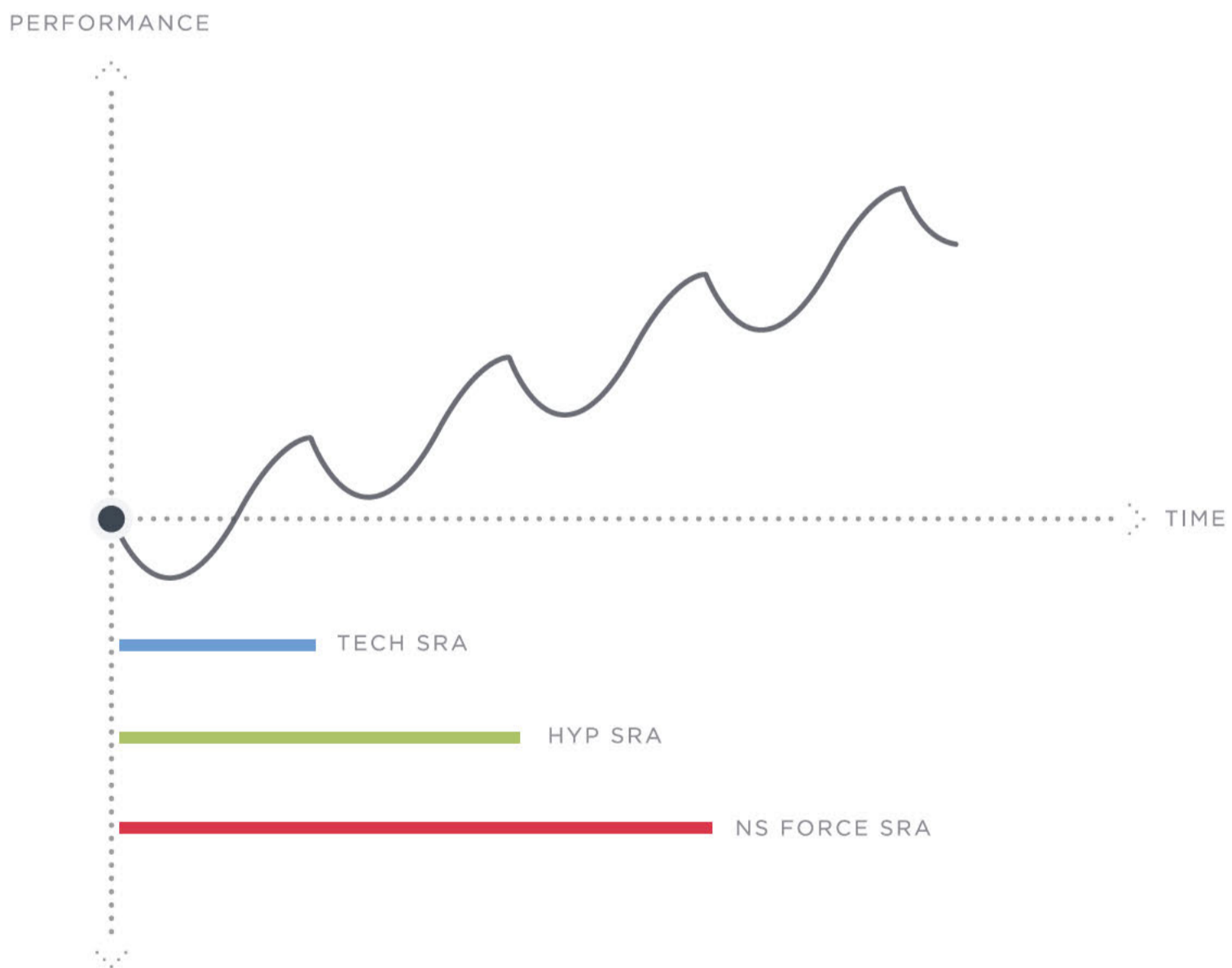


Figure 14: Timing Training to Emphasize Technical Development

To maximize muscle size accretion (or prevent size loss while cutting), we'd be training a little less frequently than with technique-dominant design, but still between 2 and 4 sessions per week for the same muscle groups for most lifters:

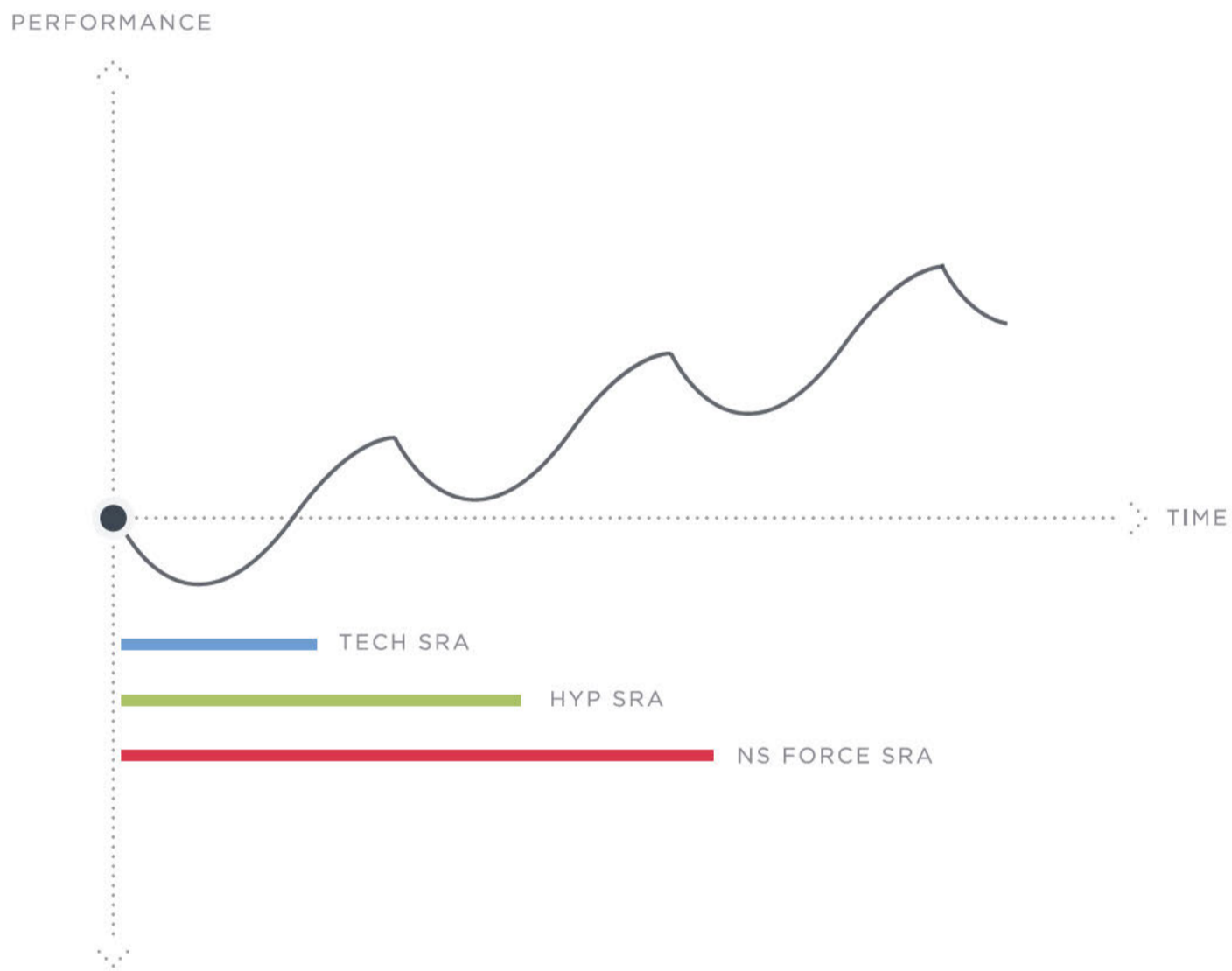


Figure 15: Timing Training to Emphasize Hypertrophy

Training for strength comes quite close to all-system-SRA average at 1-3 sessions per week for the same muscle groups/movements. Light sessions might be inserted as well to improve fatigue management and retain more hypertrophic and technical adaptations:

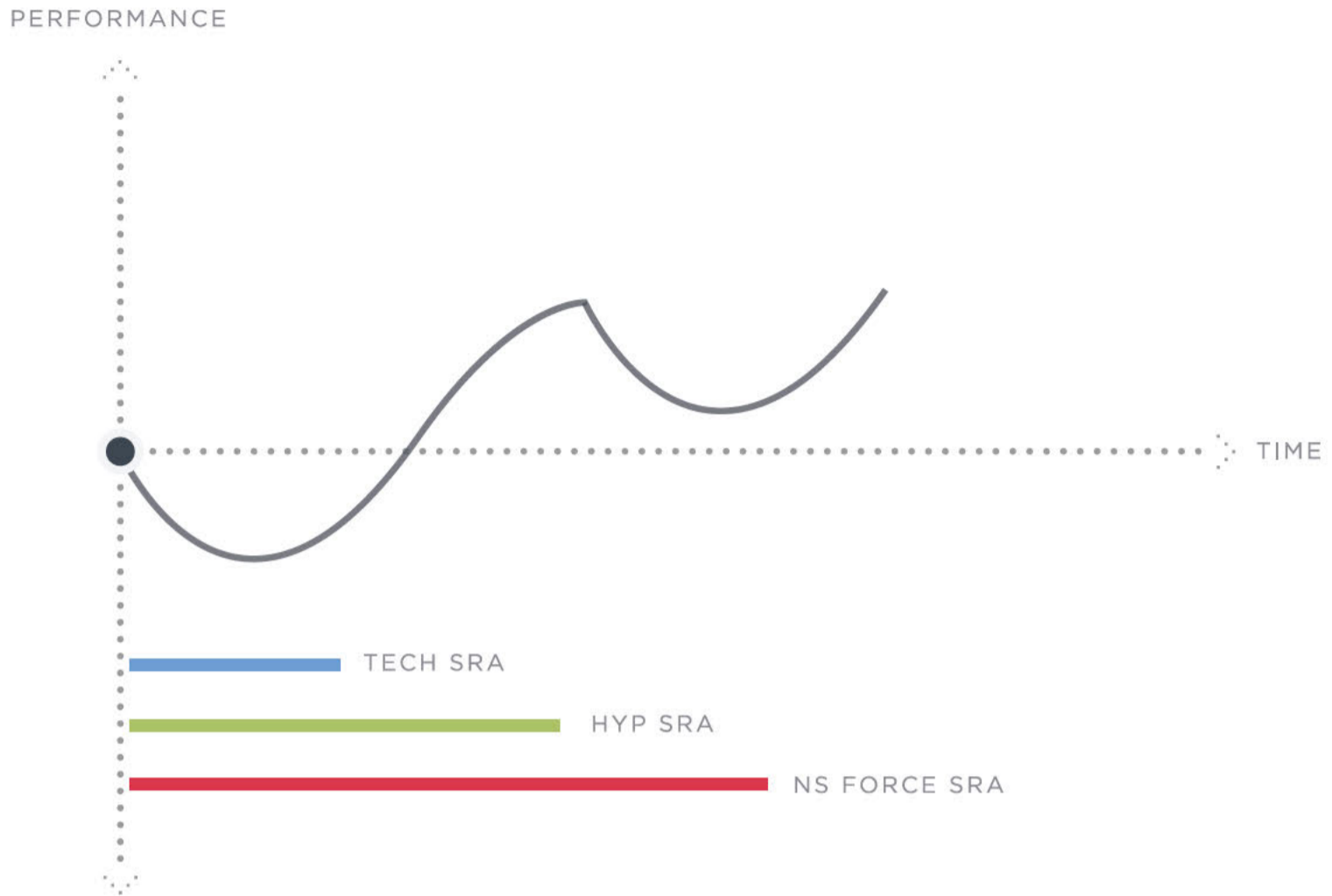


Figure 16: Timing Training to Emphasize Strength

Training to peak with the highest possible intensities may be a lower frequency than the all-system-average SRA curve, but only slightly. This is because the all-system SRA curve is so heavily biased by the disproportionately long connective tissue-remodeling curves. Training for peaking might occur only once a week or perhaps twice for the same movement/muscles, but can be interspersed with lighter sessions that promote technical and hypertrophic retention:

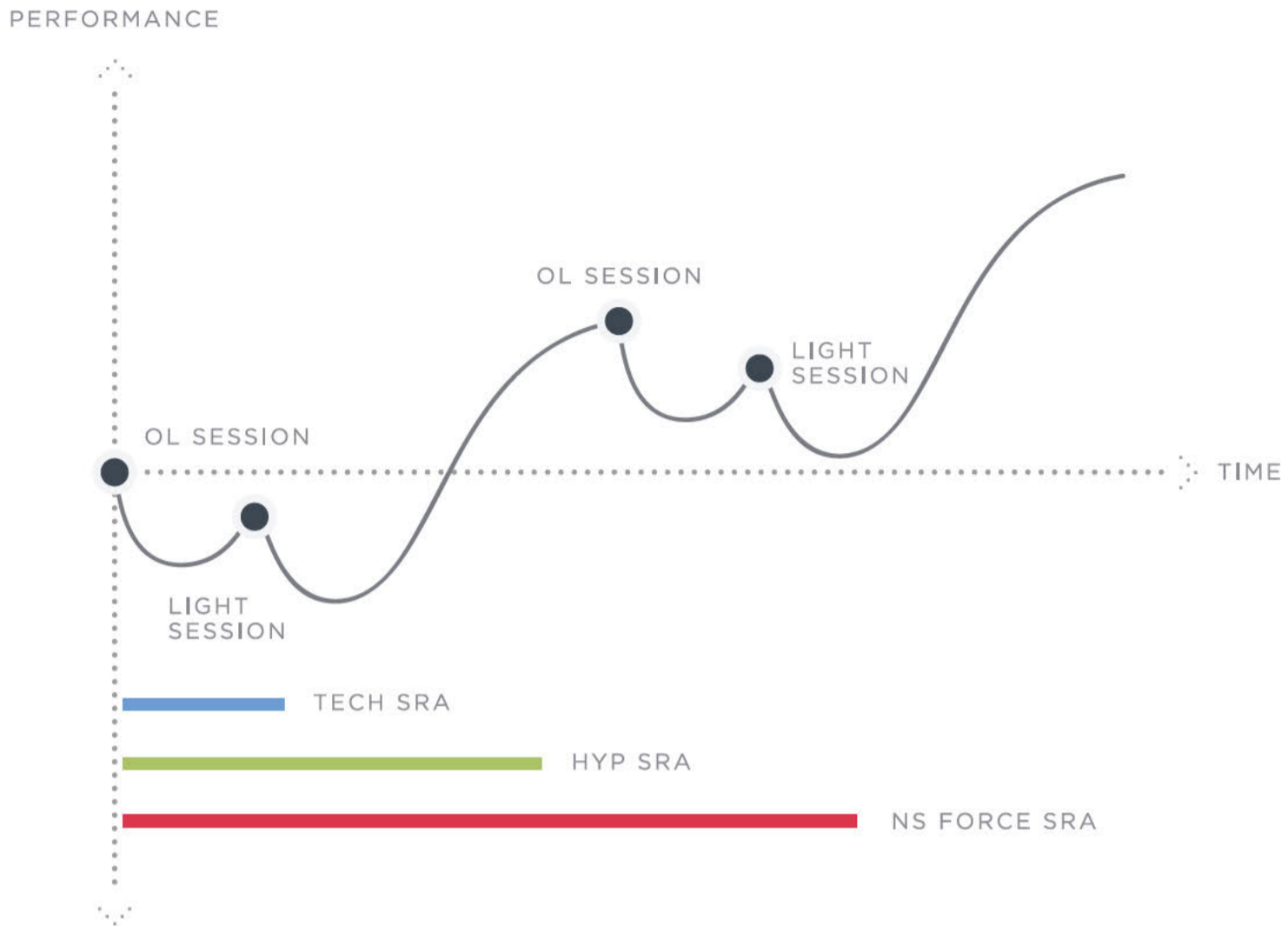


Figure 17: Timing Training to Emphasize Peaking

So far we have all curves accounted for except for those of connective tissues. Luckily, connective tissue SRA curves are only depressed with the frequent heavy training of the strength and peaking phases. During hypertrophy phases, active rests, and deloads for all of the phases, connective tissue SRA curves go through their recovery and adaptation phases. That's right, connective tissue adaptations take so long that they go through a whole SRA cycle over a mesocycle or even macrocycle length, while technical systems on the other extreme take only hours to go through their SRA cycles!

POWERLIFTING DEFINITION

The SRA principle, like all the principles so far and all the ones to come, can be put into powerlifting terms fairly easily. Because overload training a certain ability (technique, size, strength, peaking) during its recovery reduces its eventual benefit when recovery occurs, it's important to give enough rest or non-overloading training time to the systems we're training when we're training them. On the other hand, waiting too long between workouts leads to a fall of the SRA curve back to baseline (and eventually lower if you really don't train for a while), so there is such a thing as waiting too long.

Secondly, the magnitude of the adaptation peak of each SRA curve is controlled in part by the size of the training stimulus (see graph below). For example, a very tough hypertrophy session can take 3 days for the whole SRA cycle to complete, while an easier one might take only 2 days. There are slightly more complicated issues on this matter that will be discussed in the next section, but the implication for powerlifting training is that multiple frequencies are ok, so long as you give more rest time between sessions if your sessions are harder (usually higher in volume is a big part of "harder") than between the easier ones.

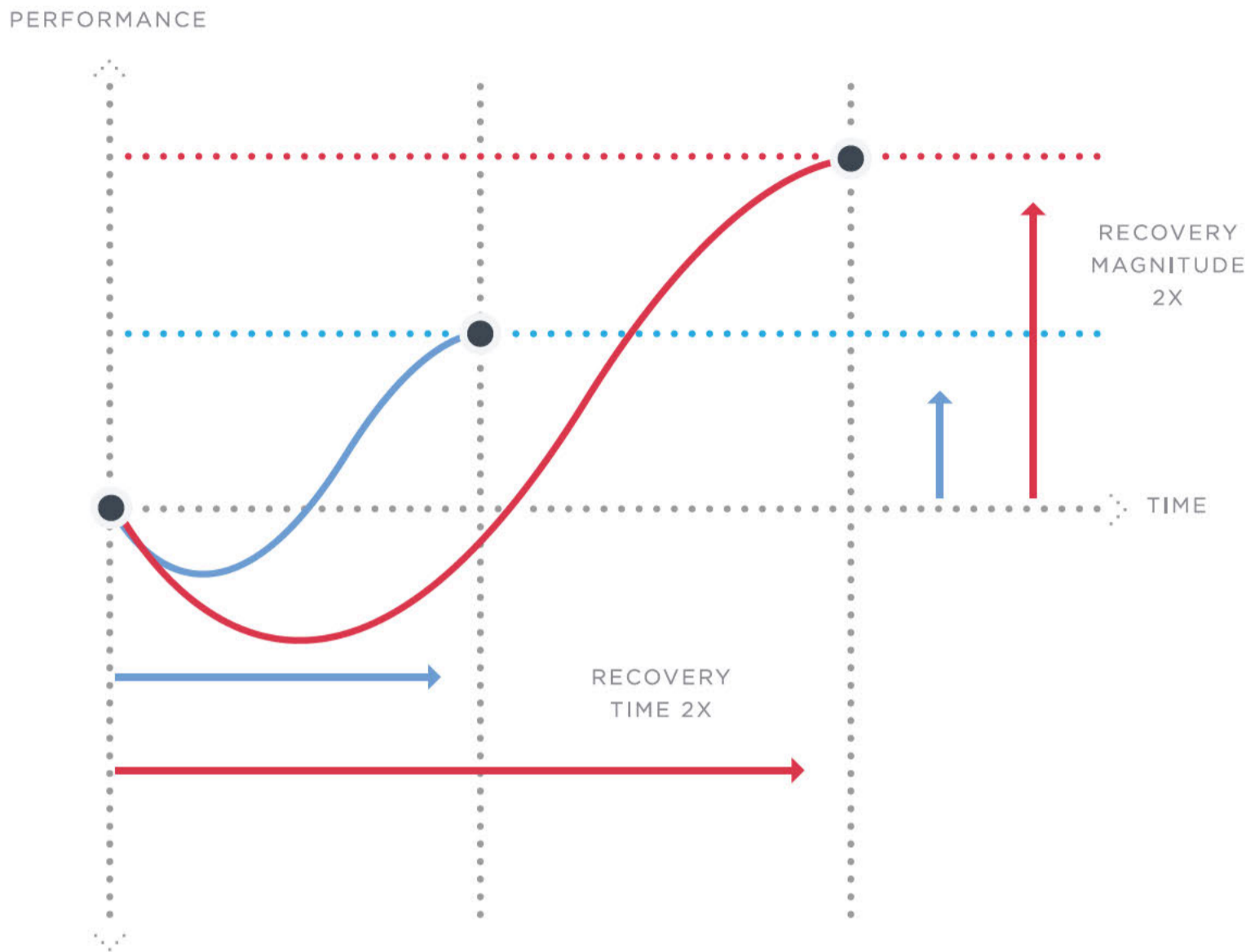


Figure 18: Session Magnitude Effects on SRA Timing

In plain terms, hit the weights hard, rest, recover, and repeat. Improvements in ability occur during recovery and adaptation which mostly happen outside of the gym, and are merely stimulated with training. If you're supposed to be resting and reaping the rewards while you're training, you won't get the best outcomes. On the other hand, if you're resting while you're supposed to be training, that will be equally bad.

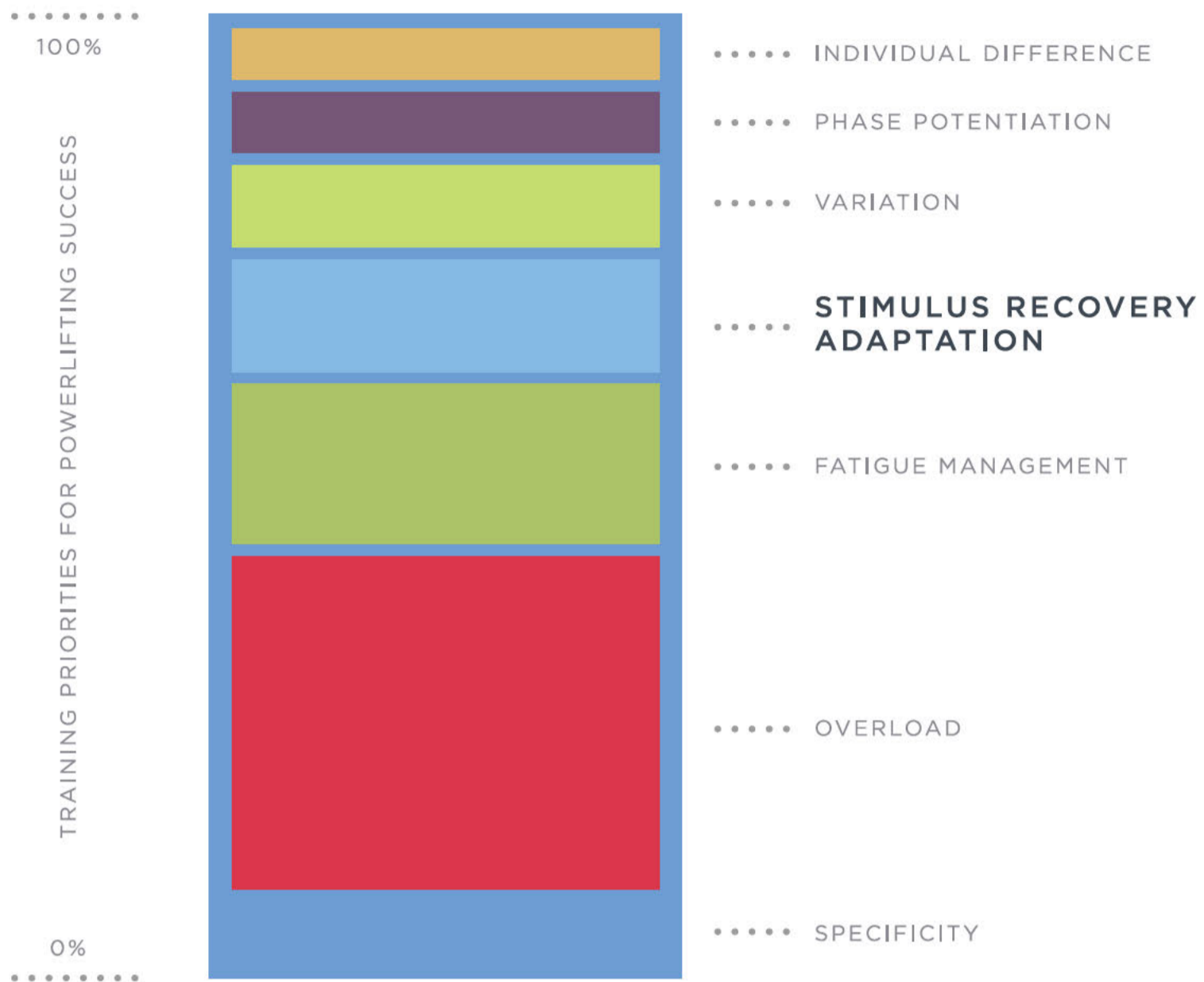
PRINCIPLE IMPORTANCE RANK

There are two big reasons why SRA is not ranked higher up on the list of the most important principles:

1.) Training at any frequency that's not insane (between once a day and once a week) generally trains all of the four systems and will produce good results, though possibly not the best results. If you don't manage fatigue properly or present an overload properly, you will go nowhere fast, but if you train with at least a reasonable frequency and structure, you'll at least be ok and make some long term gains.

2.) There are benefits as well as costs to the improper structuring of SRA curves and training frequencies. Improper structuring is a net negative, but the benefits of extreme choices make this net a smaller negative than violations of specificity, overload, and fatigue management. If training is too frequent but fatigue management is in place, functional overreaching can salvage some of the adaptations of such training. On the other hand, if training is too infrequent at various points, at least fatigue is very hard to sum up and each session can be massively overloading, which tips the scales back a bit, though not all the way.

For the above two reasons, SRA violations, especially the milder ones will not make or break a program, and this is actually the first principle on our list that we can officially qualify as "not essential to successful training." It's not essential, but it's probably the most important of the minor principles, and is thus ranked as fourth in our priority list. A program can be successful without good SRA dynamics, but the best programs accord carefully with this principle.



IMPLICATIONS & EXAMPLES OF PROPER APPLICATION OF SRA

1.) OPTIMAL FREQUENCIES OF TRAINING

In the definition of SRA, we established that there are 4 different systems that undergo their own SRA sequences with any training. It was also established that if the improvement of one of those systems was prioritized, a theoretical optimal training frequency would best support the development of that system. For example, because muscle

size accretion tends to last from one to several days after a training session, training that certain muscle group should likely occur every one to several days for best results, and something like multi-a-day training or once per week training would produce worse results than possible. Because multiple systems need to be developed in each training phase/goal (technique training, hypertrophy, general strength, peaking), lengths of phase-tailored SRA curves are biased heavily in the direction of the main systems that underlie that phase, but some effects on other systems are considered as well to produce the best total outcome. The following is a quick summary of the different training goals and their average/typical SRA curve length ranges, ordered from most to least frequent both between and within goals:

- Technique Learning, Development, Refinement: Between several overloading sessions per day to 4 or so overloading sessions per week
- Hypertrophy: Between 4 overloading sessions and 2 overloading sessions per week
- Basic Strength: Between 3 and 1 overloading sessions per week, with at least 1 light session per week if down to 1 overloading sessions to conserve hypertrophy and technique
- Peaking: Between 2 and 1 overloading sessions per week, with at least 1 light session to conserve hypertrophy and technique
- Connective Tissue Strengthening: A break from training past 80% 1RM for at least a month every 4 months or so

Many readers of this book, especially ones that are very detail minded, might wonder why such broad ranges are described. In effect, why can't frequency recommendations appear as points on a timeline rather than

wide ranges? For example, why can't the hypertrophy recommendation be "train exactly two days apart when trying to put on size" rather than the lacking "train between 2 and 4 times per week?" On the other hand, the opposite question is also valid. Why are the recommendations so delimiting? Can't other program variables be structured in some way as to produce best results with most any frequency shorter than about a week? For example, if you train a muscle REALLY hard, shouldn't its SRA curve now be longer and thus accommodate less frequent training? In order to address those concerns, we will split the discussion into two; firstly concerning ourselves with sources for variance of frequency recommendations and secondly with constraints on the variance of frequencies. Discussions about these differences could be article-length in their own right, so we'll only seek to supply the basic information here to keep the discussion to a reasonable length!

SOURCES OF VARIANCE

SESSION-VOLUME VARIANCE

If a training session is overloading in intensity but low on volume, the SRA curves generated are shorter, but still elicit a net adaptive peak. With low volumes, the height of this peak will be shorter, but the length of the SRA curve will be concomitantly shorter as well. What this means is that training can occur more frequently if the per-session volume is lower.

Suppose we usually did 8 sets of squats every 4 days. If we were to do 4 sets of squats every two days instead, we would only get about half of the adaptive peak with each of those workouts, but we'd be able to do double the workouts than before in the same 4 day span, so that the

net adaptation yield is essentially the same. On the other hand, if we normally do 4 sets of squats every two days but for some reason our schedule changes and now we can only train squats every 4 days, we can simply do 8 sets every 4 days and receive a very comparable net adaptive yeild. Please see the graphs below.

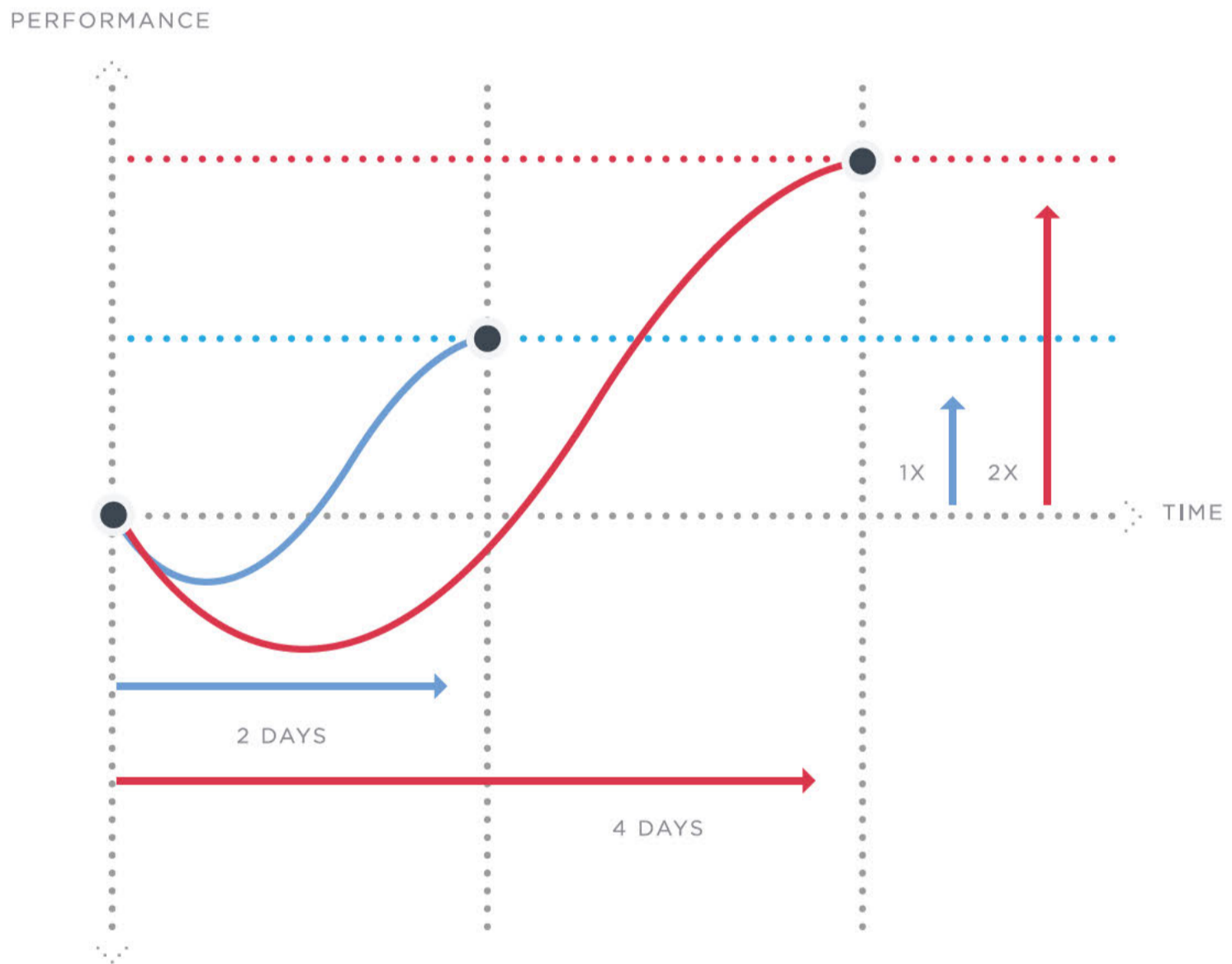


Figure 19: Similar Results Through Different SRA Arrangements

Can we extrapolate infinitely in both directions and still equalize net adaptation? If we squat one set per day or only squat with 16 sets every 8 days, are the results still the same? Probably not, and we'll examine

that idea in depth in the next section on constraints to frequency variation. But for this section, the big message is that within some rather broad timelines, there is a good bit of leeway on effective training frequencies by simply spreading out or clustering the workload, so long as the total work is still the same.

TECHNICAL PROFICIENCY DIFFERENCES

Lifters that are new to powerlifting do not yet demonstrate a mastery of the technical execution of the lifts. In fact, not only do they demonstrate a lack of mastery, they in fact have a very high lack of technical stability. For example, their squat can look noticeably different with every session, their bench press can touch on wildly different parts of their chest, or their deadlift setup changes in breathing patterns every other workout.

Especially when beginning powerlifting training, it's very important to establish a good technical base that will help the lifter:

a.) Develop effective technique that puts their body in the right position to lift the most weight possible. You can get away with crappy technique with beginner weights, but you're not going to good-morning 585 when you're supposed to be squatting it. Techniques are very hard to change once they are well-established in the early phases of training. This is a good and bad thing, because while it means that good coaching early on can set up an excellent technique for a lifetime, a lack of technical practice or poor technique early on can cost the lifter for years down the road.

b.) Develop a safe technique that will prevent the lifter from getting hurt needlessly later in their development when their weights in training and competition begin to rise to the kind that can really mess you up!

c.) Capitalize on early neural strength gains. One of the oldest observations in strength research is that the first several months of strength training sees strength improvements that far outpace muscle size additions. This is because the nervous system is both learning to enhance its force output per individual neuron and groups of neurons as well as coordinate muscle timing better to produce higher forces. Higher training frequencies give the nervous system more practice to improve its abilities and have been shown to result in more rapid improvement in strength levels of beginners.

As the lifts are practiced for months and years, the incremental benefits of more and more technical practice begin to decline. Powerlifting is incredibly simple in its technical demands when compared to literally every single other sport, and advanced lifters show a remarkable technical stability even when lifts are not performed for weeks at a time. Of course if the goal is optimal technical prowess, practice of the lifts still needs to be more frequent than once every several weeks, but it becomes difficult to construct an argument for more frequent lifting than about twice a week (for each movement) for advanced lifters. And if the added frequency is not improving technique or accomplishing anything else, the lifter might be better served simply taking the extra days off from training to further promote recovery/adaptation.

The implication is that based on lifter development/experience in the sport, different frequencies from the perspective of technical development/retention arise and are placed on a spectrum of most to least frequent. This means that two lifters who would normally train together may not want the identical session frequency if one of the lifters is significantly more experienced than the other. It also means that as a lifter gains experiences and begins to demonstrate technique

solidification, one of the advantages of super-high frequency programs can become less prominent.

FIBER TYPE DIFFERENCES

Fiber type is determined mostly by the alpha motor neuron that innervates the muscle fiber. Thus, any discussion of fiber types is also a discussion of PNS physiology. Slower twitch fiber types don't produce as much force as faster twitch fibers. Slower twitch fibers do not undergo the same level of damage and homeostatic disruption from training, and they heal faster from such damage. They don't increase their protein synthesis rates (FSR curves) for nearly as long or as high as faster twitch fibers do. For those reasons, slower twitch fibers can and need to be trained more frequently, while faster twitch fibers less frequently.

These differences can reflect themselves within the different muscles of the same lifter and between different lifters. Some muscles on average contain a larger fraction of faster twitch fibers than others. The hamstrings, for example, are usually faster twitch than the quads in most lifters. Thus, all else being equal, the hamstrings may benefit from lower training frequencies than the quads. This is well illustrated in the observation that high frequency squatting programs are very successful especially with newer and smaller lifters but that the first proponent of the high frequency deadlift program is probably lying dead in a power rack somewhere as you read this! Differences in fiber type ratios also exist between different lifters. If a certain lifter has a higher predominance of slower-twitch muscle fibers than another, he/she can likely tolerate and benefit from higher frequency training. Lifters with faster average fiber characteristics can instead benefit more from lower frequencies of training.

MUSCLE SIZE & ARCHITECTURE DIFFERENCES

Bigger muscles can take on more damage and can take longer to recover and longer to grow after every session of training. This has something to do with their strength, but the sheer size plays a role as the amount of physical tissue to be remodeled is greater, leading the immune system and other systems within the muscle to have to work longer. Bigger muscle fibers (cells) still produce new proteins at a rate limited largely by their nuclei, and the number of nuclei doesn't change much, especially after all satellite cell donations of nuclei have run their course. This means that if your chest is the size of Ronnie Coleman's, an overloading session may generate SRA curves similar in length to those of the typical lifter's quads! This of course also means that smaller muscles usually have faster SRA curves and thus frequency demands than larger muscles. You can get away with training your biceps and rear delts nearly every day with hard, overloading sessions, but trying that with your quads with any decent volume per session will lead to training sore almost all the time, and plenty of adaptive interference that goes along with that.

In addition to muscle size, all muscles have different architectures. Their fibers are arranged in different patterns, leading to unipennate, multipennate, fusiform, and other sorts of arrangements. Muscles with certain fiber arrangements have higher proclivities to output force and thus take on damage and homeostatic disruption. Yes, you can hypothetically get your biceps as sore as your pecs, but the volume of training required to do that will bring your biceps into overreaching within several sessions. Because different muscles have different fiber arrangements within the same lifter, certain lifts will benefit from different frequencies of training than others. The best example is

that most lifters can tolerate upper body pulling work (vertical and horizontal pulling exercises) multiple times per week, often with every training session, but that chest and glute training almost every session is essentially unheard of. Also, different lifters vary in their muscle architecture even in the same muscle, such that one person may have quads that are better suited for high frequencies in their architecture than another.

STRENGTH DIFFERENCES

Stronger lifters can disrupt homeostasis more profoundly than weaker lifters. That means their SRA curves for hypertrophy, but especially for nervous system strength adaptations and connective tissue strength adaptations are going to be longer. A nearly universal observation on the training of powerlifters is that stronger lifters tend to gravitate naturally towards lower frequencies and vice-versa.

PSYCHIC ENERGY DIFFERENCES

Lifters that psych up more for their training sessions can generate longer SRA curves than lifters who stay calmer. Because the SRA curves of the psych-up lifters are higher in magnitude as well, the net benefits might be similar between the two groups, but only if lifters that give it more of their “all” in each rep and set reduce their frequency of training. Observation of the sport reveals that both approaches seem to work well, but only if they are frequency-adjusted to their needs. If you’re getting pumped for a lot of training, you likely need more time to recover and adapt between sessions. If you’re calm and cool, you should probably train more often to take advantage of your faster SRA curves. On the extremes, training with minimal arousal infrequently has not produced many champions, and training with maximal arousal frequently



has produced many early retirees from lifting due to poor results, overtraining, injury, and psychological burnout.

LIFT-SPECIFIC DIFFERENCES

Because different lifts activate different amounts of muscle, because they produce more or less force, because they tend to be associated with different levels of psychological arousal, and because they tend to require more or less nervous system activity and damage more or less tissue, they tend to have different average SRA curve lengths. The SRA curve of a lift is the amount of time it takes for performance in that lift to adapt to its maximum. Now, only in peaking and over the course of a deload are we ever going to allow full recovery between lifts, but because some lifts take much longer to go through their SRA cycles than others, they tend to overreach faster and risk dipping into net-neutral overtraining within the mesocycle, as opposed to other lifts that can experience a beneficial overreaching effect within that same time. There are still other lifts that have such short SRA curves that training them only as frequently as the average lift may entirely pass their adaptive peak and lead to suboptimal adaptive summation and thus unimpressive improvements in the long run.

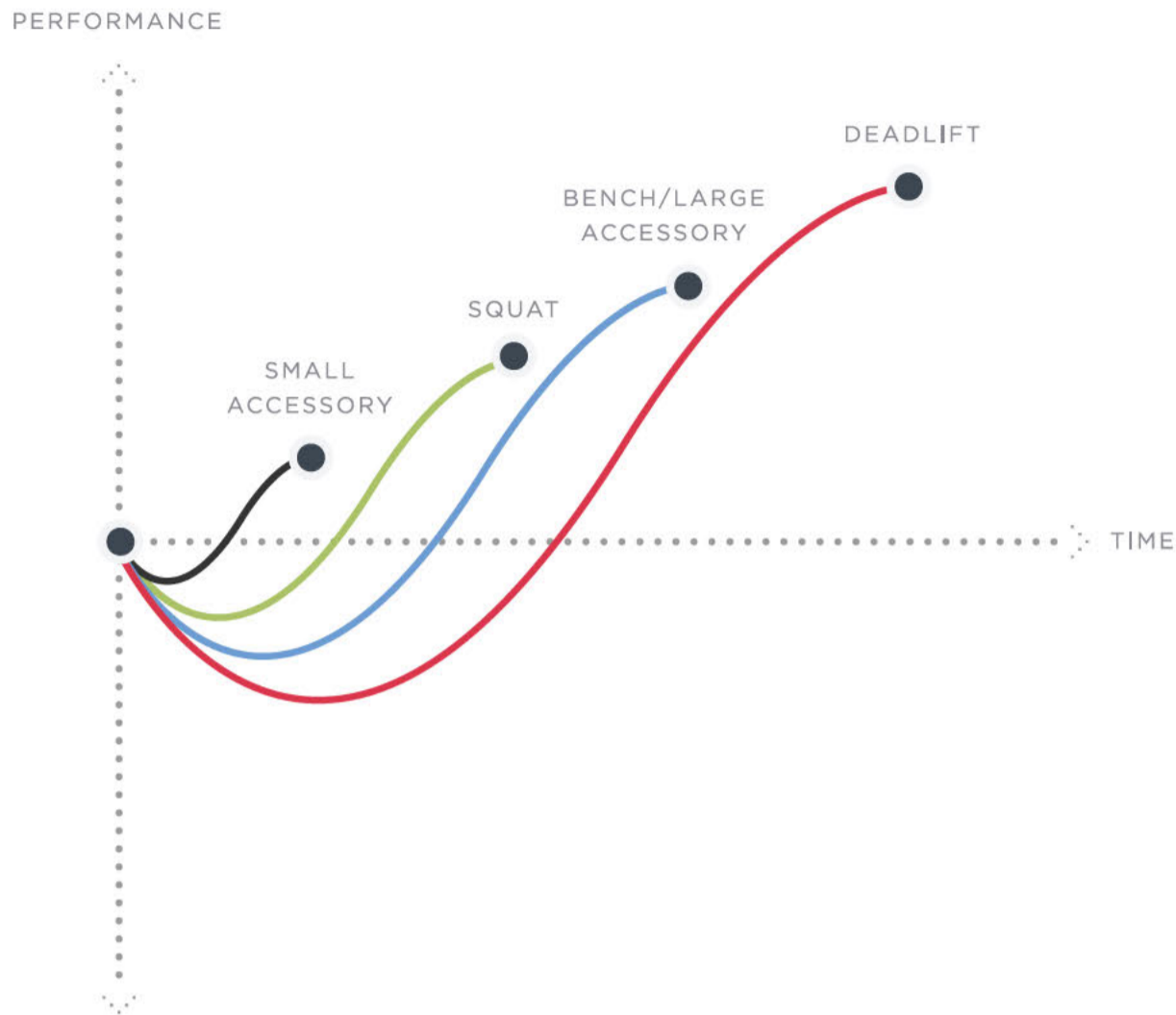


Figure 20: SRA Curve Examples of Squatting, Benching, Deadlifting, Large and Small Accessory Work

Here is a quick guide to SRA curves for different common powerlifting movements, both competition and accessory:

Small Muscle Lifts/Upper Back Lifts: Muscles such as the biceps, rear and medial delts, lats, and other smaller muscles of the upper back typically recover very quickly from overloading sessions, allowing many lifters to train them up to four times per week, and in some cases even more often than that.

Squat: Squats are heavy enough to be very taxing, but the slower-twitch characteristics of the quads tend to mitigate that somewhat. Especially

for smaller and less strong lifters, squatting daily for short periods of time can be sustainable, and even the bigger and stronger lifters report some kind of lower body quad-heavy work at least twice a week, with only once a week of any kind of quad stimulus being quite rare.

Bench: Likely due to the fan-shaped structure of the pecs and the multipennate structure of the triceps, as well as the usually faster-twitch characteristics of these muscles, bench pressing does not usually lend itself to the same frequency as squatting. While squat every day programs have been popular with beginner lifters and continue to be a perennial feature of the powerlifting training scene, “bench every day” programs remain considerably absent. Smaller and less strong lifters can benefit from overload benching up to 4x a week, but stronger lifters rarely overload the bench more than once per week, and as previously stated, current world record holder (at the time of this writing) Kiril Sarychev only overloads the bench every week and half or so, just to illustrate the extreme. Of course the muscles of the bench can be trained more often, with most doing at least 2x a week, but that second session tends not to be as overloading and usually avoids overloading the bench press itself again, with assistance lifts usually being overloaded instead.

Deadlift/OHP/Hamstring Work: The hamstrings tend to be faster twitch and can produce high forces relative to their size, so typically experience long SRA curves. Deadlifts and overhead presses face similar problems, but also demand very high psychological arousal and engage a vast quantity of muscle. Deadlifts engage something like 80% of the skeletal muscles of the body, and standing overhead pressing requires almost every single muscle below the shoulder to act in a stabilizing fashion, especially during very overloading and relatively intense sets. This leads to the conviction by many lifters that heavy deadlifts (overloading

intensities and volumes) can only be programmed once a week for most lifters, with similar thoughts on standing overhead pressing. In fact, many of the biggest and strongest deadlifters in the world only pull overloads as infrequently as every two weeks!

TRAINING-MEDIATED CHANGES

Body systems have a high (though not limitless) degree of adaptability. This means that training at a certain frequency can slightly improve a lifter's ability to benefit from that frequency. This works especially for the high-frequency end, as chronic training in higher frequencies usually makes them more tolerable and beneficial as recovery mechanisms adapt to work faster. This likely has mostly to do with fiber type alterations but may include other mechanisms and is worthy of its own mention.

CONSTRAINTS ON VARIANCE

There are three main constraints on the potential variance of training frequencies that produce best results; the “insufficient overload problem” in the high frequency direction and the “excessive fatigue/overload ratio problem” and the “adaptive dissipation problem” in the low frequency direction.

INSUFFICIENT OVERLOAD PROBLEM

Human physiology evolved mostly in a very calorically restricted (or at least pulsatile) environment. Our hunter-gatherer ancestors went for long periods without much food, and thus developed a host of mechanisms to conserve energy use when such use has not demonstrated to be worthwhile for survival and replication. One such adaptation is the

very physiology that governs the overload principle itself. The systems that govern strength development need an overloading condition in order to adapt and improve their function, which is a metabolically expensive process. The muscles and nervous system don't just change their performance and structure with any stimulus. A stimulus must meet the overload condition in order to elicit adaptive responses, which means there must be a minimal range of both intensities and volumes for adaptation to occur.

This range of intensities and volumes definitely defines what is overloading and what is not in a single week. If you lift heavy enough (intensity) and do enough heavy lifting (volume) during a week, then you'll likely be getting stronger than last week. Same of course goes for the month and the year, but does it go the other way for shorter slices of time? Probably. In any one training session, there is likely a minimum volume and intensity needed to overload and disrupt homeostasis enough to activate adaptive pathways. If a session does not meet that minimum and falls far short, the amount of adaptations may fall below the ratio of volume it took to get there. Even if you do 10x that many sessions, it may be the case that the sum total adaptive magnitude from 10x that many sessions is not as high as if you had done 10x the work in one session. There is a likely a small but meaningful effect of the disruption of homeostasis in one session all at once that triggers adaptation, something that multiple smaller sessions cannot replicate.

A quick analogy can be constructed as the following. Imagine you had a piece of paper and gave a friend a bunch of scotch tape. Your goal is to get the whole piece of paper covered with tape (adaptations), and your tool was a pencil (training overload). Your friend is only allowed to tape up holes poked in the paper. He cannot simply tape the paper

if it has not been ripped. So being the evil genius that you are, you poke moderately sized holes in the paper and let the friend tape over each one... soon tape covers the whole paper and you're met your goal! But what if your pokes were not sufficiently hard to cause any tears whatever? How much tape would be put down? None, it seems.

The above analogy exaggerates the point... some adaptation would still occur even if you just tapped the pencil against the paper, the analogical equivalent of going into the gym and doing 1 rep of squats every several hours. However, there does seem to be good reason to think that the magnitude of the disruption is meaningfully related to the level of adaptation in a nonlinear matter. Below some intensity and "within-session volume," physiological changes are not made nearly as much in proportion to the work done and for more advanced lifters may not be enough to make any positive changes at all.

In common terms, if you don't challenge the physiology enough at any one time, the signal to make adaptation is simply not as strong as it would otherwise be if a sufficient overload was presented. Even squatting to a max single once a day likely becomes an insufficient overload for more advanced lifters. Yes, a 1RM has a very high intensity, but one single heavy rep causes almost no physiological disruption to a sufficiently well-trained lifter's physiology. Muscle microtears are almost non-existent, neural perturbations are hardly caused, and the molecular detectors of force transduction in the muscle may not have summed enough activity to even convey the minimal necessary message for any cellular changes to occur.

The insufficient overload problem bounds our higher frequency possibilities to some extent. If you train so often that your per-session



volume must be tiny for MRV to be matched and excessive fatigue to be avoided, you might simply not be getting the best ratio of work to adaptation, as your SRA curves barely blip down because of the stimulus and thus barely blip up to make an adaptation.

This is not a concern for most programs as super high frequencies are rare, but it must be noted on a theoretical level so as to prevent possible errors in programming down the line. The “squat everyday” approach may be an example of such a program if applied to very advanced lifters. Such lifters would have to do so little daily work (perhaps only a relative “for that day” 1RM at most) that their very advanced and already adapted (and thus recalcitrant) physiology may simply not reach the overload conditions needed for best adaptations. Splitting their weekly training into fewer but more individually overloading sessions may be a better approach.

EXCESSIVE FATIGUE/OVERLOAD RATIO PROBLEM

From the paper and tape analogy in the last section, what would happen if you used the pencil to tear the paper into tiny bits that could barely be located to tape up? The very damage that is supposed to be part of stimulating the adaptations becomes too excessive and itself interferes with the adaptive process. You'd spend more time picking up the pieces than you would doing the taping, even if we assume you'd be able to rearrange the pieces back into a single sheet. If a lifter would endeavor to train with excessively low frequency (let's say once every 2 weeks for the average lifter), the amount of volume that would need to be presented in that one session to come close to MRV would be astronomical. So astronomical, in fact, that adaptive processes may mostly or entirely take a backseat to recovery processes. The end result after the SRA curve has run its course is perhaps a much smaller magnitude of gain than expected or a mere re-establishment of past performance with no net gain. In plain terms, training very infrequently would have to be so hard that the body may not even be able to adapt to it, but would instead struggle to barely recover. Car accidents can make people's necks sore for weeks on end due to the profound forces of the wreck, but not many people use car wrecks as a hypertrophic tool. Weak as that analogy is, it does make some point, which was better made by many lifters of generations past with the adage; "stimulate, don't annihilate."

What are some practical timeframes in which overloading too much causes mostly fatigue and no stimulus? This depends highly on the lifter in question and their particular situation, but some basic guidelines can be drawn. Technical abilities likely need at least two sessions of technique work per week to improve performance (which includes overload sessions themselves, not just technique-only sessions).

Advanced lifters who already have stable technique can get away with less (ala Westside), but technical improvement is still not what is being sought, even in that case. For hypertrophic adaptations, beginners likely need at least weekly stimulation of the same musculature, but even that becomes inadequate within several months and is only good enough for maintaining size from that point on. The per-session volume loads required to still make best gains on only 1x per week training per muscle group are too much for all but the most muscular individuals, and training in such a manner is not likely to be the best approach for most. Interestingly, the bodybuilding routines of the pros seen in magazines and copied by beginners across the world on a daily basis often include once-weekly programming for the larger muscles (chest, back, legs). This might actually be appropriate for bodybuilders of pro size due to their muscularity and the longer SRA curves they can generate. Unfortunately, this once-weekly training strategy only works well if you're over 250lbs of mostly muscle, and the majority of muscle magazine readers who copy these routines do not fit that profile.

Neural force output adaptations probably require training at least every 1.5 weeks for most individuals, which is not commonly violated in powerlifting. We have to remember though that if you only train often enough to properly adapt that system, you're missing out on hypertrophic and technical adaptations that can yield manifold greater improvements. Connective tissue disruption curves are very lengthy, but require constant levels of sub-maximal stimulation over long periods of time to adapt. One reason for this is that the risks of infrequent and very tough single-sessions for connective tissue training are just too great. You'd need such high forces and so many stimuli of them at once that acute connective tissue integrity (example: tendon strength) would be greatly risked and severe injury could result. For this reason,

the connective tissue adaptation system is probably the worst one with which to try ultra-infrequent training.

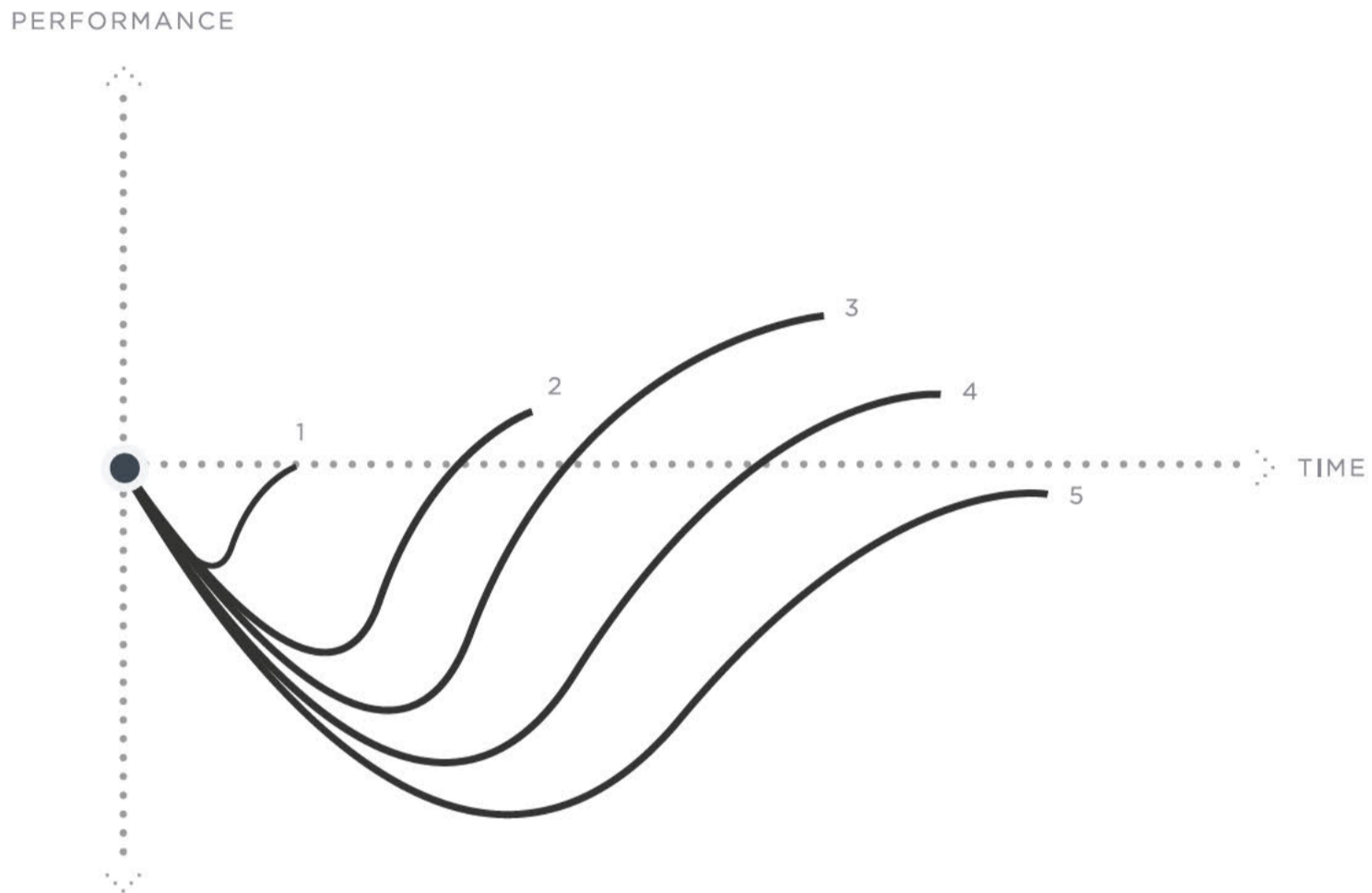


Figure 21: SRA with Ultra-Low Frequency Training

ADAPTIVE DISSIPATION PROBLEM

The second constraint on lower frequency training is the problem of adaptive dissipation. If you take a look at the graph of an SRA curve, you'll notice that once the adaptive peak has been reached, adaptations don't stay elevated there forever. If the next training session for that system does not occur at the adaptive peak but rather occurs later, not as much of the adaptation will be conserved.

PERFORMANCE

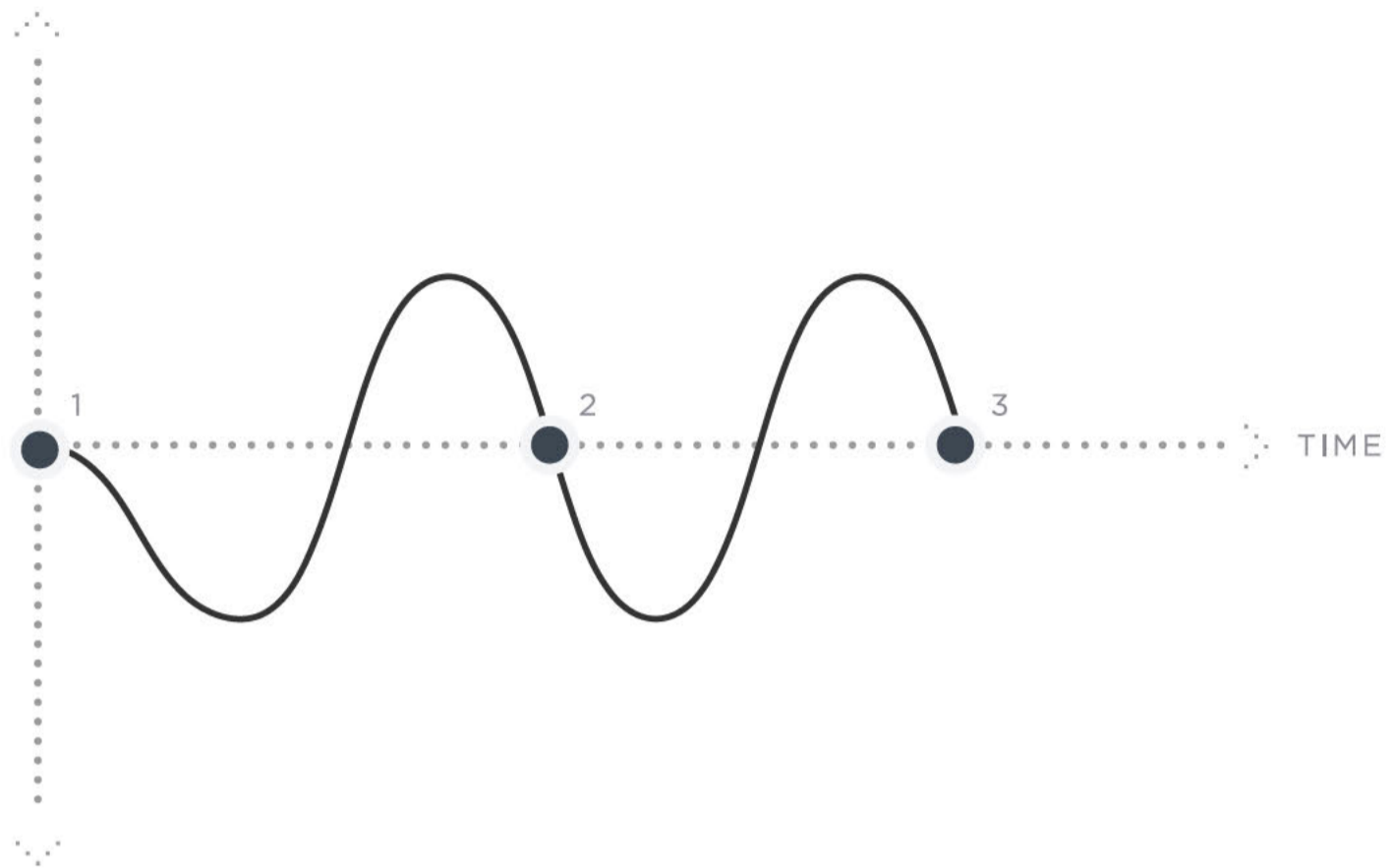


Figure 22: Adaptive Dissipation Between SRA Curves

If a long enough time lag exists between the first and second SRA curves, the entire adaptive gain could have deteriorated and no net gains are realized from that first SRA cycle. Worse still, if a really long time passes between the two sequential sessions, adaptation could fall below the original state before training occurs, which is termed ‘Involution.’ Involution is a particularly undesirable effect because the next session’s adaptive gains have to start in a deficit, and will be hampered no matter what. An easy example of this occurrence can be drawn from muscle growth. Muscles begin to grow within several hours of the last training session, and they can continue to grow for 2 to 4 days afterwards. But if you train a week apart, after the fifth day or so, muscle size starts to decline from its highest adaptive peak reached after the last session.

After the 6th day, some of the muscle from that first session has already been lost. If we train on the 7th day, we're only saving some of the muscle we built last time, and training any later might get us starting back from baseline or worse.

We know from the excessive fatigue/overload problem that SRA curves can only be stretched out so far via larger and larger single-session stimuli before they yield very little or no adaptive magnitude and essentially just become recovery curves. So if we stick to single-session stimuli that are small enough to avoid this problem, we also need to train frequently enough to avoid the second problem of adaptive dissipation. Both constraints act together to reign in the possibility of maximally productive ultra-low frequency routines.

RESULT: MANY FREQUENCIES POSSIBLE

The above constraints on frequencies do indeed create upper and lower boundaries for potential program design. But these boundaries leave a very wide margin for potentially productive frequencies of training. When we take into account the different contributors to the variation in frequencies such as lifter strength, muscle size and level of technical proficiency, we are lead to the conclusion that many frequencies are possible and can be optimal at different times and for different lifters.

If weekly volumes and intensities are being met at close to MRV, the frequency of a program is not a gigantic determinant of success, and in fact a variety of frequencies can be productive. More specifically, any one individual at a certain point in their development in the sport can have a narrower optimal frequency range depending on their goals, but there is not much sense in saying that one type of frequency range is

just plain better than another type so long as both are within the three constraints mentioned above and workloads and intensities are equated. In the debate between Westside's low frequency proponents and "Squat Everyday" proponents, the correct approach is dependent on the situation of the lifter, and neither is categorically better or worse.

2.) ARRANGEMENT OF TRAINING DAYS

Technically speaking, the training frequency of a program is only the number of days within a certain time period (let's say a week, but it doesn't have to be) that training occurs. There is another important variable derived from the structure of SRA curves that must be discussed as well, which is the arrangement of training days within a certain time period.

Arrangement of training days describes how the days are actually clustered within a certain time period.

For example, if you train the lower body three times a week, this can mean several things:

- Training on Monday, Wednesday, Friday
- Training on Monday, Friday, Saturday
- Training on Monday, Tuesday, Wednesday
- Etc...

The above examples present very different approaches to structuring training, but the training frequency (as measured by week) for all of

them is identical. However, the results of those training approaches are not identical. The first approach seems logical. An SRA curve is generated and has sufficient time to produce adaptation before the next training session is performed to sum adaptations further. The second approach is fairly spread out, but two problems can be noted; first, there is seemingly way too much lag time between Monday and Friday, and perhaps not enough recovery time between Friday-Saturday. The good news is that we can still get great results if we make Monday a very hard session with a longer SRA curve and make Friday a very easy session with a very short SRA curve, or simply keep all of the days the same in difficulty and let functional overreaching take care of the asymmetries. But even functional overreaching has limits. If we look at the last training arrangement above, we will have a very tough time getting the most out of that sequence. If we train with an even difficulty in each session, our Wednesday session will have a very hard time meeting overload requirements because of the two consecutive fatiguing sessions that precede it. And because of the massive lag time between Wednesday and the next Monday session, we're sure to start pushing up on the low frequency boundaries of optimal technical and hypertrophic frequencies.

The recommendation we can thus derive here is that once we've decided on a training frequency, structuring our workouts in a manner that roughly spaces them out in an even manner is probably the best idea. In reality, most everyone discovers this within a few months or years of training, even if it's the hard way. If you have heavy squats on Monday, heavy front squats on Tuesday, and heavy deadlifts and leg presses on Wednesday, you'll quickly figure out that your "heavy" deadlifts are anything but, and that the only good workout you have all week is the squat workout.

UNDER-APPLICATION OF SRA

Under-application of the SRA principle is when a lifter designs or executes a program without being aware of (or aware enough) of the SRA principle. There are at least three notable examples of this sort of error.

1.) TOO HIGH OF A FREQUENCY FOR THE SITUATION

High frequencies of training and especially of overload training are best for the development and solidification of technique and the stimulating of hypertrophy. When these are the preeminent goals, very high frequency programs are incredibly effective. Mostly, such goals and thus programs are best suited for beginner and intermediate lifters due to their need for technical work and hypertrophy. Smaller lifters and slower twitch lifters are also candidates for high frequency programs even if they are quite experienced and don't intend on putting on much more muscle.

So far so good, but the problem arises when high frequency programming is applied to all lifters across all levels of development, fiber type, strength, and size differences. The number of superheavyweight lifters that train very frequently is incredibly small, as is the number of very advanced lifters. These groups of people generate much longer SRA curves from their greater overload needs and thus need more time to recover, as well as training to focus much more on neural force production abilities than on muscle size or technique. High frequency advocates maintain that powerlifting is a sport, and you must practice the skills of the sport often in order to improve, much like any other sport. The next conclusion is that squatting, benching, and

deadlifting must be done often so as to maximize technical adaptations. This is true as far as it goes, but for more advanced lifters, it doesn't go far enough. The powerlifting moves are some of the most simple of all formal human movements, and technical near-mastery is possible within months of time with good coaching. After mastery has occurred, the techniques need to be practiced, but only at a maintenance level (1-2x per week). The kicker; practicing them more often than that simply doesn't yield the kind of benefits it does for beginners, and more recovery/adaptation by rest or light training may be of greater benefit for advanced lifters with stable technique.

Much the same issue presents itself in the realm of hypertrophy. Once a lifter has reached his or her weightclass limit, the role of hypertrophy training is highly diminished until they choose to move up a weightclass. If a lean 198lb lifter trains mostly for hypertrophy by overloading frequently, this fatigues them too much to get optimal neural force output adaptations, but what good does it do them? They're going to have to lower their calories in order to avoid having to go up to the next class, and not much else will happen. As good as hypertrophy training is, it's mostly useful if you're moving up in weight or saving muscle while burning fat. If you're at the top of your class already, size training is often just going to be interfering with strength training you could have been doing. For example, the guys at Westside are incredibly muscular, so for them, the impetus to train frequently enough to gain maximal muscle is simply not as great as it is for other lifters.

When choosing a program frequency, don't choose the highest frequency possibly simply because there have been reports of good results by other lifters. It always pays to consider the multiple variables that affect potential optimal frequencies for each individual lifter.



2.) TOO LOW OF A FREQUENCY FOR THE SITUATION

While ultra-high frequency training routines are a relatively newly popular approach, most of the late 90's and early to mid-2000's were the time of the low frequency routines, and some of these programs are still in wide use. For many lifters, including the ones that popularized the programs, lower training frequencies are indeed a very effective approach. But not all of the lifters using these programs are training often enough, and some could benefit from more frequent training.

This violation is the mirror image of the previous (#1 above) violation. In the 90's and 2000's, Westside was king, and everyone and their grandmother was trying out a Westside-inspired split, just like some

circles today are treating “Squat Everyday” as a holy grail. The result was that lots of experienced lifters were getting great results, but beginners were not doing as well as they could. By only training a muscle group heavy once a week, the technical practice in such routines was very low, and not ironically, some pretty atrocious technique from beginners was rampant (not nearly like the high frequency beginners today, whose technique is actually not bad). The 19 year old in a canvas suit doing something like a good morning at a meet became a comedic commonplace during this time. In addition, the same 19 year old seemed to gain very little size from meet to meet, so his performance did not improve at nearly the expected rate. While his older training partners benefitted greatly from the neural improvements of the program, they had the technical and muscle size base on which to lean on... a base he didn't yet have and wasn't on his way to establishing at any fast rate.

The way to avoid both this and the opposite error (training too frequently if you're too advanced or strong or for other reasons) is to program frequencies with the state and needs of the lifter in mind. If that means that the whole training crew might not be able to train on the exact same program all the time, that's a tradeoff that might have to be made if best results for each lifter are the goal.

3.) TRAINING THAT IS TOO CLUSTERED

This violation has already been fairly well illustrated in the discussion of the arrangement of training days within a certain frequency. Here, we can break down the discussion into a slightly more precise series of points.

Overload training too soon after the last session can have the following negative effects:

- Interferes with the ability to provide an overload in the present session, as the fatigue from the last session is still quite high.
- Leaves a long gap between the present session and the next overloading session, during which involution is more likely to occur.
- Directly blunts current adaptations in progress, limiting the adaptive magnitude of the previous session.

Overload training too late after the last session and very close to the next session after can have the following negative effects:

- Presents fatigue that will interfere with overload presentation in the next session.

So there is both a reason to keep sessions far apart both before and after one another, creating the need to spread sessions out within the specified frequency. This recommendation applies not only for each muscle group, but for taxing sessions in general. Placing too many taxing sessions back to back may create high levels of disruption to central systems such as the brain and spinal cord, which can lead to adaptive interference and performance interference even between different body parts. Training heavy squat, bench, and deadlift on 3 consecutive days is thus mostly unheard of, as all of the days interfere with each other and more even spacing within the week is almost certainly better.

OVER-APPLICATION OF SRA

Over-application of the SRA principle occurs when a lifter has over-interpreted the SRA principle to be more valuable and impactful to the training process than it really is. This creates an obsessive tendency to attempt to create “perfect” training structures and presents itself in at least three notable ways.

1.) WAITING FOR COMPLETE HEALING TO TRAIN AGAIN

We have to wait for the particular SRA curve of the adaptation we are focusing on to reach its adaptive peak and fully recover before training. Muscle growth must just have come to an end before we train for muscle growth again. This does not mean we have to wait for all of the SRA curves generated by each training session to complete before we can train again. If we wait for the nervous system force production SRA curve to finish its course each time, our technique and hypertrophy adaptations would have involuted long ago! And if we waited for connective tissue curves to heal also, we’d be waiting for weeks before training again!

When we train for some abilities, we are ok with the accumulating fatigue of other abilities so long as we manage fatigue on occasion and don’t let it get too high. Waiting for full recovery of all systems before training them again would waste an absurd amount of time and potential improvement. This means that if your program variables are arranged correctly and your goal is a technical emphasis, it’s ok to train sore sometimes. If your goal is a hypertrophic emphasis, it’s ok to not train at your strongest. If your goal is strength training it’s ok to have sore joints for some periods of time. So long as you manage fatigue and periodically

bring down the fatigue in all systems, it's absolutely fine and in fact necessary for training to occur without full healing of all systems.

2.) NOT TAKING ADVANTAGE OF FUNCTIONAL OVERREACHING

By clustering overloading training sessions close together, we can get the effect of depressing SRA curves much lower than they would normally drop. If the overreaching is within the body's total ability to recover and adapt over time, the adaptive rebound back from overreaching can be massive, and at various points a very useful tool in training, especially before deloads and tapering periods before a peak for a meet.

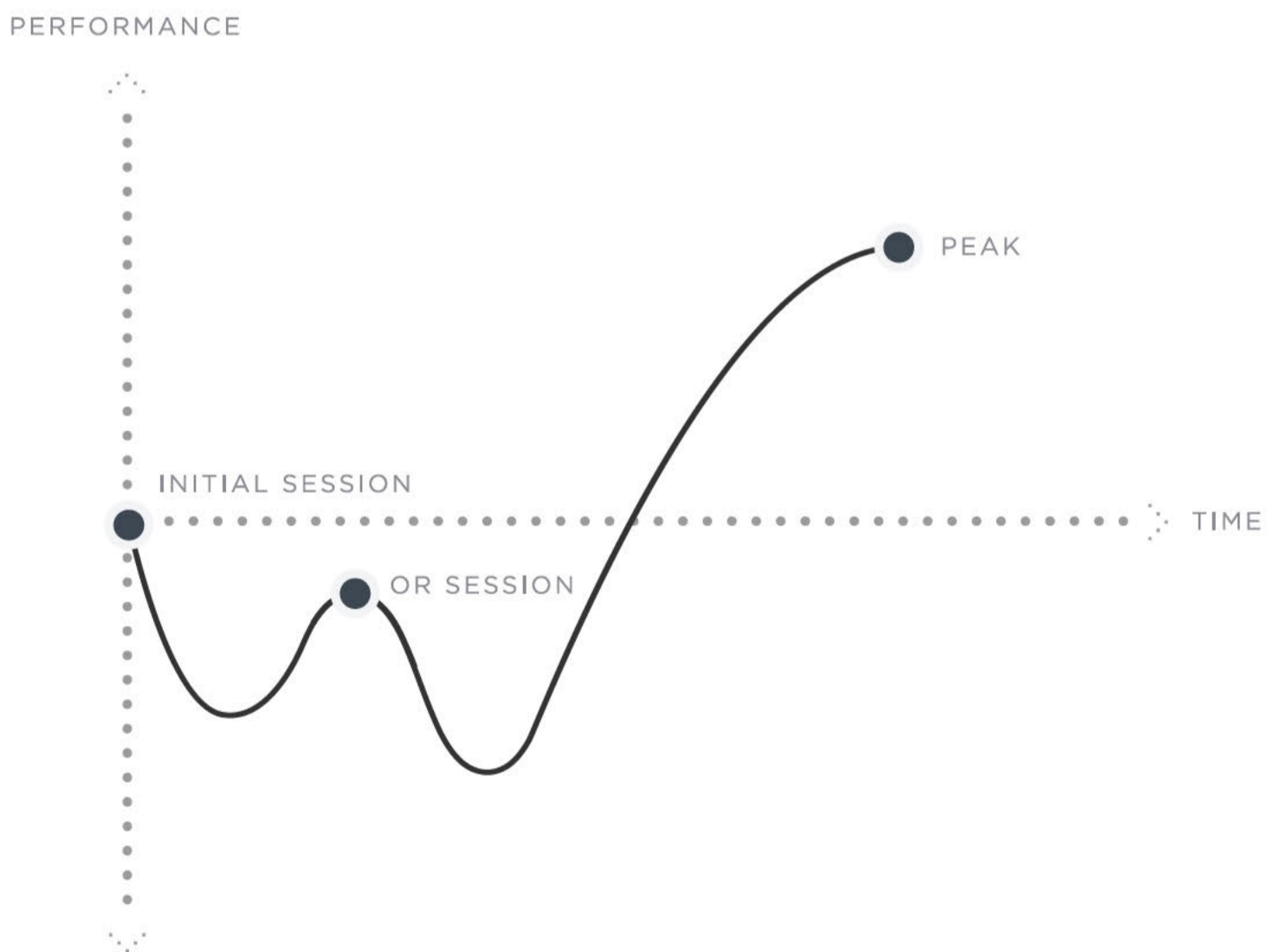


Figure 23: Overreaching

While most training should not take advantage of overreaching as much as it takes advantage of timely recovery, functional overreaching is very useful in some circumstances, and is more useful in those circumstances than if we avoided it on principle. By extending the time it takes to realize adaptations, overreaching can allow us to recover from overloading training while training very easily to drop fatigue. At the end of this process (to be covered extensively in the chapter on phase potentiation), we have both recovered AND supercompensated at the same time, thus allowing either the expression of best performance at the end of that period or the use of the lighter period for the generation of adaptations and not just to drop fatigue.

An inappropriate time to overreach would be before a lot of overloading training has yet to be done. The early overreach interferes with further training by both dulling adaptations at the cellular level and preventing maximal overload presentation via fatigue. If you overreach in week 1 of a strength mesocycle, you're going to run into serious problems. But if you're averse to overreaching at any point, you'll lose too much fitness during deloads and tapers, and thus see worse performances.

Overreaching can be a tough approach for those lifters that are usually used to training while feeling at least mostly recovered. Overreaching hurts, requires crazy volumes, and leaves you feeling no good for anything let alone heavy lifting! But properly employed functional overreaching can yield impressive short-term benefits to performance, which are especially useful right before competitions. A religious attitude against overreaching simply due to its unpleasant training requirements and side effects is unlikely to yield the best results.

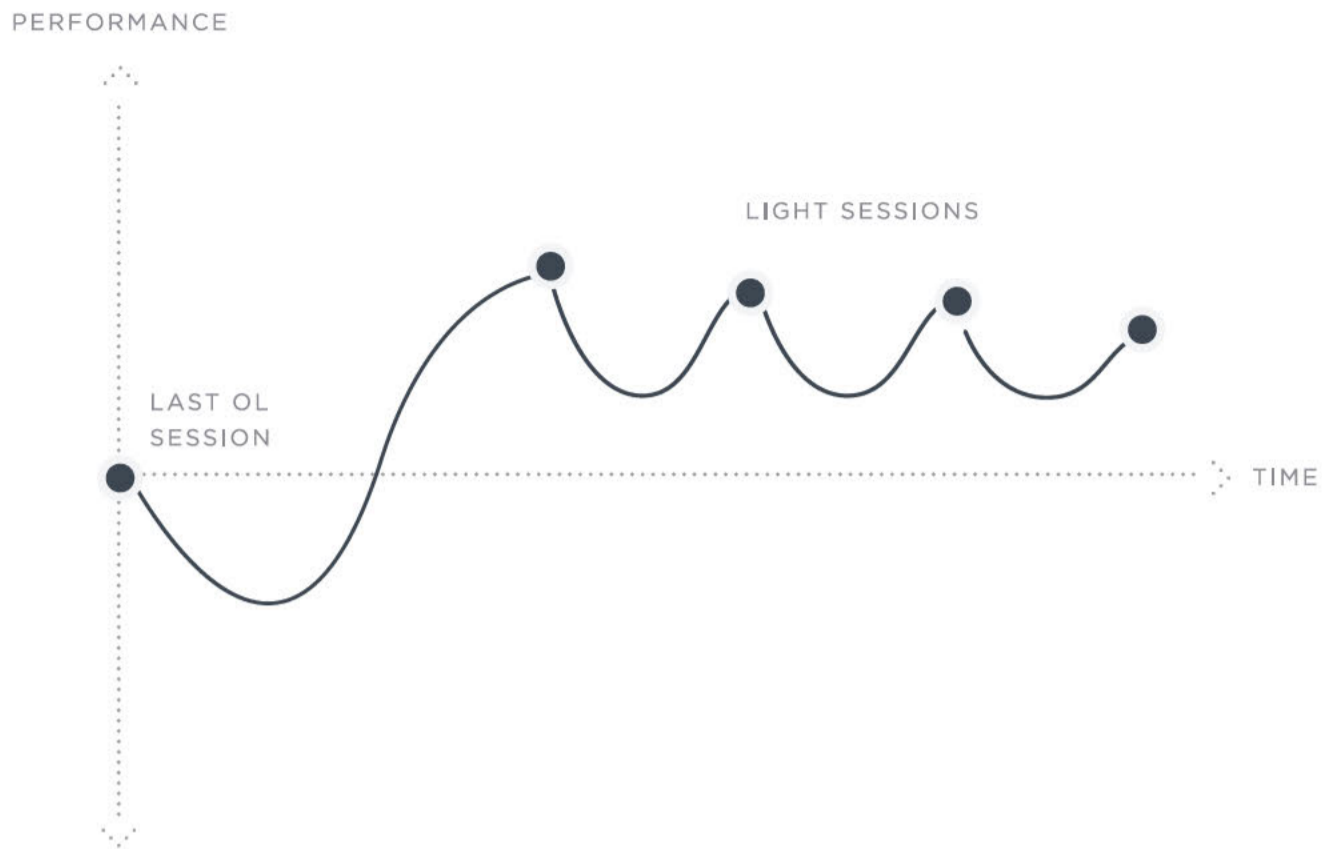


Figure 24: Adaptive Decay During a Poor Taper Design

3.) SEEKING AN OVERLY SYMMETRICAL TRAINING WEEK

Overloading training produces fatigue, and within the microcycle, light sessions and rest days dissipate that fatigue. The most powerful way to use light and rest days is in sequence, so that a lot of fatigue can be brought down at once and not simply re-upped the very next day. In the section on fatigue management, it was mentioned that two consecutive rest days are a good idea for that very reason.

You'll notice that two consecutive rest days actually doesn't concord with SRA in a perfect fashion. If you want to train with exact symmetry 4 times a week, you should train on Sunday Night, Tuesday Morning, Thursday Night, Saturday Early Morning, or some other split of that nature that never truly gives us a full two days off. While this approach concords well with the SRA principle, it actually violates the Fatigue

Management principle by not giving a distinct and prolonged time for recovery within each microcycle. In effect, perfect application of SRA violates perfect application of Fatigue Management, but because Fatigue Management is a more important training principle, it usually wins the draw.

It seems that the best approach is to get as close to perfect symmetry as possible while still leaving some bias in overload session arrangement to allow for fatigue to dissipate at the best rate.

SUMMARY

The SRA principle is described in perhaps one of the most technically complex discussions of the book, with no shortage of fancy graphs. But when it comes down to it, it's one of the simplest principles to define in basic powerlifting terms. At its core, SRA means that you wanna hit it hard in training and then take the time to recover properly before hitting it hard again. Rest too little and your performance and adaptations from each session suffer. Rest too long and the progress you've made in past sessions deteriorates too much.

Key Points

- Stimulus recovery adaptation describes the process in which a training stimulus generating a sufficient overload can lead to positive adaptations when sufficient recovery periods are implemented
- Training frequency will be highly specific to the type of training and the muscle mass involved. Deadlifting for

heavy sets of 5 reps will result in vastly different frequency requirements than practicing squat technique or doing bicep curls

- Individual differences also play a role in managing training frequency. Factors such as maximum recoverable volume, technical abilities, fiber typing, absolute muscle size, strength, psychology, and anthropometry all will play a role in how frequently each individual will be able to training

SOURCES & FURTHER READING

SRA Defined

- The General Adaptation Syndrome
- Principles and Practice of Resistance Training
- Science and Practice of Strength Training
- Periodization 5th Edition Theory and Methodology of Training

SRA Applied to the Development of Fitness Characteristics

- Sport Nutrition
- The Influence of Frequency, Intensity, Volume and Mode of Strength Training on Whole Muscle Cross-Sectional Area in Humans
- Influence of Resistance Training Frequency on Muscular Adaptations in Well-Trained Men
- Single vs. Multiple Sets of Resistance Exercise For Muscle

Hypertrophy: A Meta-Analysis

- The Development, Retention and Decay Rates of Strength and Power in Elite Rugby Union, Rugby League and American Football: A Systematic Review.
- Applications of the Dose-Response For Muscular Strength Development: A Review of Meta-Analytic Efficacy and Reliability For Designing Training Prescription

Adaptive Decay & Reversibility

- Detraining: Loss of Training-Induced Physiological and Performance Adaptations. Part I: Short Term Insufficient Training Stimulus
- Detraining: Loss of Training-Induced Physiological and Performance Adaptations. Part II: Long Term Insufficient Training Stimulus
- Muscular Characteristics of Detraining in Humans
- Upper-Body Strength and Power Changes During A Football Season
- The Development, Retention and Decay Rates of Strength and Power in Elite Rugby Union, Rugby League and American Football: A Systematic Review

VARIATION

SCIENTIFIC DEFINITION

The principle of variation is not “shocking the muscle” or “switching things up” or “muscle confusion,” though the latter term, bro as it is, comes a bit closer to reality. In order to understand what variation is and why it’s useful, we have to begin with a short working definition and then describe two fundamental concepts within that definition. The brief definition of variation is:

“The manipulation of training variables to prevent staleness and injury and to magnify the long-term adaptive response to training.”

Variation can be created through basic changes to the training program:

- Changes in volume ranges (low, moderate, high)
- Changes in intensity ranges (low, moderate, high)
- Changes in repetition ranges and metabolite loads (low, moderate, high)
- Changes in exercise selection (leg press vs. front squat)
- Changes in frequency (low, moderate, high)
- Changes in velocity (moderate, fast, maximal)

Smaller changes like those in exercise order can also matter, but make a likely tiny difference and will be omitted from this discussion for the purpose of economy. The two fundamental concepts critical to understanding the principle of variation are “negative feedback loops” and “adaptive resistance.” Once both are well defined and described, variation can seem rather obvious and quite straightforward.

NEGATIVE FEEDBACK LOOPS

There are two main types of feedback loops within biological systems; positive feedback and negative feedback. Positive feedback loops are characterized by processes in which the product of the process leads to an increased rate of production of that same product. When a blood clot forms, it signals the formation of other blood clots to form in the immediate area. As those clots form, they signal still more blood clots to form, and the wound is closed off to bleeding at a (thankfully) rapid pace due to the exponential growth of clotting in that area. More clots lead to more clots which further lead to even more clots. To use a social analogy, if one fan starts a chant at the stadium, fans nearby may pick it up and begin chanting, which gives the chant even more exposure and leads to the whole side of the stadium chanting in mere seconds. More chanting leads to more chanting.

If positive feedback loops were the dominant form of regulatory process in muscle growth and strength enhancement, we'd all be like the Super Saiyans from Dragonball Z and the whole universe would probably have been destroyed by Ed Coan long ago. Unfortunately, the primary form of regulatory process in strength development is the negative feedback loop.

Negative feedback loops also detect the amount of product made by the system, but instead of signaling for more production with more product as positive feedback loops do, the opposite occurs. The more product negative feedback loops detect, the more powerfully they suppress the system creating that product. This leads to a balancing act that conserves homeostasis as opposed to spreading events like wildfire. There are a huge number of examples of negative feedback loops in the body, and we'll look at many of the ones directly related to muscle growth and strength gain shortly. For now, a quick example in the body and one outside of it just to iron out the basic patterns of negative feedback loops. Food consumption can be a simple way to understand negative feedback in the body. The more you eat, the more various hunger-suppressing hormones are produced. Thus, the more you eat, the less hungry you become.

You might be skeptical of this analogy until you try to purposefully gain weight. It's all fun and games until you're eating 7,000 calories per day and you literally forget what hunger ever felt like because it's been weeks since you've experienced it. A simple example of negative feedback not in the human body is actually that of the home thermostat. If the thermostat is set at 65 degrees Fahrenheit and we open the living room door to let in some summer breeze, the AC will turn on and begin to cool the house. If we close the door and let the AC run for a couple of minutes, the temperature will fall back down to 65 degrees and the AC will turn off. More cold air lead to a decrease in cold air production.



ADAPTIVE RESISTANCE

Negative feedback loops are critical for maintaining proper levels of hydration (thirst), feeding (hunger), and a host of other critical functions. As well as those life-preserving basics, negative feedback loops also govern the function of adaptations. Every system in the human body that chronically adapts to stimuli is governed by negative feedback loops. The more your technique improves, the harder technical improvements become. The more muscle you grow, the harder further muscle growth becomes. The more force your nervous system can get out of your muscles, the tougher it is to get further enhancements, and so on.

When presented with a certain stimulus, adaptive pathways respond and improve the performance of the system but do so less and less robustly

each time due in large part to the actions of negative feedback loops. We can describe this phenomenon as the development of “adaptive resistance.” The more we signal a system to adapt in a particular direction, the more resistance to adaptation it develops and the harder gains are to make.

If we’re going to have the fastest rates of long-term gains, we had better do something about adaptive resistance and find a way for recalcitrant systems to improve their performances more rapidly. The primary way of doing this is to stop stressing a system in a certain way and stress it in other (though still similar) ways. During the time that it’s being stressed in other ways, that system’s adaptive resistance to the first way falls slowly, as its most recent exposure to that first stressor grows more and more distant. After some time, we can go back to the first way of stress and notice significant improvements to system performance as adaptive resistance is initially much lower. Of course adaptive resistance will start growing yet again, but we can always continue to repeat the process of purposefully changing the stimulus in order to cause improvements from one direction while those from other directions are given time to lower their adaptive resistance to prepare for future focus.

In the context of improving powerlifting performance, there are four basic abilities which demand our attention and understanding of their individual forms of adaptive resistance.

A.) TECHNIQUE

There are three general phases in the learning of a new technique. When a new technique is first introduced, early learning is slow and mistakes are plentiful. Once the early slow phase has been completed, a rapid

phase of technique learning begins, whereby enough of a base has been acquired in the first phase to make this second phase more productive. The third phase of technique learning occurs when a technique has been trained consistently for a bit too long without any breaks. This phase is characterized by very slow improvements, and sometimes even stagnation or regression. It is this last phase that is caused by adaptive resistance. A single technique presented too long in sequence develops adaptive resistance, whereby further technical improvements are slow or non-existent.

The way to avert staying in the adaptive resistance phase for longer than needed is to introduce technical variation into the program. If you've hit a point at which your competition bench press feels off, but isn't feeling better week to week (from a technical perspective), it might be a good idea to stop competition pressing altogether for several weeks and focus on other variants such as wide or close grip work, incline work, or dumbbell work. This removal of competition pressing can allow the neural pathways that execute the technique to re-sensitize to training. This can allow for the movement to feel novel upon its reintegration and for some possible further progress in technical execution to occur. Another major benefit of coming back to a movement after a layoff is the ability to see the technique cues in a new light, and specifically to stop making old mistakes. Because a bit of re-learning the movement has to occur upon return, that re-learning can be with better cues or at least a lack of older mistakes.

In basic terms, doing the same exact techniques for too long on end can result in a poorer long-term mastery of those same techniques, so that a regular "deletion and replacement" of techniques may yield best results.

B.) HYPERTROPHY

Each time a particular exercise is performed, certain groups of muscle fibers in the muscle used activate, while others remain dormant more often than not. For example, some sternal fibers in the pecs are used maximally in competition bench pressing, but are not used during incline pressing or only used on the last, hardest reps and not all the time.

The end result is that some muscle fibers will be very overloaded and exposed to lots of stimulus by a certain exercise, while still other fibers are only trained enough to maintain their adaptations.

The muscle fibers being overloaded the most encounter two problems in the medium term (weeks):

- Constant overload leads to local overreaching past MRV for those fibers
- Similar stimulus leads to adaptive resistance for those fibers

As in the above discussion on technique, the altering of exercises is a very helpful tool to combat both of these problems. Firstly, a new exercise will no longer stimulate the same fibers in the same patterns, as it will direct forces from a novel angle. This will allow the overreached fibers to make a complete recovery and supercompensation while the newly targeted fibers are now themselves overreaching. Secondly, the new exercise will allow the originally trained fibers to reduce their levels of adaptive resistance and become more sensitive to muscle growth again. When a still-newer exercise or even the old exercise is brought back in, the old fibers are now recovered and no longer as resistant to growth, so the cycle can begin anew. Experienced lifters will recognize this process by noting the higher levels of delayed onset

muscle soreness that occur when introducing a new exercise, indicating a lessened resistance to disruption and thus growth.

Altering exercises once every mesocycle (too often would interfere with the Specificity sub-principle of Directed Adaptation) can work for several mesocycles on end to continue to push along muscle growth results, but this is not a process that yields infinite gains. After multiple months of training for hypertrophy in general, the very molecular pathways that signal muscle growth can become somewhat blunted. Even with proper fatigue management, it's likely that over the longer term, mTOR activity begins to be eclipsed by AMPk activity if high volume and metabolite-generating hypertrophy training continues unabated. In this case, a wholesale declination from hypertrophy training is likely effective for re-sensitizing pathways such as mTOR and de-sensitizing pathways such as AMPk so that another several months of productive size training can occur.

Training for strength offers almost the perfect break from hypertrophic training, as it conserves muscle well but provides neither the volume nor the high-rep or short rest time to generate appreciable metabolite concentrations. Because powerlifters will likely be training for strength/peaking regularly throughout the year, few lifters will run into this particular form of longer-term of hypertrophy adaptive resistance. However, those doing more dedicated hypertrophy work to move up a weightclass may keep these limitations and remedies in mind.

C.) NEURALLY-MEDIATED STRENGTH PRODUCTION

In plain terms, training any sort of neural output by itself for too long on end will lead to adaptive resistance even with proper fatigue



management. Months upon months of dedicated short bursts of maximal motor unit recruitment eventually becomes somewhat less simulative of progress. In order to keep nervous system gains coming, an occasional layoff from the maximal recruitment of strength and peaking training may be warranted.

Does this imply that we have to back off from overloading training altogether during this time? Not in the least. The stimulus to the nervous system just has to be significantly different, not less. An almost tailor-made solution for “max effort staleness” is to focus for a mesocycle or two on repetitive, sub-maximal actions of the nervous

system and avoid low rep maximal ones. Hypertrophy and work capacity training fall squarely into this requirement and are thus nearly ideal variants from dedicated strength and peaking training when the latter encounter too much adaptive resistance.

D.) CONNECTIVE TISSUES

When a connective tissue is first deformed in a novel way, it rapidly accretes more tissue in those force lines to strengthen and become less likely to undergo further deformation (or as rapidly as connective tissue alters, anyway). After a period of stressors from similar angles and with similar forces, adaptation generally slows down significantly. If exercise selection changes (squat to front squat, for example), the lines of compression and tension change, leading to a reduction of stimulus to the original lines and an increase in the new ones. Coming back later to the original exercises is likely to re-ignite adaptations as the original force lines had time to re-sensitize to tissue alteration mechanisms.

Fatigue Management relates highly here (and it could in fact be proposed that the entire principle of fatigue management is but a subset of the grander principle of variation) in relation to potential injury. If no variation in exercise occurs, the chances for the same microfractures and microtears to be aggravated into larger deformities will likely increase. Training the same movements chronically with little or no variation then interferes with fatigue management and can lead to a higher injury rate. In effect, the use of movement variation in regards to connective tissue adaptation can be a way of continuing to train with overloads for longer but still reaping the benefits of reduced injury rates.

GENERAL PATTERN OF VARIATION

Varying at least the exercise selection, volume, and intensity of a program can have very beneficial effects on long term adaptation. More specifically, changing those variables strategically every mesocycle or so offers the best tradeoffs of variation with directed adaptation, as there is still enough time for new variants to generate solidified gains in ability that don't melt away when the focus changes next. However, it's very important to remember that while variation is a helpful tool, it has two distinct limits.

The first (and actually less important) limit is that of directed adaptation. Too frequent of variation (trying a new exercise every week) may not allow adaptations to settle in and be retained as well in the long term. More on this in the upcoming section on the over-application of variation.

The second limit to variation (which will also be discussed in greater detail later) is that of using variants that exit the general boundaries of powerlifting training that are set by the most important of principles; specificity. All variants used in a program must be in line with the specific goals of that program.

For example:

- If you're choosing variants for hypertrophy, all chosen intensities, volumes, and exercises must induce hypertrophy well
- If you're choosing variants for strength, all chosen intensities, volumes, and exercises must be optimized for generating strength gains

All use of variation must in the final sense be bounded by the fact that you're training for powerlifting. If you choose a set, rep, weight, or exercise that you can't clearly see a benefit from to your powerlifting training or any factors that underlie your ability to lift, then that's one step too far in attempting to vary training.

Taking all of the above together, we can make a more precise technical definition of variation:

“the strategic alteration of training variables to decrease adaptive resistance, bounded by the specificity of the demands of the sport.”

POWERLIFTING DEFINITION

In powerlifting, the definition of variation is a very short drive from the one for all sport above. It's simply:

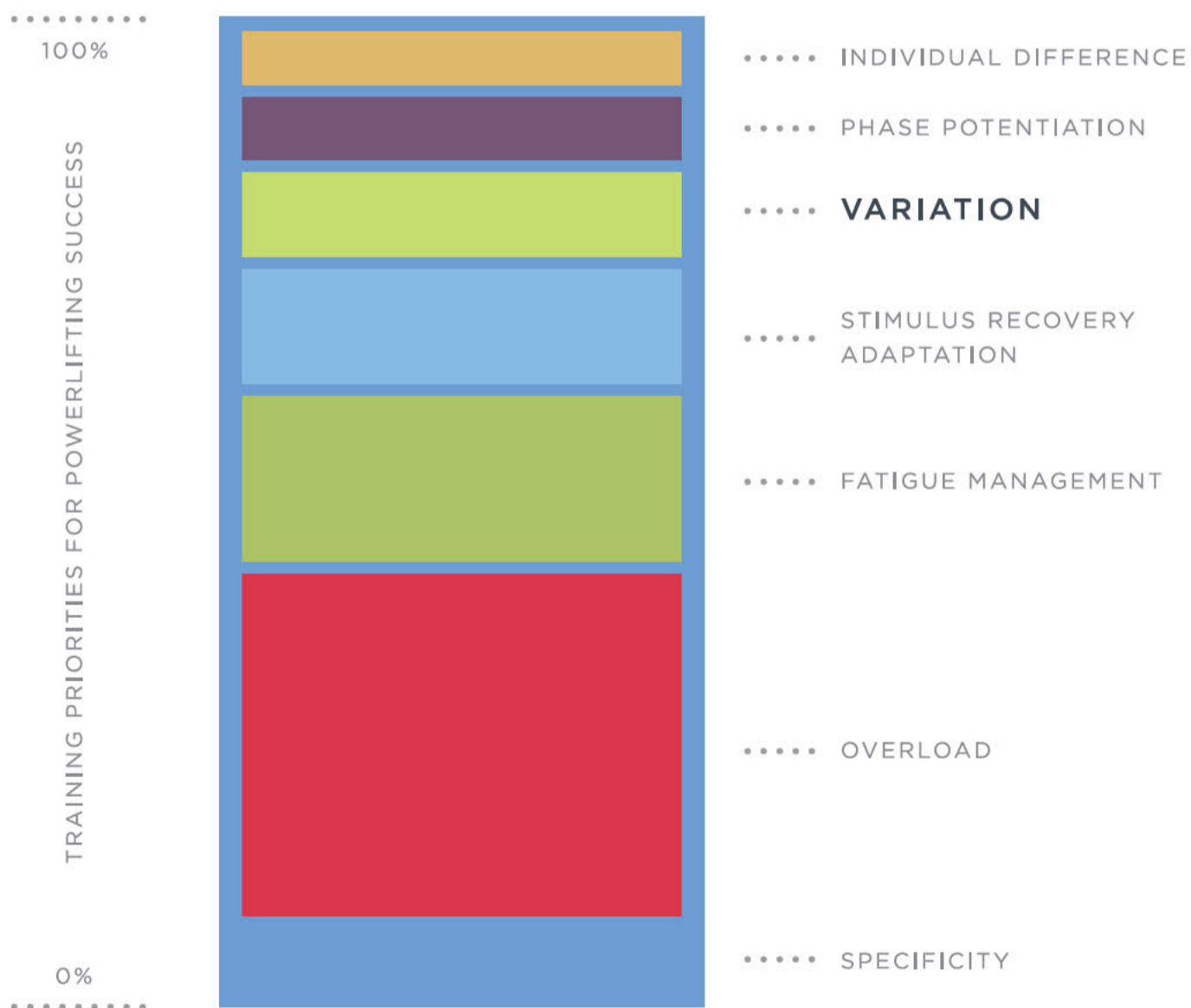
“the strategic alteration of training variables to decrease adaptive resistance, bounded by the specificity of the demands of powerlifting training.”

If it gets you big, strong, or peaked for training, then in its right place it's probably just a fine variant to use. Pretty straightforward. In the section on under- and over-application to come, we'll take a look at some ways in which we can avoid the mistakes of using variation improperly and continue to use it productively to spur new gains on a continual basis.

PRINCIPLE IMPORTANCE RANK

The basic powerlifting movements work so well that with appropriate fatigue management they can yield impressive gains in ability all by themselves for years, and in fact just training the lifts themselves can make you incredibly successful. Variation is a great tool, but it would be a pretty far stretch to call it all-important, which is why it ranks fifth on our list of priorities.

While variation for the purpose of reducing adaptive resistance is not the most powerful principle of training, it is effective nonetheless and will have at least some role in almost every lifter's training.



IMPLICATIONS & EXAMPLES OF PROPER APPLICATION OF VARIATION

1.) PROPER TIMING OF VARIATION

When we vary our exercise selection for the purposes of reducing adaptive resistance, we take away certain exercises (competition bench presses, for example) and replace them with others (close grip bench presses, for example) for at least a mesocycle. At the very least, once competition benches were re-introduced, a faster level of improvement in competition bench performance would result due to a lowered adaptive resistance. Exercise variation can be as simple as this, but for it to be more effective, when we choose to replace the competition lifts with certain variants also matters.

There are constraints on when we can use non-competitive variants. The most obvious and important of these constraints is that the principle of Specificity dictates that we must use the competition moves at least in the mesocycle leading up to the meet, if not for several mesocycles before. This is of course to make sure that technical, muscular, neural and connective tissue systems are all optimized for actual powerlifting performance on the date of the meet when it matters most. The second constraint comes from Fatigue Management. Volumes of training in especially the peaking phase leading up to the meet need to be low, so there's also not much room for much variation on top of the competition lifts even if we wanted to throw some in there. That being the case, we cannot use much if any variation in the mesocycle or two leading up to the meet and most if not all work must be done with the competition lifts. The third most important constraint is that of intensities and

repetition ranges. Because training at similar intensities all the time promotes adaptive resistance (training heavy year round without higher rep lighter periods, for example), there must be a time to vary the training intensity with planned reductions. But just as with the first two constraints, we can't quite train lighter and for higher reps right before the meet as we must be training with our heaviest weights here to avoid violating the specific demands of the nearing meet.

The problem is, we can't just do the competition lifts heavy all the time because then they'll build up a high adaptive resistance and will be recalcitrant to improvement. Thus, we can conclude that the best time (or rather, at least not the worst) to use variation in both exercise and intensity selection to reduce adaptive resistance is the deep offseason (aka general prep phases), or the time of training right after the last meet and far away from the next. By putting much of our variation far away from the meet, we can both have the adaptive resistance-reducing powers of variation and the concordance of specificity by still training with the competition moves leading up to the meet itself.

Because our specificity must be highest right before the meet and because variation is best used far away from the meet, a pattern emerges in our training structure. With each mesocycle from the beginning of the macrocycle to the end (one competition to the next), the specificity of training increases and the variation of training declines.

- Exercises begin to biomechanically resemble the competition lifts with each mesocycle. Skull crushers in the early mesocycles are replaced with close grip benches in the later mesocycles and again with competition benches right before the meet.

- Intensities of training increase on average between mesocycles. Training gets heavier and heavier until it approaches competition weights.

There is no distinct cutoff of time after which all further mesocycles are completely specific, nor is there a time before which all mesocycles are completely variable from the competition lifts and intensities. Rather, the transition is gradual, which among other things allows the variants of the early phases to potentiate improvements in the later phases, a concept we'll explore in great depths in its own chapter on Phase Potentiation.

2.) STRATEGIC VARIATION

The basic reason that we've explored so far for the use of variation is in its role in reducing adaptive resistance. We use variations in exercise selection and intensity far away from the meet itself in order to make meet training modalities effective again and prevent their staleness. This is a good start to the use of variation and definitely its best effect, but we can do even better.

While we know that the tools we use in creating variation need to be different in intensity and exercise than the powerlifts themselves and overloading enough to be effective, we can make an even more precise recommendation. So far as it meets the aforementioned criteria, variation can also be directed to improve particular systems that yield the best outcomes for our particular situation over the long term. We are no longer just varying loads and exercises in a "random if meeting basic criteria" fashion, but rather we are also choosing to meet our particular needs at the time. Because intensity variation will be covered completely

in the chapter on Phase Potentiation (it turns out that there is not much leeway in intensity anyway once the three different phases are applied properly), the remainder of this discussion will focus on variation in exercise selection.

The basic question on “needs” in training is answered by “whatever gets you the biggest total in the long term,” and this is definitely true. The process of choosing the right variants in exercise to do this is constrained by two factors; what we will call Adaptive Proclivity Training and Limiting Factor Training.

A.) ADAPTIVE PROCLIVITY TRAINING

When we’re constructing our early-macrocycle mesos far away from the next meet, we can choose our exercises with the goal of capitalizing on our individual adaptive proclivities. This method works especially well for intermediate lifters. In essence, we choose our variants to work on our genetically-endowed advantages, because it is these advantages that will propel us by leaps and bounds towards at least “good” performances.

If you are just starting in lifting, you may not know what these are for you yet, and using a more non-directed variation for a time can be the best way to find out. Once you’ve done several macrocycles of non-directed variation (training every muscle involved in powerlifting evenly), you’ll be able to more clearly identify your advantages in genetic potential and responsiveness to training. Just pick effective lifts that you’d like to do, so long as they are not the powerlifts themselves. Track your performance, and you’ll find that some lifts and body parts in particular seem to make much faster and more consistent gains than others.



Once you have identified where your strengths are, it's time to make them even stronger (and bigger). For example, if a lifter's quads were always pretty big and responded very well to training, it's probably a good idea for them to choose quad-heavy variants like leg presses and front squats early in the macrocycle. The rapid growth in quad size will be used to propel impressive increases in quad strength and thus build a massive base for a huge squat. If your triceps are enormous to begin with, make them bigger by choosing close grip and triceps work. If your upper back is downright freaky in its response to training, focus on that in your deadlift work. There will be a time later for working on weak points, but to have anything like a true weak point, you've gotta have strong points first. Use your gifts and make them as good as you can for a long time (years) after your beginner phase is over, because it's those gifts that will contribute the most to your strength. People might

call you a “quad squatter” or “triceps bencher” or describe your deadlift as “all upper back,” but so what? Those descriptions have been used to refer to lifts of many of the greats earlier in their careers. And this is no hypothetical... there is not a single great in the sport of powerlifting that did not take advantage of their gifts. To do so would be sheer lunacy. They don’t give an award for “most balanced” lifter... only for the lifts and the total.

B.) LIMITING FACTOR TRAINING

Once a very strong base has been built on the genetic endowments of the individual lifter, some cracks can begin to show. There comes a point when certain muscle groups are so strong that the weight lifted by them can leave other contributing and supporting muscles behind. This risks both injury and performance plateaus. For example, if you squatted mostly with your glutes and hamstrings while having decent quad development, you may get to a point where your quads are too weak to power your unprecedented squat weights out of the hole to let your posterior chain even begin to take over. At this point, your quads begin to seriously hold back your squat. If your bench has been chest-powered for a long time, at some point your triceps might be incapable of locking out the massive weights your chest throws up almost to lockout before the triceps must kick in. In the deadlift, your massive grip and hamstrings are getting you both crappy performance and injury risk as your much weaker back begins to round at your heavy training weights.

Because adjusting proper technique can allow you to make the best possible use of your advantages, truly limiting factors are not quite universal. But in more advanced lifters with incredibly well developed strengths, they are very commonly what are holding improvements back.

When such limiting factors present themselves, further work on the advantaged body parts and movements will not yield almost any more improvement on the competition lifts themselves. To make the clearest example, it doesn't matter how strong your hams and back are... if you can't grip the bar, you can't count it towards your competition deadlift. At some point the intelligent lifter has to focus on these limiting factor weak points.

One of the best ways to do this is through variation in exercise selection. Variants early in the macrocycle can be chosen with the specific intent to target weak points. Pause squats and front squats for quads, wide grip benches and dumbbell flies for the chest, and rowing, pull-ups, and block pulling for the upper back. Once limiting factors have been brought up, the powerlifts themselves will likely improve as well! This method works especially well for intermediate and advanced lifters that actually have a big enough "advantage base" to have weak points to begin with.

This is last point is important. Many beginner-intermediate lifters spend countless hours trying to figure out their weak points. When all is said and done, it turns out that they don't really have the strong points to even justify that distinction and that everything is a weak point! These lifters can of course continue to employ more random variation and train everything with the same level of commitment, but this would be an error. By definition, your strong points will respond better to training and it is thus a better use of time to train those body parts and movements. The only time limiting factor training comes in handy is when... you actually...have...limiting factors, and aren't just "weak all over."

Once a lifter finds their strong points, it's probably the best idea for

them to train those with the most priority, as those are their tickets to the top. Once limiting factors present themselves, they need to be dealt with and variants chosen to improve them. This variation and improvement of weak points will buy the lifter more time to work again on improving strong points, as just continuing to work on weak points won't itself lead to much gain. If you squat mostly with your quads and have a genetically weaker back, all you need to do is make sure the back is strong enough for your quads to use it as a launching pad for big squats. If you spend years working on your weak back so that you can transition into a normal squatting style that uses back a lot, you'll simply end up being an average "normal squatter" as your now stronger back will never be as strong as backs of the greats that squat in that style, and your quads won't get to contribute as much to the new style of squatting and "come to the rescue" of your back. Play to your strengths, so long as your weaknesses don't hold you back and don't fall for the illusion of "balance."

Another reason that a base of strengths needs to be built is that weaknesses need to be clear enough to be targeted and only distinct strengths can show that. If random variation is no longer improving your squat as quickly as you'd like, you might want to work on your limiting factors for that lift. But if you've been training everything evenly up until now, you might not even know what body parts or movements are even holding you back! Is it the glutes? The hams? The lower back? You know your quads might be the strong link but you're really not sure about that either. Only by developing your strengths can you properly expose your weaknesses so as to select them for targeted variation.

The long term pattern result for very advanced lifters is that alternate phases of working on advantages will be paired with phases of working

on weak points. A big point here is that a lifter not need ever stop working on his advantages lest he kill the goose that lays the golden eggs.

Another big implication of the use of variation is that it's probably not a good idea to do exactly the same variants as your training partners are doing once you are no longer a beginner. Once you know where your strengths and limiting factors lie, training should be designed to strategically alter those for your needs, which will necessarily be different in almost all cases from those of your training partners. This concept will be further explored in the chapter on individual differences to come.

3.) HOW MUCH VARIATION IS ENOUGH?

When variation in exercise selection is being applied, what are the rules for the minimal amount of difference between exercises? For example, if we move out one finger width between each mesocycle of training, is that really enough variation? Here are some guidelines, to be taken with a big grain of salt as they tend to be based much more on experience and informed reasoning rather than direct research.

The most important minimum recommendation in choosing exercise variants that present a sufficient level of variation in order to reduce adaptive resistance is to use variants that feel different. This is probably one of the most wishy-washy recommendations of the book, but it is grounded in some decent reasoning. Only when different neural circuits are engaged does an exercise feel different. Only when the muscles are engaged in different patterns or different muscles are engaged

altogether does an exercise feel different. Because it is precisely the different neural and muscular recruitment that we want, the “feel” of an exercise is an ecologically important datum.

To make a more particular recommendation and to make sure exercises do feel different and are thus presenting the needed neural and muscular variations, we can set some basic application guidelines:

- Bar position for squatting should be only in one of 3 basic categories. Front, high bar, and low bar squats are leveraged differently enough to offer a beneficial level of exercise variation. “Medium bar” squats or some other “in between” variants likely do not.
- Foot positions and grip widths should be at least one foot width or hand width apart. For example, if your competition bench is pinkies on the rings, pinkies one inch in from the rings is not a close grip bench. It’s unlikely to be different enough to offer either adaptive resistance effect or directed variation. So at a minimum, bench, squat and deadlift grips and stances should be around 3-4 inches apart from one another to be likely to have a beneficial effect on variation.

UNDER-APPLICATION OF VARIATION

1.) TRAINING WITH THE SAME INTENSITIES, SETS & REPS ALL YEAR ROUND

While exercise variation is perhaps the most effective form of variation, manipulation of sets, reps, and intensities can improve training outcomes. On the other hand, failing to sufficiently manipulate these variables can needlessly slow the improvement process.

Perhaps the most common and obvious violation of the principle of variation in this regard is in the design or implementation of programs that specifically restrict their set and rep ranges to one condition. One such example is the 5x5 program. Though there are many variants of this approach, with some being much more variable than others, some 5x5 programs are literally just that, five sets of five reps, all the time.

The problem with such a program is twofold. First is that it does not allow for directed variation in any ability that is outside of its prescribed set and rep range. While 5x5 is very well suited for building basic strength, it is poorly suited to both peaking and hypertrophy training, both of which are important at various times. The second problem with such static programs is that they don't accommodate progression and (in a glimpse of a later principle) individual variation. The same lifter might first get amazing results from doing 5 sets of 5 reps, but over the course of several mesocycles need more volume to progress as the fastest rates. On the other hand, 5x5 will be too much for some lifters and thus may result in rapid fatigue accumulation from the very start. A good powerlifting program will usually have a wide range of sets, reps and intensities based on the phase of training (and their different MRVs) and the goals of the lifter. One size does not fit all in most respects, powerlifting included.

2.) DOING THE COMPETITION MOVES ALL YEAR ROUND

There are two potentially problematic approaches with performing the competition lifts year-round; doing only the competition lifts or doing other lifts as well but never removing the competition lifts from the program for any meaningful length of time.

A.) DOING ONLY THE COMPETITION MOVES

According to some, Ed Coan himself only really used the competition lifts year round and just changed the sets and reps as the weights got heavier through the macrocycle coming up to a meet. According to Ed Coan himself, he never did this, and instead used close variants of the lifts (shoulder presses, high bar squats, deficit pulls, etc...) as the bulk of his training in the early part of the macrocycle, and would only transition to competition lifts as the meet neared. Well, there goes that one. But now there are rumors that Andrey Malanichev himself only trains with the competition movements and does nothing else, so it seems that this idea about training has some appeal, at least to the people that relay such stories as “see, I told you the best guys only do the competition lifts... you’ve gotta practice how you play.”

The proponents have a point. You do have to practice how you play, especially as the competition nears. Specificity is very important, more so than variation, in fact. But specificity is not a stand-alone principle that is a net positive no matter how excessively it is applied. By only doing the competition lifts year round, you miss out on the benefits of directed adaptation in a big way. If your triceps are holding you back on the bench but your shoulders and pecs have already been plenty beat up, insistence on a “comp lifts only” routine will leave you with no options of triceps development. By sticking only to the competition lifts and avoiding any specialty targeting moves, your ability to improve both weak and strong points in a purposeful manner declines greatly. You don’t get to be the best at basketball by just playing games and you don’t get to be the best at powerlifting by just doing the competition lifts.



An equally large problem with this approach is that adaptive resistance to the lifts is never reduced. After some time, productive stimulation of adaptive pathways becomes severely hindered and performance improvements decline in magnitude.

B.) NEVER REMOVING THE COMPETITION MOVES

While training using only competition lifts is often rumored, very few people actually do this. It turns out even the famed Bulgarians of Olympic lifting lore didn't just train with the competition lifts all the time. However, while few lifters never do anything but the competition lifts, many lifters never completely drop out the competition lifts. A lot of lifters will do close grip benches for triceps, front squats for quads, and rack pulls for the back, but will always do the competition lifts in addition to these specialty variants. Every mesocycle of training

may include new specialty moves, but it also includes the competition lifts. Some lifters will subtract assistance work as the meet nears and add it back in after the meet is over and when the next meet is still far off.

While this method of training is quite sound, it can be improved. By adding and subtracting assistance lifts, directed variation can be adequately high. However, the ability to reduce the adaptive resistance of the competition lifts is severely hampered. If the competition lifts are never removed, the systems responsible for improving them with training dull over time, and eventually progress from doing these lifts grinds to a very slow pace, if not completely, which is not the best for results.

An argument in defense of this approach is that specificity is important and that it's never a good idea to move away from the competition lifts for this reason. It's true that specificity is important, but it's much more important leading up to the meet than it is far away from it. And if specificity is not nearly as important far away from the meet, what exactly is the reason for keeping in competition lifts? All hypertrophy work can be done in a directed manner with special variants, and the plus side is that during this time the competition lifts can regain their sensitivity to adaptation for the time that they will be used again in the time closer to the meet. If we never stray away from the competition lifts, this adaptive resistance is never dealt with, and the benefit of such an approach is not clear.

OVER-APPLICATION OF VARIATION

Variation can be effective in both reducing adaptive resistance and in allowing for a directed targeting of needed areas of improvement. While most any exercise or set/rep range that is different from current training can accomplish the former, the latter is not as straightforward to achieve. Not just any variant can promote the best directed variation, so we have to choose wisely. Specifically, there are at least four distinct constraints on directed variation worthy of discussion:

- The use of non-specific variants
- The use of non-overloading variants
- The use of phase or goal-inappropriate variants
- The use of excessively frequent variation

Let's take a look at each one in more depth.

1.) NON-SPECIFIC VARIANTS

When choosing variants of exercises or set/rep schemes, it's important to choose variants that are specific enough to the sport of powerlifting to be worth using. For example, running is a fine variant for leg training, but its volume, load and repetition scheme is wildly inappropriate to the goals of powerlifting (build muscle, get stronger, peak, etc...). Doing exercises for sets of 20 to 30 reps suffers from similar limitations. Calf raises and biceps curls are of course possible to integrate into a good powerlifting program, but their overuse violates the specific needs of the sport and can quickly become underproductive or counterproductive. If

you continuously employ exercise variants that give you bigger arms and calves simply to have bigger arms and calves, this is unlikely to make you as good at powerlifting as the use of variants that best transfer to sport performance. It's a very small difference, but PRs on the platform can be very small as well, so it's worth considering even the nitty-gritty if maximal performance is the goal.

2.) NON-OVERLOADING VARIANTS

Because our variants need to make us at least bigger, stronger, ready to peak or something along those performance lines, they all need to be overloading enough to actually stimulate adaptations. Some exercises are simply not as overloading as others, and should be used sparingly if not at all as variants in powerlifting training. To quote elite powerlifter and famous Facebook troll Michael Zundeleovich, "how many band rear laterals do you have to do to bench 600lbs?" That's a very difficult question to answer, and perhaps the answer is that the benefit of this variant is so indirect and so small that no amount of ability or work in this move will be productive enough to be worth a major investment. Other, more specific and overloading lifts don't share such problem. With even mediocre triceps, if you can dumbbell flye the 100s for strict sets of 8 reps, you're going to bench a lot. If you can front squat 600lbs, you'll have 99 problems but your squat won't be one. These moves are so overloading that the adaptations they cause readily transfer to performance in the competitive lifts. How many leg extensions with how much weight do you have to do to squat more? What about reverse curls? One-arm cable pec flyes? With such non-overloading moves, strength and size gains may be tiny compared to their much more effective alternatives. So how many of those does it take? To quote the

wise Tootsie-Roll Owl, “the world may never know.” Just make sure you don’t overuse such low-overload moves yourself and avoid the largely pointless quest to try and find out!

3.) PHASE-INAPPROPRIATE VARIANTS

Each phase of powerlifting training has a specific goal. Some phases are designed mostly to build muscle, some to build general strength, and some to perfect the expression of that strength at maximal loads. Whatever the goal, the variants used have to match up with it.

If you’re using low bar squats to pack on quad size, chances are your back, glutes, and hams will tire out and reap the benefits well before your quads get their due diligence. If you’re using dumbbell flyes to get stronger, you’re going to mess your pecs up and possibly cause a muscle tear with sets of 5 in this isolation move long before you get any stronger. Lastly, if you’re using banded cambered bar squats in your peaking phase, that’s all well and good, but when the meet requires you to do competition squats instead, you’ll realize that you’ve been peaking for the wrong lift!

In general, it’s recommended to stick to more focused lifts that are conducive to high reps when hypertrophy is the goal, stick only to stable compound lifts and away from isolation moves during strength phases, and focus most of your energy on the actual competition moves during peaking training.

4.) TOO FREQUENT VARIATION

Variation that occurs at too rapid a frequency can become less than optimally productive because it can violate the Specificity sub-principle of Directed Adaptation, and in some cases the sub-principle of training modality compatibility. Directed adaptation describes that a similar stimulus must be presented in sequence for some time in order that the adaptations made be retained when the stimulus is altered later. For example, the triceps muscle tissue added with close grip benching has more of a chance of sticking around when regular benching is resumed if the close grip work was presented in a sequential manner concentrated over the several weeks of a dedicated mesocycle rather than sporadically throughout the training macrocycle.

Training modality compatibility describes the extent to which different methods of training interfere with one another. For example, the high volumes of hypertrophy training produce too much fatigue for meaningful peaking training to occur at the same time.

Two common violations of directed adaptation and training modality compatibility in powerlifting training include the overly rapid cycling of exercises and the overly rapid cycling of repetition and load ranges.

A.) TOO FAST OF EXERCISE ROTATION

When exercise selection is altered every training session, directed adaptation is violated and adaptations are not likely to be retained as well as they are with blocked training phases of distinct exercise selection. The Westside method is probably the best example of this slight error in programming, as it advocates rotating exercises completely usually within the span of just a week. Westside programming

thus developed a reputation for allowing its lifters to PR often in a seemingly endless number of variants, but such PRs sometimes failed to translate to steady strength gains as much as those of other, more monotonous programs.

B.) TOO FAST OF REP RANGE ROTATION

There are two kinds of daily undulating periodization (DUP) training styles, both employing a variation in repetitions performed within each training week. The first kind of DUP varies the load and repetitions slightly, keeping them in the same range of physiological effect. Some DUP programs will do sets of 6 one day, sets of 4 another day, and sets of 2 another day within the same weeks. Because all of those repetition ranges are close to or within the “general strength” range, they are actually an effective way to provide variation and manage fatigue at the same time. A well designed powerlifting program is likely to have some variation in rep range within the week and technically be a form of DUP.

The second, more extreme type of DUP is characterized by variations in rep range and volume that span multiple physiological ranges. Some forms of DUP will do sets of 12 for hypertrophy, sets of 6 for strength and sets of 2 for peaking all in the same week. The first problem with this approach is that directed adaptation is violated. It’s difficult to make meaningful strength improvements to the nervous system when it’s concurrently being re-trained for repetitive rather than maximal exertions on a weekly basis, for example. The second problem with this extreme form of DUP is that of adaptive interference of multiple physiological abilities with one another, violating the specificity sub-principle of training modality compatibility. When training the three different powerlifting sub-goals of size, strength and peaking in the same week, some problems may arise:

Hypertrophy vs. Strength

- Hypertrophy training benefits from high weekly volumes, so strength training will lower the volumes needed for best hypertrophy
- Strength training requires lower fatigue levels, the very same fatigue levels that are raised by hypertrophy training
- Hypertrophy training tailors the nervous system for repetitive, submaximal exertions, strength training needs forceful and low-endurance exertion characteristics

Hypertrophy vs. Peaking

- Hypertrophy needs high volumes, peaking creates the lowest volumes
- Peaking needs the lowest fatigue levels, hypertrophy creates the highest fatigue levels
- Peaking needs conversions to fast-twitch fibers, hypertrophy training converts to slow twitch fibers
- Peaking needs explosive neural characteristics, hypertrophy promotes submaximal repetitive neural characteristics

Strength vs. Peaking

- Peaking needs lower fatigue levels than the ones caused as a side effect of strength training

In the above ways, the best environment for any particular goal is sullied by an inclusion of a radically different form of training. The end result is

a good overall training effect, but a limited amount of progress in any of the particular abilities, leaving a good deal of total progress to be desired. DUP is a great way to train, but taking it to the extremes of rep ranges and physiological effects may be unwarranted and perhaps less than fully productive.

SUMMARY

Variation is an important principle in powerlifting training for two main reasons. First of all, variation lowers adaptive resistance, keeping our training methods continuously refreshed and effective. Secondly, directed variation allows us to target needed areas for improvement to our capabilities by emphasizing certain muscle groups and movements that could benefit from focused development. With the tools of properly executed variation, training will not be revolutionized. But, it will go a heck of a lot smoother and plateaus in performance as well as nagging injuries are likely to become less common.

Key Points

- Variation is a break in linearity of the training process. Stimuli which are repeated for long periods of time tend to become ineffective at causing the best rates of gain. Variation of variables such as volume, intensity, exercise selection, and other factors can help maintain adaptive sensitivity and prevent staleness
- By periodically varying the training stimulus, the athlete is simultaneously managing fatigue by allowing certain muscle fibers to recover and adapt while also presenting an overload stimulus through the use of novelty

- Variation works very closely with directed adaptation. Training cannot be spontaneous and random for best results; rather training should be focused for periods of time and subtly varied between training phases while still within the constraints of specificity

SOURCES & FURTHER READING

Variation Defined

- Periodization 5th Edition Theory and Methodology of Training
- Principles and Practice of Resistance Training
- Training principles: evaluation of modes and methods of resistance training – a coaching perspective

Manipulation of Training Variables

- Designing Resistance Training Programs
- Periodization: Effects Of Manipulating Volume And Intensity. Part 1
- Periodization: Effects of Manipulating Volume and Intensity. Part 2
- Effects of Single vs. Multiple Sets of Weight Training: Impact of Volume, Intensity, and Variation

PHASE POTENTIATION

SCIENTIFIC DEFINITION

Phase Potentiation is an advanced training principle which in common terms can be defined as the logical sequencing of training phases to promote the best overall long-term outcomes. The more detailed definition requires us to investigate the physiological realities that underpin Phase Potentiation and also require us to define a needed sub-principle; Adaptive Decay.

PHASE POTENTIATION

The first step in understanding the logic of phase potentiation is the realization that a certain type of training phase now can improve the gains from a different type of training later. That is, training to accomplish some capability can improve the results of training for a different capability later. Thus, the phase of training for the first capability can be said to “potentiate” (or improve) the results of the second capability.

There are many examples of abilities that enhance each other and can benefit from a phase-potentiated training structure. If your goal is to be able to do a crossover and then a layup in basketball, learning how

to dribble and shoot beforehand will greatly potentiate your success vs. learning to dribble and shoot after learning to crossover into a layup. Building a base of aerobic fitness with longer duration running or cycling can improve output and recovery abilities so that hard interval training can be much more productive. You could say that the aerobic base phase gets the endurance athlete “in shape to actually train hard.” In an example much closer to home, having lots of muscle around to make strong with neural and tissue alignment adaptations lets you get strong a lot easier and makes strength training more productive.

All of these examples of the derivation of a phasic structure rely on 3 fundamental assumptions: Specificity, Sequence and Adaptive Decay. Let's take a look at each condition.

A.) SPECIFICITY

The principle of specificity tells us that how we train had better reflect what it is we're trying to achieve. More specifically to phase potentiation, the sub-principles of directed adaptation and training modality compatibility tell us that we can't train with the most productivity for everything at the same time. Directed Adaptation states that in order to get stronger, we need to train for strength for weeks on end without switching goals to peaking or size in between. Training Modality Compatibility tells us that if we were to train everything at once, some of the methods would interfere with each other substantially and the whole training process would be negatively affected (see previous discussion of the too-frequent use of variation for details).

Thus the conclusion from the principle of specificity is that at least in some regard, our training must be composed of distinct phases with

distinct goals that don't interfere with each other but must in fact complement each other. This doesn't have to mean that a pure rigidity must be employed. If you do sets of 6 and 10 in the same workout, the world does not come to an end. But if you do every single rep range with every single goal, you might be missing out on some potential benefits of both specificity/variation and phase potentiation.

B.) SEQUENCE

From point a.), we can justify the use of dedicated phases. But how do we order the phases? Just do any one phase, then another, then another? It can be done like that, but not for best results. Order matters for two reasons. Firstly, because which phase precedes another determines whether or not potentiation will occur, and secondly because the nature of the final phase is usually fixed, which means not all combinations are logical. The skyscraper analogy works very well to illustrate both reasons.

If your goal is to build the biggest possible skyscraper to house the most workers and to support a TV antenna as well, what do you do? You've got the base, the main floors, and the spire/TV antenna. First of all, you know that a strong and wide base is actually one of the biggest factors in eventual building height. Some of the world's tallest buildings have more than 10 underground floors... how interesting that digging down is the first step to building up? Not so much unlike the temporary decrease in 1RM during a hypertrophy phase! You have the base down, and now you can build up for the first time and take the main floors as high as they can go. If you skipped the base, your main floors would never reach as high. If you just propped the spire onto the base, you couldn't make it high enough without its tiny diameter making it unstable at quite a

short height. There is also the reason of final-phase fixing involved in our decision about the spire. TV antennas only work best if they are put up as high as possible. Even if your antenna was made of advanced nanomaterials and could somehow hold up the main floors, it would only serve half of its purpose... contributing to height but not TV signal projection. Thus, the main floors are the only logical choice to lay down second. Lastly, the only remaining choice by simply being the only thing left to install is the spire with TV antenna. And just like that, we've not only built the highest building possible but have developed a phase-potentiated sequence which we can use to build other tall buildings later!

In powerlifting, we have one goal: biggest 1RMs possible and 3 methods; training for size, training for strength, and training to peak. Just like with the skyscraper, our peaking phase is by definition going to be last because we have to be peaked to lift! Now all we have to decide is whether or not to put the strength phase or the size phase first. While strength training can take existing size and make it stronger (get the most force production out of a given unit of muscle), size training actually reverses the neural and tissue alignment adaptations of strength training to some degree. Because we much prefer peaking a strong physique than an equally big but more repetition-suited one, our strength phase must come before the peaking phase and thus our size phase must be first. Thus we have the first formal mention of a phase-potentiated structure in powerlifting; build the size, make it stronger, peak for performance.

C.) ADAPTIVE DECAY

We know two things so far. First of all, we need phases because we can't train everything at the same time for best results. Second, we know that the phases cannot be random in their sequencing and work best if ordered in a particular, phase-potentiated manner. The final assumption we must make (and of course make sure it's correct) is that of adaptive decay. Since we rely on the adaptations of previous phases to hang around and boost performance in current phases, we have to make sure those adaptations... actually hang around! For example, if we build a base for our skyscraper and then an investment crisis halts construction, can we just resume construction again



when we have money? After 5 or 10 years, sure. But after 20 years, the base may have cracked in various places or otherwise be in disrepair... building main floors on it is no longer as straightforward. After 70 years, the entire base may have moved or tilted or cracked to the point of being completely useless, and we must now go through the process of re-building it entirely! In just the same way, if we build muscle to support strength development but start to lose that muscle halfway through the strength phase, we can run into serious problems of declining strength and now our whole phase-potentiated structure crumbles! It looks like we'll have to dedicate a whole separate in-depth discussion to the sub-principle of adaptive decay to make sure we don't commit this type of error of ignorance.

Adaptive Decay: "If you don't use it, you lose it" is perhaps the most straightforward and simple definition of the sub-principle of Adaptive Decay. In sport science, this principle has two features:

- 1.) How long it takes to lose adaptive characteristics with no training.
- 2.) How long it takes to lose adaptive characteristics with different (various forms) of training.

The first feature describes how fast you'd lose muscle, strength, or a peak without training at all. Interesting from an exercise science perspective, but not of much use to us in this discussion since nobody is planning on quitting training altogether as a method of improvement!

The second feature is right up our phase-potential alley. If we are to do only strength training, how much of our size can we keep and for how

long? If we hold a peak, can we keep size and strength long enough to benefit from phase-potentiated structure? Luckily, there are pretty good answers to these questions, which we'll address in the discussion of this principle as it applies to powerlifting.

POWERLIFTING DEFINITION

The literature on adaptive decay outlines several interesting patterns:

- a.) Muscle size can be conserved indefinitely with only strength and no hypertrophy training.
- b.) Peaking training can conserve muscle size for between 1 and 3 months until declines begin to affect strength and thus peak performance. Closer to one month for beginners and closer to 3 months for advanced lifters.

Several related notes from other chapters can help us pin together an applicable phase-potentiated structure for powerlifting:

- c.) From variation, we have seen that hypertrophy phases longer than about 3-6 months can benefit from the lower, resensitizing volumes of a strength phase.
- d.) Within 3-6 months, most neural and tissue alignment adaptations of strength training have been made, and progress without a return to hypertrophy phase is needlessly slow, unless it's time for a demonstration of gains with a peaking phase.
- e.) Switching phases more often than every 3 weeks or so violates directed adaptation and does not allow each phase to yield its best results nor allow those results to be conserved into the later phases.

Based on the observations from the previous sections and the above observations on adaptive decay, we have an emergent structure for phase-potentiated powerlifting training:

Hypertrophy Phase: 3 weeks to 6 months long

Strength Phase: 3 weeks to 6 months long

Peaking Phase: 3 weeks to 3 months long.

The above timelines imply 3 possible ends on a spectrum of competition frequency. Some lifters will be able to compete as often as every 9 weeks without really sacrificing any phase-potentiated gains (outside of the occasional active rest that might space some meets out further). Still other lifters may benefit best by putting together 6 months of hypertrophy, 6 months of strength training, and 3 months of peaking training and only compete every year and a half. A third group of lifters might forego competition for longer and focus on moving up or down in weightclass or making some serious gains in ability before competing again. This group might string together hypertrophy phases with strength phases, and thus build muscle and then make it stronger for several 6 week to one-year macrocycles depending on the conditions. Peaking for powerlifting is only a good idea if you've got something to show for it... if you aren't ready to compete after just one hypertrophy-strength sequence, there is nothing wrong at all with repeating that paradigm once, twice, or as many times as you choose.

One final note is that the phases can be extended in length and perhaps even productivity if they are not completely unitary in their training method. A small amount of basic strength work during especially the tail end of a hypertrophy phase can make the next strength phase

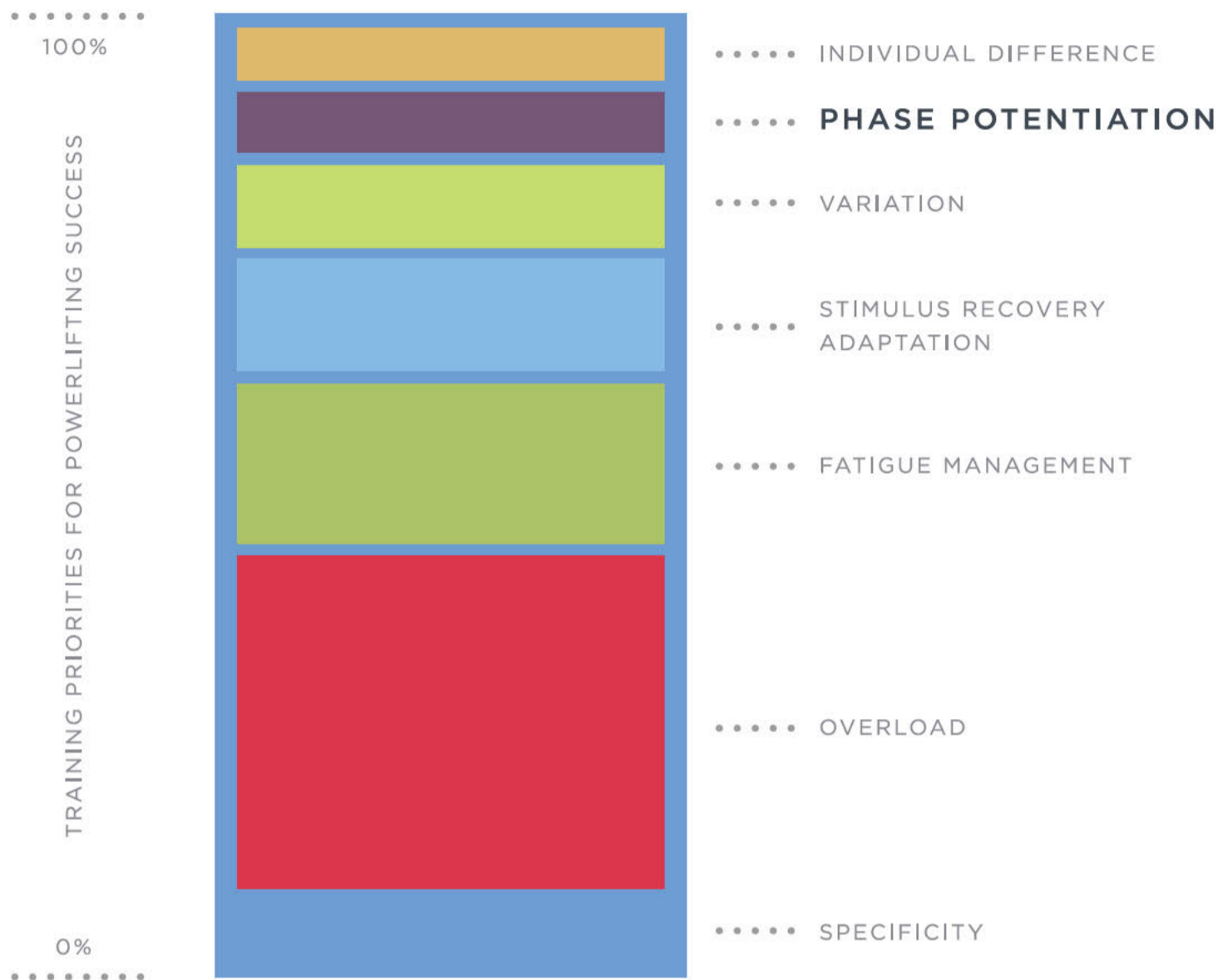
transition go more smoothly. A small amount of extra volume during a strength phase may allow for a bit more muscle growth without taxing strength developments too much. A small amount of extra strength work especially at the beginning of a peaking phase can allow the peaking phase to be longer, which for advanced, fatigue-prone athletes with longer SRA curves and lower training frequencies may be just the thing needed to make the peaking phase long enough to work up to the heaviest weights required in a safe and progressive manner. That being said, the focus of each phase must still be on the goals of that phase. If you're doing more than 30% of non-phasic work and less than 70% of phase-specific work at any one time, you are not likely to benefit maximally from phase potentiation.

PRINCIPLE IMPORTANCE RANK

Every single author of this book is wildly passionate about phase potentiation. Drs. Israetel and Hoffmann both spent 3 years getting PhDs in the field and spent months in quiet labs solely studying phase potentiation. Chad Wesley Smith has been gathering texts and speaking directly to scientists, authors, coaches and athletes about phase potentiation for the majority of his strength career. But passion is not objectivity, and the facts must be plainly stated; phase potentiation is the second-least important principle of training described in this book. How much of an advantage does phase potentiation really net? Probably on the order of several percent. While the European literature on phase potentiation (as applied in block periodization) is voluminous, the American studies looking into it are few. In all studies no matter their source, the net effect of phase potentiation is small. Why? Because

training hard and heavy gets you very strong and very big. Add volume to get bigger, take it away to get stronger, and do the right thing to peak and you're well on your way to a superbly effective program. If you really screw up phase potentiation, you might not do as well as possible in powerlifting. But if Ed Coan in his prime walks into a meet right during a hypertrophy phase, he's still going to beat everyone by a long shot, phasing be damned. But can we really say the same for the earlier principles?

If Ed violated overload and trained light all the time, would he still be so dominant? No way. What about no fatigue management? Uh uh. What if he never went over to powerlifting and did bodybuilding for good just like when he started, would he still be "the Ed Coan?" Unlikely. Phase potentiation may be much more important for team sports and highly technical sports, but not as much for powerlifting. Phase potentiation is important because it can help make training run smoothly and more optimally. It matters plenty for especially advanced lifters who now count their gains in single digit percentages per year, but it's just not the most important thing for beginners to either know or apply.



IMPLICATIONS & EXAMPLES OF PROPER APPLICATION OF PHASE POTENTIATION

1.) PHASE GUIDELINES

While we can use “phase” as a general term, more often in this discussion and hereafter we will be using the term “block” or “training block” to reflect the standard use of “block” in modern periodization literature as a sequence of several mesocycles designed to prioritize one goal, such as hypertrophy, strength or power. It’s the blocks that are sequenced to phase-potentiate each other.

The following list will illustrate each phase and the following relevant information regarding the training recommended during that phase:

- adaptation goals
- preservation goals
- primary modalities
- sets/reps/intensities
- durations(very rough average, as more detailed discussion on phase length variation will be addressed in the individual differences chapter)

Hypertrophy/Work Capacity Block

- Adaptation Goals: gain muscle size and build work capacity for later strength training
- Preservation Goals: do not let fiber type and neural characteristics drift too far away from strength performance. This means that sets far over 10 reps may not be recommended
- Primary Modalities: variations of the compound movements with limited isolation work, overload training sessions being presented often, between 2 and 6 times per week, per muscle group in most cases. Focus should be on the muscles the lifter needs to get bigger, like pecs for the bench, for example
- Sets/Reps/Intensities: 15-30 overloading sets per muscle group per week for most lifters, reps of 6-10, average intensity between 60 and 75% 1RM
- Durations: 3 weeks to 6 months long, but usually around 2-3 months for most intermediate lifters

Basic Strength Block

- Adaptation Goals: gain general muscle strength
- Preservation Goals: maintain muscle size
- Primary Modalities: variations of the compound movements with limited isolation work or none at all, overload training sessions being presented between 2 and 4 times per week, per muscle group in most cases. Focus should be on the movements the lifter needs to get stronger, like stiff legged deadlifts for posterior chain strength, for example
- Sets/Reps/Intensities: 10-20 overloading sets per muscle group per week for most lifters, reps of 3-6, average intensity between 75% and 90% 1RM
- Durations: 3 weeks to 6 months long, but usually between 3 and 4 months for most intermediate lifters

Peaking Block

- Adaptation Goals: sharpen technical and neural abilities to execute limit (1RM) loads
- Preservation Goals: maintain muscle size and basic strength
- Primary Modalities: mostly the competition lifts themselves with little additional compound variations, overload training sessions being presented between 1 and 3 times per week, per muscle group, in most cases with high possibility of additional light sessions. Focus should be on mastering the execution of the competition lifts at high loads
- Sets/Reps/Intensities: 5-10 overloading sets per muscle group per week for most lifters, reps of 1-3, average intensity around 75%, but almost always split between light sessions of 50% 1RM and overload sessions between 85% and 95% 1RM

- Durations: 3 weeks to 3 months long, but usually between 1 and 2 months for most intermediate lifters

Details on active rest phase requirements will be presented in the chapter on the big picture periodization of powerlifting.

2.) CONSERVING PROGRESS BETWEEN PHASES

Preserving established gains is much easier than making new ones. This is a fundamental reality that allows the very concept of phase potentiation to occur. If the lower, easier volumes of strength training did not at least maintain gains in muscle, both hypertrophy and strength would have to be trained simultaneously for any long term adaptations to meaningfully sum up. However, while less work is required to retain adaptations, especially adaptively-resistant areas (trouble areas or hard-gaining areas) are going to require more work than usual, even to maintain. Thus, the choosing over appropriate transitional exercises and volumes may help.

For example, if your quads have been a weak point with squats, you may choose to add leg press and front squat volume during your hypertrophy block to increase their size. Once you transition into the strength block, just going back to standard training may not be sufficiently stimulative to retain the new quad size and strengthen it. A better option may be to add a bit more front squat or high bar squat volume than usual in order that the quads continue to get stimulated enough to retain their size. In the peaking block, keeping in just a bit more high bar squatting may just be the trick to get the most adaptive conservation and thus performance that was first added during the hypertrophy block.

An example with the bench press can further illustrate this idea. If you want to bring up your triceps, skull crushers may be an excellent tool in the hypertrophy block. However, if you simply switch next to more of a chest emphasis through the first mesocycle of the strength phase by employing more wide grip and incline work, that stimulus may not be enough to conserve the newly minted triceps size. Instead, focusing on more general pressing without any bias away from the triceps or even better, focusing a bit more on close grip moves, may ease the transition and retain more adaptations.

Once a whole macrocycle of relative focus on a weak or needy muscle group or movement pattern has been completed, the adaptations made are much more resistant to decay than when they were new, and less attention can be paid to them without their regression.

3.) TAPERING & PEAKING FOR COMPETITION

At the end of every peaking phase is a taper. The goals of a taper are very straightforward:

- Maintain Fitness (muscle mass, strength, and ability to execute 1RM loads with good technique)
- Drop Fatigue

The result of dropping fatigue as much as possible while keeping fitness as high as possible can be re-stated as the maximization of preparedness, since preparedness is defined literally as the sum of fitness and fatigue. The ideal peaking phase would have fitness infinitely high and fatigue at zero, but in the real world, the higher the fitness, the lower the fatigue and thus the higher the preparedness, the better.

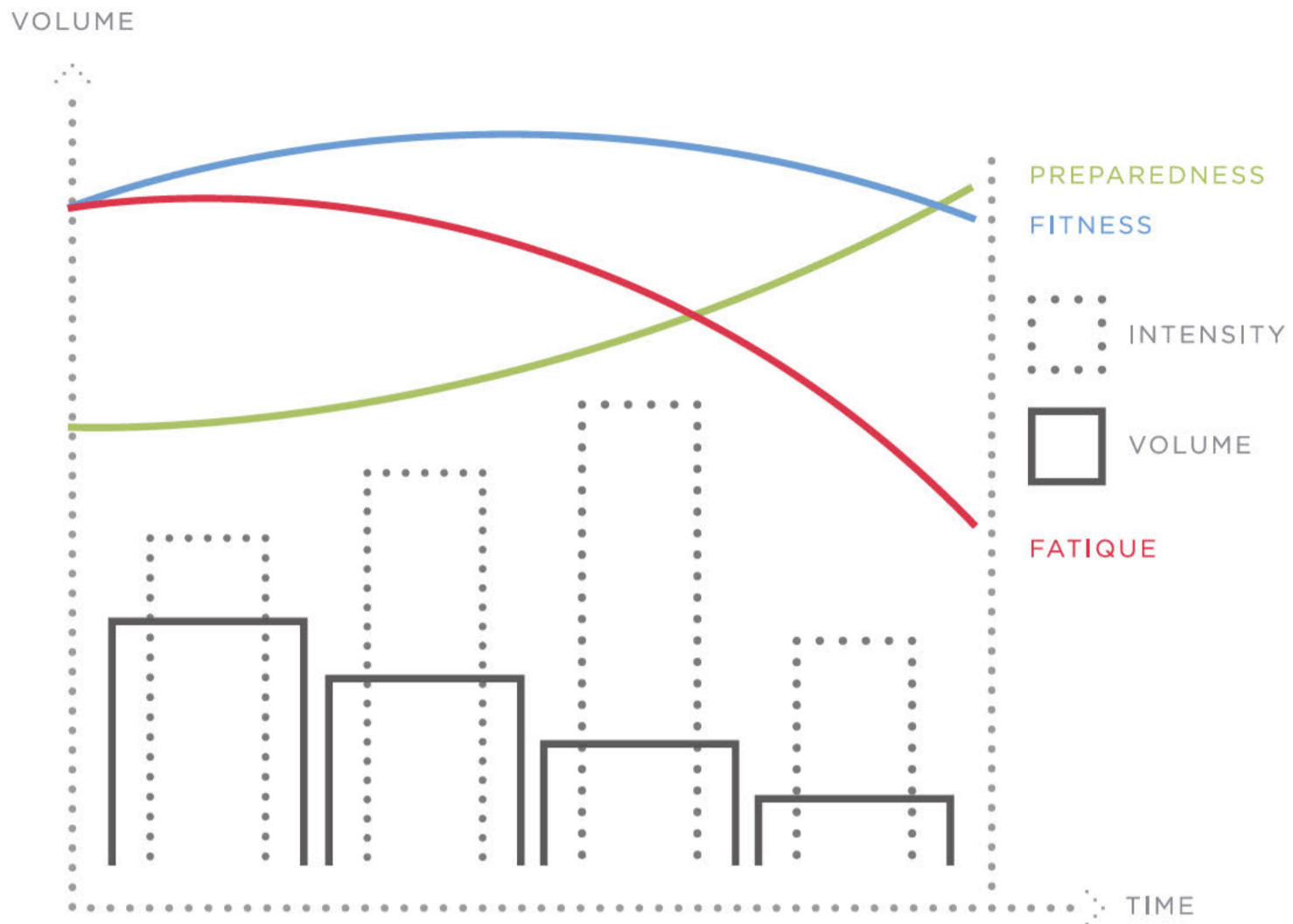


Figure 25: Preparedness

In general sport tapering, volume is the biggest contributor to fatigue and intensity is the biggest contributor to retaining fitness, so that a standard taper usually involves lowering volumes and maintaining intensities as a competition approaches. But since higher intensities do contribute to fatigue and powerlifting is by definition the highest possible intensity sport, we'll also have to bring down intensity at some later point if we're going to design a proper taper.

An additional concern especially with more advanced lifters is the use of functional overreaching. Concentrated loads beyond MRV of very high intensities can depress and then elevate nervous system force



production SRA curves so that they are peaked at or close to the time of competition. Thus, an intentional overreach within several weeks of the meet can set this process in motion and yield a net benefit.

Bringing all of these factors together, we can begin to visualize a three-part sequence for the tapering process:

- Part 1: Normal volume training with classic peaking recommendations OR Functional Overreaching volume with classical peaking recommendation. Functional overreaching volumes can range between 1.5 and 2x normal peaking volumes.
- Part 2: Reduced volume but maintained or even elevated intensity training. Volume can be reduced to between 90% and 50% of normal peaking training.
- Part 3: Reduced volume and intensity phase, averaging 50% volume and 50% intensity of the normal peaking phase.

An extra series of rest days may be taken after part 3, and then, the meet!

There is quite a bit of variation within those guidelines mostly because of the three major contributors to differences in peaking structure:

- 1) Lifter Size
- 2) Lifter Strength
- 3) Lifter Experience

LIFTER SIZE

Lifters with larger muscles and connective tissues tend to be able to do more homeostatic damage during training, and thus require concomitantly longer to taper. Muscle soreness in larger muscles almost always lasts longer and is more profound than soreness in smaller muscles. Lifters who are prone to add size to high extents also tend to be more fast twitch in muscle composition. Faster twitch muscles usually have longer recovery curves than slower twitch muscles, mostly because they can generate more force and take more damage, but also because they are not as well vascularized as slower twitch fibers and thus don't receive nourishing bloodflow as quickly to match slower twitch healing rates.

LIFTER STRENGTH

Stronger lifters tend to have a faster-twitch muscular composition, so all of the slow fatigue dissipation tendencies of faster twitch muscles apply. But even obviating for size and fiber type, stronger lifters can exert more force and thus disrupt homeostasis more profoundly and for longer. An 800lb double in the deadlift may take days longer to recover from than a 400lb double, even if the relative intensity is the same (the lifters have maxes of 900 and 450, respectively). At some point, absolute

intensity is not completely surmountable by adaptations, and stronger lifters just have to be able to program around this. You can't just scale up a program or a taper based on percentages. If Andy Bolton hit a 900+ deadlift the week of the competition (like many weaker lifters do with their 90% pulls just fine), he'd barely be able to get 850 off of the ground, never mind 1000.

LIFTER EXPERIENCE

The more experienced a lifter is, the closer to his/her adaptive limits they are. Approaching adaptive limits carries both a negative and positive implication. Negative because the body's ability to recover homeostasis after disruption is slower. The muscles and nervous system have grown so advanced and able to present such massive stimuli that the other systems (digestive, immune, etc...) will have a tougher and tougher time aiding in recovery. This creates the need for longer tapers.

On the positive side, highly trained systems close to their peak tend to have a high degree of decay resistance. This means that they don't lose much or any capability with even very small levels of stimulation. If you've benched over and around 405 19 times in competition, it's going to take a lot for you to fall very far off that mark. Thus, even though high lifter experience necessitates longer tapers, these lifters can easily tolerate such increased taper lengths due to their high level of decay resistance.

SELECTING TAPERS

We can spread the recommendations for peaking protocols into 3 general categories of lifter type, and readers can further tailor their own peaking programs based on which category they find themselves closer

to or combinations of category they find themselves between. Genetic and other differences of course make this only a rough guide.

Category 1: Lifters under 165lbs, totaling class 2 or under for their weight, and/or those who have been training for less than 3 years.

Category 2: Lifters between 165lbs and 220lbs, totaling class 1 or better for their weight, and/or those who have been lifting for 3-6 years.

Category 3: Lifters weighing more than 220lbs, totaling elite or pro (aka “International Elite”) for their weight, and/or those who have been lifting for more than 6 years.

Which category can you place yourself in? Use the following guide as a rough start:

FINDING TAPERING CATEGORY

	BODYWEIGHT	TOTAL	EXPERIENCE	
1	Under 165	Class 2 or lower	Under 3 years	1 POINT EACH
2	165-220	Class 1 or Master	3-6 years	2 POINTS EACH
3	Over 220	Elite or Pro	Over 6 years	3 POINTS EACH

Once you’ve assigned yourself points from each of the factors above, sum the point totals to find your tapering category:

Category Classification

- 3-4 points: Category 1
- 5-7 points: Category 2
- 8-9 points: Category 3

Once you find your recommended category, see the instructions on taper duration below. Before that, a review of taper parts

Part 1: Normal volume training with classic peaking recommendations OR Functional Overreaching volume with classical peaking recommendation. Functional overreaching volumes can range between 1.5 and 2x normal peaking volumes.

Part 2: Reduced volume but maintained or even elevated intensity training. Volume can be reduced to between 90% and 50% of normal peaking training.

Part 3: Reduced volume and intensity phase, averaging 50% volume and 50% intensity of the normal peaking phase.

Typical taper guidelines for each category:

Category 1

- Total Taper Duration: 1 week
- Duration of Part 1: 0-3 days
- Duration of Part 2: 1-4 days
- Duration of Part 3: 0-3 days

Category 2

- Total Taper Duration: 2 weeks
- Duration of Part 1: 4-5 days
- Duration of Part 2: 4-5 days
- Duration of Part 3: 4-5 days

Category 3

- Total Taper Duration: 3 weeks
- Duration of Part 1: 1 week
- Duration of Part 2: 1 week
- Duration of Part 3: 1 week

An example on using the above. If you're a lifter of 2 years' experience, compete in the 198 weightclass and total masters class poundages (1436-1558 in USPA, for example), then you accumulate 5 total category points, which lands you in the "Category 2" taper recommendations. That mean you're going to take about two weeks total to taper and split your time evenly in those weeks between normal training/overreaching, reduced volume training, and reduced volume/intensity training per the percentage 1RM recommendations listed in the "taper parts" discussion above. Boom! Try this out on your own numbers and see if it adds up to a reasonable starting recommendation.

UNDER-APPLICATION OF PHASE POTENTIATION

1.) EXCESSIVE HYPERTROPHY BLOCK LENGTH

Training for hypertrophy is an absolutely great way to enhance powerlifting performance. Especially in beginners and intermediates, hypertrophy training adds so much muscle size that strength levels and thus powerlifting performances skyrocket. Even in advanced lifters, a certain loss of size during the longer peaking phases needs hypertrophy training to re-establish lost muscle, and even advanced lifters towards the top ends of their weightclasses can benefit from intelligently directed hypertrophy of certain muscle groups.

But as the principle of variation implies, like all methods, hypertrophy training is not as effective if trained all the time or for too long at a time. When subjected to chronic high volumes (as during hypertrophy training), the very molecular regulators of muscle growth tend to desensitize and thwart much further growth, even with the inclusion of proper fatigue management. Practically this means that once every several months, low volume training must be employed for at least a mesocycle in order to re-sensitize the molecular regulatory systems to further hypertrophic potential. Even under the best circumstances, it is unlikely that training with high volumes steadily for more than 6 months or so continues to elicit the same growth stimuli as shorter bouts of hypertrophy training. This physiological reality likely limits the maximal duration of a hypertrophy phase at the top end and creates the first underpinnings of phase-potentiated structure.

From the cumulative coaching and educational experience of the authors, the tentative advice is that most lifters will be constrained to

poor hypertrophy results much sooner than 6 months into continual hypertrophy training. 3 months or so is our recommended timepoint on average for the consideration of inserting at least a short (month-long or so) mesocycle of lower volume training, if not moving on altogether into the strength block.

2.) EXCESSIVE STRENGTH BLOCK LENGTH

Excessively long phases of exclusively general strength training are also problematic. Though generally effective, very long strength phases can be enhanced if limited to no longer than 6 months of exclusive strength training, and perhaps closer to 3 months for most lifters. The big issue with prolonged strength phases is that they are, like hypertrophy phases, inherently self-limiting. Strength increases to the same amount of musculature rely entirely on neural (force production and technical) and muscle architectural changes. While these are powerful mediators of strength, within several months they have pretty much run their course and further improvements come at a snail's pace, if at all. Once several months of strength training is performed on a muscle mass that is not increasing, neural and architectural changes are mostly maximized, and thus further increases in strength are minor or non-existent.

At this point, there are two options; run another hypertrophy phase to build more muscle to strengthen (or to improve work capacity) or peak for meet performance and re-start an entire macrocycle. Stories about people gaining strength for long periods of time without doing anything but general strength training usually turn out to include gains in weight and muscle, which is another way of saying that hypertrophy occurred. If you're going to grow muscle, you might as well do it maximally and

with your best efforts in a dedicated hypertrophy phase, rather than by hypercaloric accident during a prolonged strength phase. Efficient use of career time notwithstanding, the dedicated hypertrophy approach will at the very least keep you leaner by only allowing hypercaloric dieting during high volume training.

3.) EXCESSIVE PEAKING BLOCK LENGTH

Because peaking phases require such low volumes of training, they present an insufficient stimulus for indefinite muscle retention. Peaking for longer than 3 months may begin to risk muscle and thus strength, and most lifters should err on the side of 2 months maximum.

Additionally, there is questionable value as to the purpose of peaking even if muscle loss was hypothetically not a concern. Training in heavy sets of 1-3 reps does not provide even the volume needed for strength enhancement, especially for intermediate and advanced lifters. After only weeks of maximal lifting, technical adaptations to such exertions have likely run their course, which begs the question of why continuing to peak is remotely a good idea. After 2-3 months of peaking, even if muscle loss wasn't a concern, you'd have to have a very good reason to miss out on the possible size benefits of a hypertrophy phase or the strength benefits of a strength phase. Oh and in the real world for almost all lifters, muscle loss is a concern on a peaking phase!

OVER-APPLICATION OF PHASE POTENTIATION

1.) TRAINING ALL ABILITIES IN EACH SESSION

It's a very good thing that certain adaptations like size and strength can hang around when they are not being trained specifically. If that were not the case, we might try to train all three main powerlifting systems (size, strength, peaking) within the same workout. It's a very good thing that abilities hold because such a feat would be incredibly difficult to pull off, if not entirely impossible.

First of all, such training would require an impressive amount of work. Just doing a single set of heavy weight is not enough to learn peaking technique, just two sets of 5 at 85% is not enough for strength and just 3 sets of 10 is not enough for size in most cases. Each ability needs enough volume within its own specific weight/intensity ranges to meet overload and meaningfully adapt. Thus, a typical session would be 3 sets of 3 at 90%, 5x5 at 80% and 4x10 at 65%... for one muscle group/lift. Sounds like fun if doing everything all at once is your idea of fun, but after 3 hours, it might prove to be unsustainable from a fatigue management perspective.

Let's say that such sessions are in fact doable. After all, dedicated hypertrophy-only training comes close to those volumes if not intensities. The next problem we run into is that of adaptive interference via directed adaptation and training modality compatibility. The very technical and neural force production abilities trained in that day's peaking and strength sets are reversed in the later hypertrophy training! So then why do the first peaking and strength training on that same day at all if the hypertrophy training will reverse some of those adaptations literally within the next hour?



Ok, so we might come to the conclusion that within-session concurrent training is problematic enough to be avoided. How about we dedicate a whole workout in each week or several times per week to each ability? While this is definitely a better option, we still run into some of the same problems, addressed in the next section.

2.) TRAINING ALL ABILITIES IN EACH WEEK

In our earlier discussion of DUP in the chapter on variation, we outlined some of the limitations of such an approach. Directed Adaptation is violated by the daily switches in priority. The adaptations of one workout can largely decay by the time the next workout of its kind is performed again. As well, Training Modality Compatibility implies that alterations made to physiology in some workouts (peaking, strength) may be largely replaced with opposing alterations of later workouts (hypertrophy).

Additionally, fatigue management problems can be an important part of training modality compatibility concerns. Doing heavy triples within days of high volume hypertrophy work may be so difficult as to be unlikely to provide an overload.

If the “extreme DUP” of training all abilities within the same week is not the best approach, perhaps training them in a more dedicated fashion for just several weeks at a time is more effective?

3.) ALTERING PHASES EVERY SEVERAL WEEKS

When training blocks of the major abilities are only several weeks long each, not enough time may be given for the individual adaptations to run their full course. Meaningful gains in muscle take weeks to accomplish, and meaningful alterations to neural function and technique at high loads take at least that long. Needless switching in too short a time when gains in these abilities are being well made from no changes to the focus are hard to justify. Why stop growing muscle if muscle growth is still going strong? Why switch to peaking so soon that most strength gains are simply cut off? Changing phases too quickly (less than about three weeks at least for each phase) may be effective, but needlessly complicates the training process by introducing phasic variation too often than is maximally beneficial.

SUMMARY

Behind all the technical jargon, phase potentiation is quite simple to understand. Powerlifting requires 3 types of improvements: increases

in muscle size, in general strength, and in the ability to handle maximal loads. We can't train each one of these at the same time because they interfere with each other, so have to train them in different phases. Luckily, adaptations made in some of these phases hold robustly through other phases in which they are not being trained, so the phasic approach is not negated by fitness decay. Lastly, some of the phases are enhanced if preceded by some others. Muscle mass makes strength training more productive and a strength base makes peaking much more straightforward. Because of these physiological realities and some others, the emergent structure of phase potentiation is revealed as:

- Put on muscle over several months
- Make the new muscle stronger over several months
- Take a month or two to peak for powerlifting performance, and repeat!

So long as that basic framework is followed, phase potentiation can be effectively employed to enhance powerlifting performance in the long term.

Key Points

- Phase potentiation is the systematic sequencing of training phases that result in the summation of fitness characteristics and abilities for optimal performance at pre-determined time points
- For powerlifting the general model of phase potentiation will be to grow the muscle mass needed for success, make that muscle stronger, and translate that new strength into an improved 1RM performance

- Although most fitness characteristics are subject to reversibility and adaptive decay over time, as long as minimal training volumes and intensity are held, powerlifters can effectively sequence different training phases together without the risk of losing fitness from earlier phases. Ex: Peaking for a meet will not result in meaningful muscle atrophy (assuming normal training is resumed shortly after)

SOURCES & FURTHER READING

Phase Potentiation Defined

- Principles and Practice of Resistance Training
- Periodization 5th Edition Theory and Methodology of Training
- Science and Practice of Strength Training

Phase Potentiation in Practice

- Interplay among the changes of muscle strength, cross-sectional area and maximal explosive power: theory and facts
- Periodization paradigms in the 21st century: evidence-led or tradition-driven
- New horizons for the methodology and physiology of training periodization
- Block periodization versus traditional training theory: a review

Peaking & Tapering

- Tapering and Peaking for Optimal Performance

INDIVIDUAL DIFFERENCE

SCIENTIFIC DEFINITION

The principle of individual difference describes that while all of the training principles apply to everyone, different individuals will respond in slightly different magnitude to each principle. For example, while everyone needs overload, exactly how much training is overloading can be different in quantity (not quality) between individuals or the same person at different times. This last point is important, as in the sport science literature, there are two different and important types of individual difference:

INTER-INDIVIDUAL DIFFERENCE

Differences between individuals in how they respond to the same training. These differences are often genetic, but can also be environmental, such as how much sleep someone is getting, how their nutrition is, what supplements or drugs they take, how long they have been training and so on.

INTRA-INDIVIDUAL DIFFERENCE

Differences between the same individual at two different times. Genetics

will be the same, but sleep patterns, diet, drugs, supplements, and other environmental factors may be different enough to alter the training response. Training age and experience are especially large sources of intra-individual differences as many environmental variables may be very stable over long time periods.

The big implication of individual differences in the training for any sport is the understanding that no two individuals or even the same person over two times will respond identically to the same program. This means that every single training program ever written should ideally have room for some sort of alterations to accommodate for individual differences.

At first this revelation can be quite daunting. If every program must be custom-tailored, exactly how complex can programming get? Is there any hope of generalizing between individuals? There absolutely is. Firstly and as already mentioned above, individual differences are always within the realm of all training principles. There is no one on earth who grows best without overload, doesn't need to manage fatigue with hard training, or benefits most from zero variation. Secondly, even within the boundaries of the principles, most individual differences between and within are found in only 5 areas, to be described in the next section.

POWERLIFTING DEFINITION

In powerlifting, program alterations to accommodate individual differences turn out to be surprisingly simple. In fact, most of the alterations made to a program to better suit it to the individual are categorized in only 5 areas:

- MRV
- Fatigue and Fitness Decay Times
- Development Status/Goals
- Exercise Selection
- Exercise Technique

1.) MRV

Different lifters and the same lifter at different times may have wildly differing MRVs. The irony is that in powerlifting, the very fast-twitch musculature that makes you better also predisposes you to relatively low MRVs. Sometimes talented lifters will chronically overreach or even overtrain when attempting to go set for set with less talented lifters because the faster fiber types of the talented lifters simply can't handle the same volume of work.

In a similar vein, a volume phase or multiple volume phases over time can greatly increase an individual lifter's MRV. So can enhanced recovery strategies like diet, sleep, intelligent training design, and supplements/drugs. What used to be a very effective dose of training can later be barely enough to maintain performance, let alone improve it.



2.) FATIGUE & FITNESS DECAY TIMES

Bigger, stronger, and more experienced lifters tend to dissipate fatigue and decay fitness more slowly. But genetic differences independent to those three factors play roles as well. Often these differences are linked to both fitness and fatigue to the same extent, but sometimes they are not. It's very possible that some individuals drop fatigue very quickly, but decay fitness very slowly (lucky, lucky), while still others drop fatigue slowly but decay fitness rapidly, which may require a more frequent training approach and a less aggressive taper for competition.

Additionally, environmental variables can influence the dissipation of fatigue and decay of fitness between and within individuals. Drugs, supplements, good nutrition and other recovery modalities generally speed up fatigue drops while delaying fitness drops. Considerations of these variables may be useful when choosing taper length and characteristics. Those who drop fatigue slowly but also drop fitness slowly may benefit from longer, more aggressive (bigger decreases in volume/intensity) tapers. Those who drop both quickly may benefit from shorter, less aggressive tapers. Those who drop fatigue slowly but fitness rapidly can benefit from long tapers that don't cut volume as drastically at any point, and those who drop fatigue quickly but retain fitness well can hardly need to taper at all, with perhaps nothing more than a deload needed before a meet. Most of us are somewhere between those four extreme cases, and must find what type of taper works best with either the help of a coach, via measurement (bar velocity, force plate data, etc...), or the old-fashioned form of trial and error.

3.) DEVELOPMENT STATUS/GOALS

There are three main development statuses of lifter that can be helpful in organizing thinking about the larger periodized structure of training.

BEGINNER LIFTERS

Beginner lifters (1-3 years or so of experience) almost all need more hypertrophy work than anything else for best rates of improvement. Thus, their hypertrophy phases can be longer and their strength and peaking phases can be shorter. Because they are fresh to the sport and probably not strong enough to have any major injuries or too many bumps and bruises yet, their active rest phases can be shorter as well.

In their development focus, they should prioritize all movements and muscles fairly evenly so as to build a strong base for later training and discover where their proclivities lie.

INTERMEDIATE LIFTERS

Intermediate Lifters (3-6 years or so of experience) almost all need plenty of hypertrophy work, but now have the muscle mass to benefit from longer phases of dedicated strength work. This can mean that they still do full hypertrophy phases, but can now also maximally benefit from extended (3-6 month) strength phases as well. These stronger lifters don't need too much time to peak, but will need an average length active recovery phase in order to recover from their now more disruptive training.

Because they have built a good foundation of all body part and lift focused training, intermediate lifters would now likely benefit from focusing more on their proclivities. Close stance squatters with big quads should focus on their quads, chest benchers on their pecs, back-dominant deadlifters on their back work. It's these strengths maximally developed that will have the highest contribution to eventually taking lifters to elite performances.

ADVANCED LIFTERS

Advanced lifters not seeking to move up a weightclass already have most of the muscle and strength that they'll have. Their biggest focus now is on perfecting the peaking process and competing more often to show off the strength they've built for so long. Because they already have tons of muscle and a well developed strength base, they can do longer peaking phases to really squeeze out the most ability from their



nervous system force production and technique. Those who move between classes will have similar recommendations as intermediates.

Because advanced lifters have heavily developed their “best weapon” strong points, they may now be in a position where further development of those body parts and movements is slow. As well, because of their high level of development, these strong points may now begin to be limited by weak points. For example, hamstrings don’t contribute much to the forces of a quad squatter. But if you’re squatting 700lbs and tip forward even the least bit (guaranteed to happen on occasion), insufficient hamstring strength will lead to caving over and a possible missed lift, if not worse. Thus when quads get very developed (as they should in this example) during the intermediate development stage, the hamstrings need to be

brought up during the advanced stage so as not to be a limiting factor. The same idea applies to all limiting factors for the advanced lifter; train them hard to allow the strong points to continue to exert their maximal contributions to performance.

4.) EXERCISE SELECTION

For those beginning powerlifting, a very wide range of exercises should be performed so as to seek a well-rounded base.

As beginners transition to intermediate status, they will become familiar with their genetic proclivities and start prioritizing them more. Because everyone but identical twins are genetically different, different individuals will have different proclivities. This will result in the need for different exercise selections. For example a “chest bencher” will do more flyes and a “triceps bencher” will do more skull crushers in the intermediate phase so as to develop their strong points.

In the advanced phase, lifters with different strengths will almost always have different weaknesses. Thus exercise selection is again going to be individualized to target the weak points of the advanced lifters. In all cases but the beginner, doing exactly the same lifts as your training partner is probably effective, but not maximally so.

5.) EXERCISE TECHNIQUE

Not only do different lifters have muscles that grow at different rates or to different final sizes, but they also have different bone and joint

structures. The resultant skeletal differences produce lifters with a very wide range of different limb ratios and levers.

Though the fundamentals of technique stay the same for all lifters (blocking and core bracing for squats and deadlifts, retracting shoulder blades for benching, etc...), some technique details can be changed for the individual lifter to maximize results. Lifters with shorter torsos may want to squat with a wider stance so that their thighs create a smaller lever arm and they don't have to good-morning the weight. Longer-armed deadlifters may not have to worry about sinking their hips down as much into the deadlift as shorter-armed lifters. Longer-armed benchers may benefit from touching their presses lower on their chests and arching the bar back more during the lift.

While the exact prescriptions for such differences are numerous and not the focus of this text (a good powerlifting coach is the go-to guide on such matters), understanding that not everyone is going to train and execute the lifts identically is the important message. So long as basic technique is not being violated (rounded lower backs in the deadlift are for no one), there is considerable room for optimizing individual technique based on limb ratios.

PRINCIPLE IMPORTANCE RANK

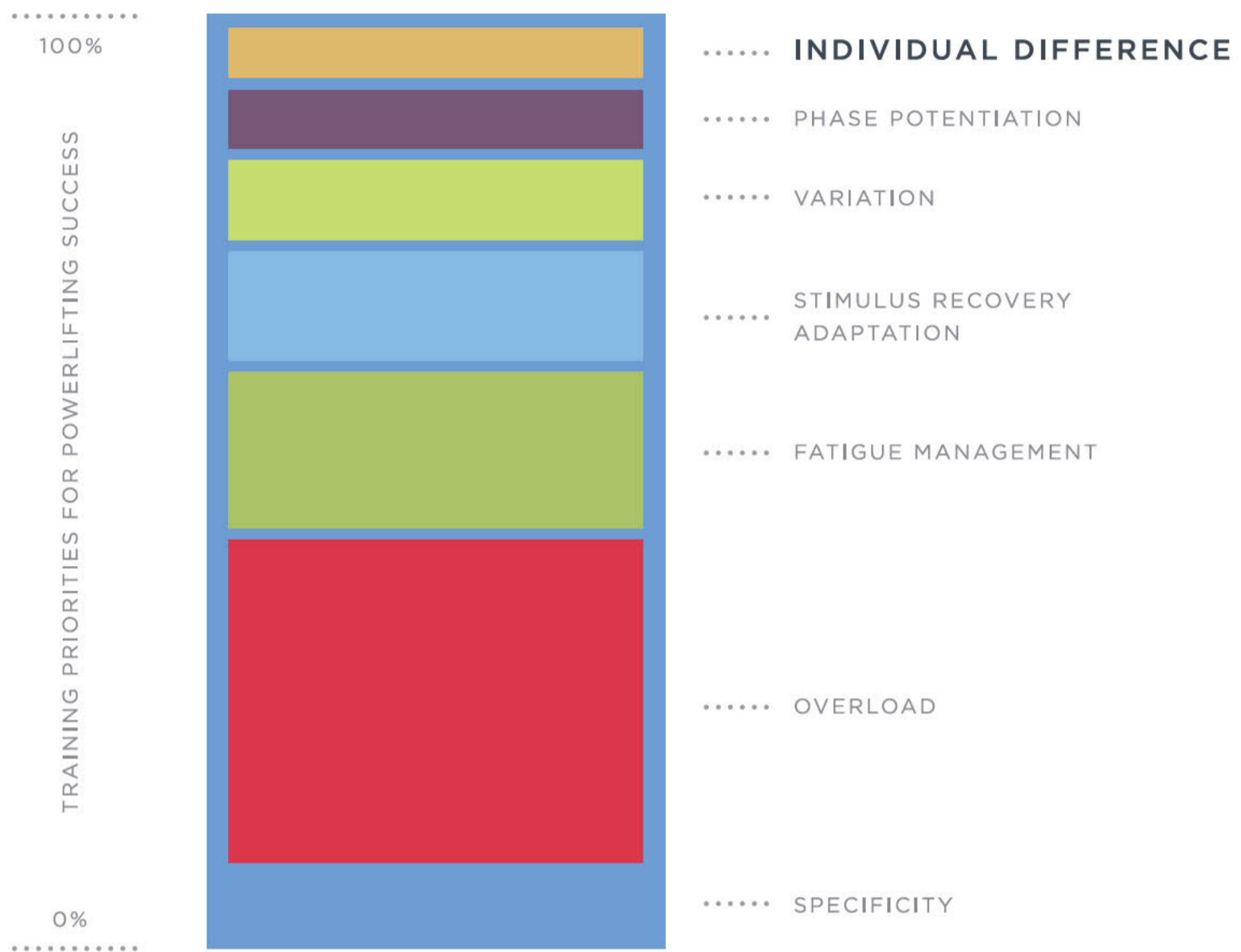
Individual variation seems to be touted almost everywhere as a super-important principle, except here we have it ranked last. Why?

Without putting too fine a point on it, the effects of individual variation

are often overstated. One of America's top sport scientists, Dr. Mike Stone, has often repeated the adage that "you're special... just like everyone else." On a technical rather than comedic note, humans are all genetically almost completely the same. A small fraction of a percent difference in genetic code separates all humans from each other. We share upwards of 90% of our DNA with lab mice, and they respond to training in very similar ways to humans, down to some very intricate pathways. The systems of the body designed to augment strength, size, and neural output are evolutionarily dozens of millions of years old. The mTOR/AMPk system is likely even older, as are most other basic cell responses to loading, stress, and fatigue.

When we get right down to it, humans are so similar that they all respond to training in incredibly homogenous ways. Every single of the first 6 principles applies to every single living human. There is not a single person alive that doesn't benefit from specificity. Not a single person who doesn't accumulate fatigue. Not a single person who experiences no adaptive resistance with a stale program. The only big difference between individuals is to what degree they respond to training and detraining, not if they do or how they do.

Yes, within the realms in which they matter, individual differences are important. But because each tweak only applies to some people, they're not more important than the basic principles that apply to everyone. All people and thus lifters are different, but in the grand scheme, it's in relatively simple ways that are not overwhelmingly difficult to adjust to in program design. Next up, how to make sure your program is properly tailored to the individual but at the same time doesn't go too far in customization and lose track of the foundational training principles.



IMPLICATIONS & EXAMPLES OF PROPER APPLICATION OF INDIVIDUAL DIFFERENCE

1.) CHOOSING THE RIGHT VARIANTS/ASSISTANCE MOVES

The first notable way in which individual variation can be applied is by programming the right assistance moves for the lifter. To review, the basic progression in variation based on development is as follows:

Beginner: A wide range of variants targeting all movement patterns and muscle groups involved in producing force for powerlifting.

Intermediate: Mostly variants targeting the improvement of highly responsive and contributory movements and muscles (genetic proclivities) with “back burner” work in other areas. For example, a lifter with highly responsive quads should choose lots of leg presses, front squats, and high bar squats in their programming.

Advanced: Mostly variants targeting the improvement of weak points that are holding back highly responsive and well developed muscles and movements from contributing maximally to the three main lifts. For example, an advanced lifter with highly developed pecs should choose lots of skull crusher, close grip, and slingshot work to allow lockout strength to stop limiting lifts that start with plenty of strength off the chest but stall closer to lockout.

Within those major categories, there is a near-endless list of possible exercises matched up with a near-endless list of needs of the particular lifter. Some of the criteria can be much more personalized than general development status. Some lifts, for biomechanical, neuromuscular, or sheer preference reasons may feel and/or be better for some lifters, and as long as they are within the bounds of effectiveness via the other principles, those lifts should be chosen. If dumbbell skull crushers are the only kind that don't wear down on your elbows (so long as the other kind of skull crushers are not hurting you because of wrong technique), by all means do them. So long as the intended big picture effect is being achieved, lifters should choose their own variants with care. Another example is the difference in stimulus angle. Both hack squats and leg presses stimulate the quads very well, but hack squats tend to stimulate

a different part of the quadriceps more so than the leg press and vice-versa. Some lifters love the leg press and respond very well to it (they get sore in the muscle and their knees and hips feel fine), but hack squats give them knee pain and not much else. Other lifters respond very well to hacks but hate the leg press. The good news is that both exercises develop the general quad hypertrophy that's needed as raw material for a strength phase to work into an efficient force producing unit, so either (or both) of these exercises work well, and it often comes down to individual choice as to their selection.

2.) CHOOSING LIFTING STYLES FOR YOUR BODY TYPE

As discussed earlier, different body types respond better to different forms of technique. Especially once in the intermediate phase, lifters should choose their lifting style even in the competitive lifts themselves based on their musculoskeletal structures, proclivities, and limitations. If you have narrow hips and short femurs but a longer torso and weaker back, a narrow stance upright squat may maximize your leverages and prevent you from exposing your weak points too much and limiting your weights. If your triceps are a strong point, you may be able to benefit from a closer grip on bench presses and lift more in that style. If your pecs dominate, a wider grip may prevent your triceps from limiting your lifts as much. If you have a long torso and short legs but a weaker posterior chain, you might want to pull with a low starting position and stay upright, but if you have long arms, short torso, and long legs with strong hamstrings but weaker quads, a relatively straighter-leg deadlift might yield best results.



There are two caveats to this personalization of lifting styles

a.) You can't just stick to the style you started with as a beginner. You might have some amazing quad proclivity you simply don't know about yet, but the person who taught you how to lift had you squat with a wider stance because that's what worked for them. There's nothing wrong with that, but as you try out different variants as a beginner, you should also try out different versions of the competitive lifts. While they might seem awkward first, some of these versions may fit your eventual proclivities more than the ones you started out with. Experimenting with different styles is a very good idea early in development, all the way up to intermediate levels when proclivities are clearer and a suitable style can be settled on.

b.) Don't just do what "feels right." Most people like high bar squatting more than they like low bar squatting. Low bar hurts,

it's uncomfortable, and the technique can be tricky to master compared to a high bar squat. Problem is, almost everyone can low bar more than they can high bar. When picking technique styles for the main lifts, pick the style that reliably (after years of experimentation as a beginner and intermediate) gets you bigger numbers. If it doesn't feel "quite right," you might have to suck it up. After all, lifting maximally usually doesn't feel "quite right" either but here you are in this weird sport anyway!

3.) CHOOSING YOUR BEST MRV & PROGRESSION RATES

Based on individualizing to your own MRV, it's very important to choose a volume that you can find optimally challenging yet still recoverable. The way to do this is rather straightforward. Keep track of total volumes at any given intensity range, start with the basic recommendation in this book, and track your progress. If you're recovering easily and hitting expected numbers week after week, slowly raise the set numbers until you're regularly overreaching in the week before deloads. That is your MRV for that phase/intensity range, and next time you program, you can use similar set numbers and be that much more precise.

Additionally, your progression rate can be optimized. Some lifters can put 15lbs on the bar each week and do great, while others benefit much more from slower progressions like 5lbs per week. For any given volume and intensity, the slower progression requires a higher starting value for both, but doesn't rise as high, whereas the faster progression requires a lower starting volume/intensity but climbs higher in the pre-deload peak week. Notice, two different lifters may have the same average MRV but different proclivities for progression rate. Some lifters get very beat up with a relatively high initial volume of new movements, so they are better off starting lower and making bigger jumps. Other lifters can handle

the high starting point just fine, but the bigger jumps quickly overreach them. It's up to the individual to find what method they find most recoverable and effective, and not just "doing what others do." More on that in the next section on under-application of individual differences.

UNDER-APPLICATION OF INDIVIDUAL DIFFERENCE

1.) DOING THE EXACT SAME WORKOUT AS YOUR TRAINING PARTNER

While you may not look or act like your training partner, that relationship can contain quite a meaningful bond. You show up to the gym together, train together, suffer together, and progress together. Training partnerships are one of the many really beautiful and enjoyable elements of the sport.

One of the unfortunate side effects of improving any process is the inevitable need to consider discarding comfortable, established processes that have been adhered to previously, some of them for a very long time. While training partners are indeed a great part of the sport and can absolutely help maximize performance, the principle of individual differences must limit the degree of similarity in training between you and your training partner or partners. It's almost always easier to do the same exercises as your training partners. To keep things really simple a lot of lifters even do the same sets and reps. At the extreme ends, some lifters will use the same weight on the bar as their training partners.

In all cases, these approaches deviate from the recommended approach by not sufficiently considering the principle of individual difference. For each variable, there is a problem if training is made too similar to that of your training partner(s) on principle:

- Doing the same exercises violates the principle of variation, particularly directed variation to target certain muscles and movements more than others. If your training partner needs more quad work and you need more ham work, do you do stiff legged deads, hack squats, or what?
- Doing the same set numbers as your training partner can violate either overload or fatigue management. What may not be enough volume for you to progress your fastest may be just enough volume to consistently overreach your training partner and prevent or negate most of his/her gains. This insistence on doing the same sets as each other or as that prescribed by an internet powerlifting program is likely responsible for a large percentage of the cases in which someone says a program “didn’t work for them.” It should be no surprise that a program far off of your MRV is not going to work well, if at all.
- Doing the same repetitions as your training partner might be ok, but only if you are choosing the right weight and in the same training block (hypertrophy vs. strength vs. peaking). Even still, faster-twitch lifters often benefit from the lower end of a rep range while slower twitch from the higher, so even a hypertrophy phase may call for one lifter doing sets of 8 while another does sets of 12
- Using the same weight is probably the most absurd form of training partner homogeneity. Never mind that lifters start out at different strengths, they also progress at different rates! Using the same weights as your training partners is inappropriate even for assistance moves, on which it is more

common for training partners to just use the same weight for convenience. The real deal is that if you want the best results, move some plates around on the bar and get the best training you and your training partners all need, not some mishmash that fits well for only one of you or no one at all.

2.) TRAINING EXACTLY LIKE THE BEST

We have a lot to learn from studying the techniques and programs of the best lifters. They are not the best by accident, and though genetics, drugs, nutrition, and time spent under the bar all weigh into performance, training approaches absolutely do as well. Those that are the best do most of the basics right most of the time. That being said the particular details of their approaches are not always going to be the same details that work for all other lifters. In fact, especially for beginner and intermediate lifters, the programs of “the best” tend to be different in predictable ways from those programs and approaches that work better for most other lifters, especially beginner and intermediate lifters. Here is a list of some of the more notable predictable differences:

A.) INDIVIDUAL TECHNIQUE

Some of the best lifters may be built very differently from the average lifter. The best squatters have shorter legs, the best bench pressers have shorter arms, and the best deadlifters have both longer arms and shorter torsos. Most people don't have those leverages to those extremes, thus simply replicating that the technique that works for the best may not always produce the best results for you. Yeah, you can pull like Ed Coan if you're built like him, but are you built like him?



B.) OPTIMAL REPETITION RANGES/VOLUMES

The top lifters tend to be more predominantly fast-twitch. This means among other things that they likely benefit from slightly lower repetition ranges and total volumes, especially in hypertrophy phases. Yes, that elite powerlifter may grow almost maximal muscle size from sets of 5, but you will likely benefit most from at least 8 reps per set.

C.) LENGTH OF BLOCKS/PHASES

Elite lifters have built most of the muscle and even most of the basic strength that they will in their careers. Now, they are focusing on

peaking more often and perfecting their technique at higher loads, so chances are that they will be spending much more time at high loads than most lifters should be, especially those in the beginner and intermediate stages. Another way to put this is; if you want to copy the best, do what they did to get to the top, not what they're doing to stay there.

D.) MAGNITUDE OF INDIVIDUAL TRAINING SESSIONS

After the years of overload presented in sequence to take lifters to the top, not just any old workout will spur adaptation. In fact, anything other than a gigantic homeostatic disruption is unlikely to make a dent in the lifter's physiology and make them any better. Thus, elite lifters are likely to have individual sessions that are monumentally overloading. In fact, much more overloading than what beginner and intermediate lifters can beneficially recover from in any one session. Follow elite lifter advice to the letter and some of the workouts might be brutal, but not any more productive and perhaps less so.

E.) FREQUENCY OF HOMEOSTATICALLY DISRUPTIVE (OVERLOAD) TRAINING

Elite lifters are capable of absolutely massive homeostatic disruption, and in fact need such disruption in order to continue to present an overload. However, most elite lifters are very close to their physiological limits on recovery, and that usually implies that such disruptive training cannot occur as frequently as it can in beginners and must be interspersed with more light sessions to promote recovery while holding onto fitness gains. Yes, Vince Urbank only deadlifts heavy every two to three weeks, and you might too if your working sets were in the 800s. But they are not, so you can likely train heavy more often. In the unlikely case that you are Vince Urbank... hey! Hope you like the book!

F.) USE OF DIRECTED VARIATION

Elite lifters, especially if they are taking intelligent approaches to training, will likely be spending a lot of time working on bringing up weak points or other limiting factors. Most other lifters should be working on all areas as beginners or focusing on strengths as intermediates, not working on lagging areas with most focus. Even if you are an elite lifter yourself, copying even better elite lifters' programs may not be the answer. After all, not all lifters have the same weak points, and copying a program verbatim might instead work on your strong points more and neglect the very weak points you're trying to hit. Jay Nera might need more quad work, but you might need more ham work... simply copying his routine is unlikely to get you the best results.

3.) TRAINING LIKE YOU USED TO

No matter how good any program is, someone will always say "man, I got pretty good results with this program, but the bench program I did in high school really shot my pressing up!"

The biggest problem with this line of thinking is that as the body changes and adapts, the type of stimuli needed for progression will change as well. And because the untrained state is so conducive to rapid adaptation, of course all sorts of routines "used to work" but don't anymore. A program heavily based in hypertrophy might not work as well as it used to once the lifter doing it nears their ideal weightclass. Even a basic strength program is left lacking when advanced athletes who need more peaking time are involved. By training the same way all the time and "training like I always have," the intra-individual variation

and career progression of training is not attended to and thus results cannot be expected to be great. An older program can be updated to reflect current abilities, but it's unlikely to produce the best results verbatim with no modification.

4.) DOING AN INTERNET PROGRAM VERBATIM WITHOUT ADJUSTMENT

Programs off of the internet (without a coach to adjust them for you based on needs and responses) are not without value. In fact, they can be absolutely great, especially for beginner and intermediate lifters. However, the better programs are the ones that allow plenty of room for individual variation. If a program is highly delimiting (prescribes exact exercises, sets, reps, percentages) and does not offer suggestions for alteration based on needs, it's likely somewhat limited in its effectiveness.

Any time you use an internet program, try to gravitate towards the more flexible ones, and worst-case, make some off-the-path adjustments to the non-flexible ones if needed. So long as the program you end up with after all the changes still follows the main principles of training, it should work well no matter what individual particularities you specified.

OVER-APPLICATION OF INDIVIDUAL DIFFERENCE

1.) POOR TECHNIQUE

There is no one effective and fitting technique for all lifters of all body types and strengths. However, there are some basic rules of technical execution that hold true through every single lifting style. Here are some, mostly for an illustration and not a comprehensive list:

- Keeping a lordotic lumbar spine in the squat and deadlift
- Moving your hips back as well as your knees forward during the squat
- Benching with your shoulder blades retracted
- Not bending your elbows when you deadlift
- Not letting your knees cave inwards on the squat
- Etc...

These technique universals have the combination of enhancing lift safety, reducing long-term wear and tear, and allowing the lifter to put more force into the bar and thus lift higher loads.

Variation in personal technique is just fine, but only if it does not involve variation outside of such technique basics. If it does, the lifter is simply not being as effective as he/she could be, and is also needlessly risking injury. At some point, we can just call what's being done "bad technique" and nothing more. Sometimes lifters get quite strong with less than the best technique, but that's no defense of bad practices. 'That's just how he pulls' is all well and good, but maybe if he pulled better he could

actually lift more and be safer. In fact, “that’s just how I pull” is one of those priceless “famous last words” before a possibly nasty lower back injury.

It’s absolutely great to vary technique to fit the lifter’s body, but if your deadlift looks like a question mark impression, you’re just lifting wrong and you need to correct the practice.

2.) GROSS VIOLATIONS OF OTHER PRINCIPLES

A huge swath over the over-application of individual difference is really just an application of individual difference while failing to apply or under-applying the other important training principles. In essence, over-applying individual difference often means that your training is no longer overloading or fatigue is no longer being managed or specificity is thrown out the window. This is of course not the best thing, since the most effective training concords with all of the training principles at the same time. Some examples of this phenomenon:

SPECIFICITY

When you replace a normal leg workout with sled pushes, you exit the realm of powerlifting-specific adaptations and are now just “working out.” Will this benefit your lifting? Maybe, but more specific work like squats and leg presses are much more likely to work even better. You might even “really feel” the sled pushes in your legs, but feelings can be deceiving. Stick to what works for sure and only take wild detours on rare occasions.

OVERLOAD

Using cable overhead one-arm triceps extensions with the rope attachment is a fine triceps exercise, but it lacks the capacity for overload and thus homeostatic disruption that overhead barbell extensions provide. Properly applying overload cannot be jettisoned during exercise variation if best results are the goal, even if you feel a good pump from the movement. Everyone needs overload, so individual differences should always keep that in mind.

FATIGUE MANAGEMENT

“I don’t need to deload” is a funny statement, but it’s less funny when its maker is later recovering from a knee injury sustained while training too fatigued. Sometimes lifters with very high MRVs can get away without deloading if they are chronically following average programs that underdose volume for their needs. If you don’t need to deload, you’re not training hard enough. If you still don’t need to deload even after you’ve begun to train at your MRV, you soon will because of regressions in performance and possible injuries.

“I TRIED SHEIKO AND I DIDN’T LIKE IT.”

3.) “SUCH AND SUCH METHOD WORKS BEST FOR ME”

Well, why not? It’s obviously not the name of the program that left you wanting, but a feature of its design. The interesting thought is that it’s not immediately apparent which design feature or combination of features were not a good fit. Assuming your nutrition and recovery were



good, any number of the training principles could have been off of your personal needs in the program. In fact, it might just be one, and the rest of the program is just fine, so perhaps discarding and writing off a program so hastily is not the best approach.

Alternatively, it might be a good use of time to try to figure out what it was about the program that didn't fit to your individual needs and abilities, which can give you insight about your situation and allow you to select, modify, and design better programs in the future.

SOME EXAMPLES

“Sheiko didn’t work for me.”

Take the same Sheiko plan and reduce the set numbers by 1/3. All of a sudden, results are amazing. Turns out it wasn’t the program’s structure but rather the total volume that was problematic.

“Westside doesn’t work for raw lifters.”

The Westside system is not ideal, but it can be quite effective for raw lifters. Replace the dynamic day’s bands and chains with full range of motion raw assistance lifts, and all of a sudden Westside works pretty well. The structure is just fine; it was just the exercise selection that was non-specific to raw lifting.

In the end, the training principles work for everyone, but the degrees to which they apply can differ. Most programs work well if you customize just a couple of features to your needs, with no need to throw the baby out with the bathwater.

SUMMARY

In powerlifting terms, Individual Differences imply that no two lifters are exactly alike and that no single lifter doesn’t change in their needs and responses to training over time. While lifters are all different, these differences are usually small and mostly on the amounts in which various principles are applied, not if they are applied or if other principles are applied instead. By modifying mostly the volume, progression rate, exercise selection and phase-focus (mostly hypertrophy vs. mostly peaking, for example) of a program, almost all individual differences can be easily accommodated.

Key Points

- Although only a relatively small priority, individual differences should be accounted for when developing a powerlifting program. No two individuals will respond exactly the same to a given training stimulus, nor will they progress in the same manner over time
- Many individual differences are already accounted for when addressing concepts like maximum recoverable volume, fatigue management, and stimulus recovery adaptation
- Keep in mind that magnitude of the effect when addressing individual differences is relatively small. Programming for powerlifting will share many commonalities between different programs, with some fine tuning for the individual

SOURCES & FURTHER READING

Individualization and Training

- Periodization 5th Edition Theory and Methodology of Training
- Genetic Influences in Sport and Physical Performance
- Adaptive Processes in Skeletal Muscle: Molecular Regulators and Genetic Influences
- Individual Differences in Response to Regular Physical Activity
- Variability in Training-Induced Skeletal Muscle Adaptation
- Genetic Inheritance Effects on Endurance and Muscle Strength: An Update

- High Responders to Resistance Exercise Training Demonstrate Differential Regulation of Skeletal Muscle microRNA Expression
- Individual Response to Exercise Training - A Statistical Perspective
- Understanding the Individual Responsiveness to Resistance Training Periodization



CHAPTER TEN

PERIODIZATION FOR POWERLIFTING

Because we've already covered most of the serious content and recommendations on training through all of the phases of a powerlifting macrocycle, this chapter will be the shortest by far of the book. In effect, it will only act as a refresher and central hub of useful recommendations on specific for every one of the 4 blocks of training for powerlifting.

When designing your own programs, this chapter's 4 tables can be a very helpful guide. Renaissance Periodization will soon have (and may already depending on the time you're reading this) digital templates that generate block-specific training programs using the very information below.

HYPERTROPHY BLOCK

MAIN PURPOSE	Add muscle mass, improve anaerobic work capacity
POSITION IN MACRO	After active rest, before the strength block
AVERAGE LENGTH	3 weeks to 6 months long, but usually around 2-3 months for most intermediate lifters
WHO NEEDS IT	Most benefit to beginners, second to intermediates, least to advanced
LIFT SELECTIONS	Overloading variants of the competition lifts designed to target needed muscles. Can include some isolation work, up to 30% of the program vs. 70% minimum compound work
MINIMUM OVERLOAD INTENSITIES, RANGE	60%1RM minimum, 75% 1RM highest recommended maximum for most... some will tolerate up to 80%1RM
AVERAGE SET VOLUME	15-30 working sets per body part per week. Compounds can count for multiple muscles (close grip benches count for chest and triceps)
WEIGHT AND SET PROGRESSIONS	5-20lb increases in weight with each week (2.5-5% per week), 0-1 set added per week in accumulation phase
AVERAGE MESOCYCLE LENGTH	Recommended start: 5 weeks total (4 accumulation, 1 deload). More advanced lifters may only tolerate 3:1 paradigm
INDICATORS OF MRV	When reps at 60%-75% intensities start falling off below the 8 rep range and you can't match reps from last week
LIGHT SESSION GUIDELINES	Volume: 50% of overload day Intensity: 50% of overload day
DELOAD GUIDELINES	First Half of Microcycle: Volume: 50% of overload day Intensity: 90% of overload day Second Half of Microcycle: Volume: 50% of overload day Intensity: 50% of overload day
AVERAGE OVERLOAD FREQUENCY	Between 2 and 6 overloading sessions per body part per week

BASIC STRENGTH BLOCK

MAIN PURPOSE	Increase general strength
POSITION IN MACRO	After hypertrophy, before peaking
AVERAGE LENGTH	3 weeks to 6 months long, but usually around 2-3 months for most intermediate lifters
WHO NEEDS IT	Most benefit to intermediates, equal importance to beginners and advanced lifters
LIFT SELECTIONS	Overloading variants of the competition lifts designed to target needed movements. Limited or no isolation work, competition lifts often included in later mesocycles
MINIMUM OVERLOAD INTENSITIES, RANGE	75%1RM minimum, 90% 1RM highest recommended maximum for most
AVERAGE SET VOLUME	10-20 working sets per body part per week. Compounds can count for multiple muscles (close grip benches count for chest and triceps)
WEIGHT AND SET PROGRESSIONS	5-20lb increases in weight with each week (2.5-5% per week), few or no sets added each week
AVERAGE MESOCYCLE LENGTH	Recommended start: 4 weeks total (3 accumulation, 1 deload). More advanced lifters may only tolerate 2:1 paradigm (rare)
INDICATORS OF MRV	When rep performances at 75%-90% intensities start falling off below the 3 rep range and you can't match reps from last week
LIGHT SESSION GUIDELINES	Volume: 70% of overload day Intensity: 70% of overload day
DELOAD GUIDELINES	First Half of Microcycle: Volume: 50% of overload day Intensity: 90% of overload day Second Half of Microcycle: Volume: 50% of overload day Intensity: 50% of overload day
AVERAGE OVERLOAD FREQUENCY	Between 2 and 4 overloading sessions per body part per week, with the possibility of light session interspersed

PEAKING BLOCK

MAIN PURPOSE	Fine-tune technique and NS force production for 1RM lifting
POSITION IN MACRO	After basic strength, before meet and active rest
AVERAGE LENGTH	3 weeks to 3 months long, but usually around 1-2 months for most intermediate lifters
WHO NEEDS IT	Most benefit to advanced, second to intermediate and least for beginner lifters
LIFT SELECTIONS	Mostly the competition lifts themselves. Limited or no assistance work, at most in a 70/30 ratio of competition lifts to assistance work
MINIMUM OVERLOAD INTENSITIES, RANGE	75%1RM average, split between 85%-95% 1RM overloading sessions and 50% 1RM light sessions
AVERAGE SET VOLUME	5-10 overloading sets per body part per week, with another 5-10 light session sets per week possible
WEIGHT AND SET PROGRESSIONS	5-20lb increases in weight with each week (2.5-5% per week), few or no sets added each week of accumulation, taper removes sets
AVERAGE MESOCYCLE LENGTH	"Accumulation can last 3 weeks, with one deload week if NOT the taper mesocycle (recommended at most one non-taper peaking meso before taper, only for high level intermediates and advanced... beginners should ONLY do a taper meso right after a strength phase) For taper, please see taper recommendations below
INDICATORS OF MRV	When rep performances and technique stability at 85%-95% intensities start falling off drastically
LIGHT SESSION GUIDELINES	Volume: 90% of overload day, Intensity: 50% of overload day
DELOAD GUIDELINES	Non-Taper Meso: First Half of Microcycle: Volume: 90% of overload day Intensity: 50% of overload day Second Half of Microcycle: Volume: 50% of overload day Intensity: 50% of overload day Taper Meso: please see taper recommendations below
AVERAGE OVERLOAD FREQUENCY	Between 1 and 3 overloading sessions per body part per week, with the likely use of light session interspersed

TAPER DESIGN RECOMMENDATIONS

1.) Taper Components

Part 1: Normal volume training with classic peaking recommendations OR Functional Overreaching volume with classical peaking recommendation. Functional overreaching volumes can range between 1.5 and 2x normal peaking volumes.

Part 2: Reduced volume but maintained or even elevated intensity training. Volume can be reduced to between 90% and 50% of normal peaking training.

Part 3: Reduced volume and intensity phase, averaging 50% volume and 50% intensity of the normal peaking phase.

2.) Lifter Categories for Taper Selection

Category 1: Lifters under 165lbs, totaling class 2 or under for their weight, and/or those who have been training for less than 3 years.

Category 2: Lifters between 165lbs and 220lbs, totaling class 1 or better for their weight, and/or those who have been lifting for 3-6 years.

Category 3: Lifters weighing more than 220lbs, totaling elite or pro (aka “International Elite”) for their weight, and/or those who have been lifting for more than 6 years.

3.) Lifter Category Calculator

	BODYWEIGHT	TOTAL	EXPERIENCE	
1	Under 165	Class 2 or lower	Under 3 years	1 POINT EACH
2	165-220	Class 1 or Master	3-6 years	2 POINTS EACH
3	Over 220	Elite or Pro	Over 6 years	3 POINTS EACH

4.) Taper Category Guidelines

Category 1

- Total Taper Duration: 1 week
- Duration of Part 1: 0-3 days
- Duration of Part 2: 1-4 days
- Duration of Part 3: 0-3 days

Category 2

- Total Taper Duration: 2 weeks
- Duration of Part 1: 4-5 day
- Duration of Part 2: 4-5 days
- Duration of Part 3: 4-5 days

Category 3:

- Total Taper Duration: 3 weeks
- Duration of Part 1: 1 week
- Duration of Part 2: 1 week
- Duration of Part 3: 1 week

ACTIVE REST BLOCK

MAIN PURPOSE	Allow fatigue to dissipate, especially connective tissue damage and chemical messenger disruption (while conserving fitness)
POSITION IN MACRO	After the meet, before the hypertrophy phase
AVERAGE LENGTH	1 to 3 weeks long, with 1 week better for beginners and up to 3 needed for advanced lifters
WHO NEEDS IT	Most benefit to advanced, second to intermediate and least for beginner lifters
LIFT SELECTIONS	Mostly the NON-competition lifts. Lots of flexibility/mobility work and technique work on new movements
MINIMUM OVERLOAD INTENSITIES, RANGE	50%1RM average, with most sessions around 50% and not much more
AVERAGE SET VOLUME	5-10 total sets per body part per week
WEIGHT AND SET PROGRESSIONS	No weight or set progressions
AVERAGE MESOCYCLE LENGTH	Just one mesocycle is appropriate in almost all cases (1-3 weeks total)
INDICATORS OF MRV	Volume is too high when rapid drops in fatigue are not noted
LIGHT SESSION GUIDELINES	N/A (all sessions are light in this phase)
DELOAD GUIDELINES	N/A (all microcycles are deloads in this phase)
AVERAGE OVERLOAD FREQUENCY	Between 2 and 4 sessions per body part per week, all light, no overloads

MYTHS, FALLACIES & FADS IN POWERLIFTING

In powerlifting, as in every sport and pursuit, it's not uncommon that certain myths continue to float around well after they have been shown to be... myths. As well, common fallacies of reasoning about training come and go, and every two years a fad comes around that is supposed to be a method of training that works wonders for everyone. The hilarious addendum to the last bit on fads is that they are often directly opposite in their recommendations, but nonetheless a lot of the same lifters swear that they must be true. One year everyone is overtraining, the next year, high volume programs are the only way to make gains. One year some lifters will tout fancy bars and bands, the next year, some of the same lifters will insist that the best lifters only train with the big three lifts!

This chapter is dedicated to a brief list and discussion of some currently and perennially popular myths, fads, and fallacies in powerlifting.

1.) BANDS & CHAINS FOR RAW POWERLIFTING

How can you get strong without using bands and chains? Why are there so few top raw powerlifters who utilize accommodating resistance in their training?

For the better part of a decade, we were inundated with information about training for powerlifting that made it seem as if bands and chains were nearly a necessity for maximizing strength and performance for powerlifting. There was a small but important caveat being left out in all of this literature and video about the use of bands and chains in your training. The caveat was that this was information being created by geared lifters, for geared lifters. Mind you, there is nothing wrong about training/competing in gear but it is important to denote the differences in training before applying them to your own raw training.

The primary purposes of utilizing accommodating resistance in your training are to challenge the lifter during the top end of the movement, stimulate the nervous system with higher intensities than could be achieved with straight weight alone and accelerate the eccentric portion of the lift. While all of these concepts have merit, their practical application to the training of raw lifters is dubious.

Overloading the top end of the range of motion in the lifts is rarely necessary for the raw lifter. How often do you see raw benches being missed at lockout? Raw squats being missed in the top half of the movement? Raw deadlifts being missed at lockout? For the overwhelming majority of raw lifters, the bottom portion of the lift is the most challenging and the most likely place for them to miss a lift. So with this being the case, why would we want to make the portion of

the lift that needs the most improvement into the relatively easiest part of the lift? Of course we wouldn't. If any specialization work is specific to raw lifting, then it likely needs to challenge the lifter during the most difficult portion of the lift with longer pauses and disadvantageous leverages, not the easiest portion of the lift with the best leverages. Overloading the body with weights heavier than it has felt before is a foundational concept in programming for strength. Using bands and/or chains is a viable way to achieve this but has some drawbacks that must be considered. How much overload is necessary to stimulate adaptation in the lifter? An overload of 10% over the athlete's 1RM is the maximum overload the athlete will need to utilize in any practical setting. This amount will provide significant stimulus to the nervous system without putting excessive stress on the joints and effecting subsequent training sessions. Limited band and chain usage can achieve this effect but with their use you need to consider the extra stress they put on the nervous system as well as joints/tendons/ligaments-particularly band resisted bench press, and the technical changes that they can make to the lifts. Because of the massive fatigue levels potentially generated by supramaximal lifting, it needs to be used sparingly and judiciously.

The most specific and highest transfer exercises that the powerlifter can perform are the competitive lifts in the competitive equipment for a 1RM. This will allow them to maximize their technique and the addition of accommodating resistance will undoubtedly change the bar path and can have a detrimental effect on that precise technique. It is a common misconception that bands and chains are something that should be reserved for advanced lifters, but it is advanced lifters who need more specific work than beginner and intermediate lifters and introducing bands and chains are an extra variation of the lift that will need to be cut out for the most advanced lifters, especially during a peaking

block as competition nears. This is why you see the most advanced and successful raw lifters using a relatively small and focused pool of exercises in their training... specificity is king, and even trumps overload on most occasions. Bands and chains are ok if intelligently programmed for variation, but they don't work any magic, especially if their low specificity is not accounted for.

2.) SUPER HIGH FREQUENCY ROUTINES FOR EVERYONE

The Bulgarians spent some phases of their training squatting every day that they trained, which was often as high as 6 times a week. They were also at some points the best weightlifters on the planet. The fad-based conclusion from that information is that squatting to a max every day, something like what the Bulgarians did is going to, if not get you their results, absolutely going to work great. The bodybuilding magazines have been lying to us for too long, you see, promoting their low frequency routines as the only way to train. But it's obvious that super high frequency routines are the absolute way to go for almost all lifters.

While it's no doubt true that much of the wisdom on powerlifting training taken from bodybuilding magazines is anything but, and that the Bulgarians were indeed successful with high frequency training, this is not immediately a reason to promote all lifters to switch to high frequency training and max every day.

First of all, the application of "Bulgarian" principles to most powerlifters has a few caveats:



- The system was designed for weightlifting, not powerlifting. With heavier weights and higher volumes used, powerlifting is likely more fatigue-generating, especially for nervous system force production systems. On the other hand, powerlifting is much less technical than weightlifting, so a part of the logic for high frequency programming (the fact that technique SRA curves are so short) simply doesn't transfer fully from weightlifting to powerlifting.
- The Bulgarians did not train in this fashion all year round and mostly seemed to train daily to a relative max during pre-completion, "peaking" times.

- The USSR did not train in the super high frequency manner that the Bulgarians did, and experienced incredible results rivaling those of Bulgaria. Many other countries similarly deviated in their training but also had fantastic results. On the net balance, it's by no means clear that the super high frequency training style was the main reason or even a major reason for Bulgaria's success. Their incredibly well developed recruiting program certainly didn't hurt.
- Most Bulgarian lifters were smaller (100kg or lighter) and could thus recover well from higher frequency programs. Many powerlifters are much larger than 100kg in size and thus may be ill-suited for such speedy recovery.
- The drug use in Bulgarian training halls was legendary. Mind you, other countries like East Germany and the USSR didn't lag behind in performance enhancing drug use, but the US and much of Western Europe sure as heck did. When you compare Bulgaria's performances to that of the UK or US, the difference is staggering. But compared to East Germany or the USSR, it's not nearly as eye-opening.

On the positive side, high frequency training can be greatly beneficial for certain situations, especially as a concentrated loading mesocycle used to functionally overreach for long term gains. These programs are best used for:

- Smaller lifters that recover quickly
- Lifters using performance enhancing drugs
- Lifters that are in beginner stages and benefit from lots of technique and hypertrophic development. The short SRA curves of these pursuits are tailor-made for high frequency training.

If you're looking to try a high frequency program, here are some tips:

- Watch your fatigue carefully. If you feel like you're overreaching early in the program, back off.
- Try a 2-3 week phase of high frequency lifting first, and then return to normal training for several weeks. If you recover well and performance improves, try a longer phase of a month or so. Phases of super high frequency training lasting longer than two months at a time are not recommended.
- Don't go to your psychologically-taxing repetition max every day. Most of these programs have you doing a daily max that requires no pumping up or getting excited. That's to reduce the amount of nervous system fatigue and is the only thing that's going to keep you in one piece during the program.
- Make sure you're working hard and just at over your MRV. It's a program designed to intentionally overreach you and not meant to be sustainable.

In summary, super high frequency programming absolutely has its place, but it's by no means the only way to train to be the best you can.

3.) CARDIO IS GOING TO MAKE YOU GREAT OR CARDIO IS GOING TO KILL YOUR GAINS

For a long time, 'cardio' was a dirty word among powerlifters, and in many circles it still is. Cardio supposedly had nothing to do with powerlifting performance at best, and would actively interfere with adaptations at worst. More recently, according to a growing constituency of lifters, cardio enhances your gains and is an indispensable part of the

training arsenal of the powerlifter, particularly because it's supposed to enhance health as well as recovery.

In reality, neither extreme is completely accurate, but both have their values.

UPSIDES OF CARDIO

Being minimally cardiovascularly fit for powerlifting is phase-dependent. Cardiovascular fitness is most required during the hypertrophy/work capacity phase, as the high volumes and repetitions stress both intra- and inter-set recovery. You're in shape to do powerlifting when you can do 10's without completely cramping up and being unable to finish workouts. What kind of cardio shape do you have to be in to do that? Not amazing, but not the worst. If your active rest phase has a decent level of activity, and you're not highly overfat (20%+ body fat), your cardio should be sufficient. If you're overfat, the impetus should be on getting leaner and optimizing your body composition for your weight class, not getting in better cardio shape to adjust to the higher fat levels.

During the strength and peaking phases, the cardio levels established in the previous phases (hypertrophy, strength) should be more than enough to support the lower rep, longer rest time, and more sparse overloading session frequency of these phases.

If cardio ability is an issue that needs resolution outside of weight training, the most non-disruptive modalities are best, so swimming, biking, and incline walking are superior for the powerlifter when compared to running of any kind.

DOWNSIDERS OF CARDIO

The higher the volume of cardio, the more of the following becomes problematic:

- High fatigue accumulation
- Transition to slow twitch fiber types (faster recovery but lower forces and growth rates)
- AMPk and other signaling pathway activation that directly stimulates muscle catabolism
- Optimization of the nervous system away from high force, explosive expression toward low force, endurance expression

While it's quite obvious that all of these things are not desirable for the dedicated powerlifter, the second point is especially interesting. By increasing vascularization to the muscle, recovery rates may improve somewhat, which could definitely help with sustaining higher volumes of training. On the other hand, the fiber type conversions, while also improving recovery, can lead to decrements in both performance and adaptations. This one reason is why small amounts of cardio are possibly beneficial for overall health and basic recovery, but higher and higher volumes may impede adaptations, even though the athlete feels better and can actually train hard more often.

Now, in most lifters cardio will not prevent them from getting stronger. But it can prevent them from getting as strong as they could have been without as much cardio. Through this book we have operated under the assumption of engineering maximally effective performance increases, so we have to make sure to point out that even the improvements in

powerlifting performance seen during the inclusion of lots of cardio could be masking the unseen potential improvements that could have been elicited without perhaps as much cardio work.

The main points on cardio for powerlifting are

- A little goes the longest way (anything over 1500 calories per week is likely to be of a net negative tradeoff)
- Less disruptive/impactful modalities are best (walking, cycling, swimming, etc...)
- Pre-hypertrophy is the best time to do dedicated cardio (active rest block)
- Adaptation matters more than recovery, don't just "feel better" and keep doing more cardio... watch your rates of lift improvement as well

4.) OVER-SIMPLIFICATION OF TRAINING

The pendulum of ideas about training is constantly swinging between different concepts and an area that it has unfortunately swung to for many is one of overly simplified training. "Just shut up and lift", "quit thinking so much and just train." Axioms like these and others are setting back training and need to be done away with. Are there people who overcomplicate the training process and overthink their programming, creating a paralysis by analysis situation? Of course, but that isn't a reason to just throw out critical thinking about our training.

There are particular concepts (such as the training principles) that are foundational to great training and overlooking these concepts in an effort to be badass or hardcore or primal is just dumb. We have a wealth of information about what makes training effective and overlooking this information is foolish.

Study what is effective, create a plan and then execute that plan with the greatest effort and focus possible, all the while thinking critically about what you're doing and its effectiveness.

5.) HYPER-CONCERN ON THE DETAILS, MISSING BIG PICTURE

One of the best features of a priority-based approach is that it can not only tell you what works and what doesn't, but also inform on the effect magnitude of the training feature. For example, both overload and phase potentiation are important, but overload is much more so. A program without phase potentiation can bring good and even great results, just not the best results. On the other hand, a program without overload will bring exactly no results at all. Thus, when designing a program, significantly more time and effort should be spent on getting specificity, overload, and fatigue management right, without nearly the same attention paid to phase potentiation or individual differences.

Within each training principle, there is also a gradation from very important large elements all the way to small details. It's important to spend most time getting the large elements correct without losing too much time worrying about the nitty-gritty.

Now, there's nothing particularly wrong about the nitty-gritty. All details do have an effect on the total and if you can, you should be getting everything right, even the tiniest of concerns. A problem only arises when details are being focused on at the expense of larger components.

Some examples

- Altering minute toe angles while squatting only halfway down
- Wondering whether or not to go up by 2.5 or 5lbs on the dumbbell moves during a hypertrophy phase, while neglecting to add sets to the session
- Choosing leg extensions or adductor machine to do first, while needlessly avoiding front squats
- Reading Eastern European literature on fatigue management strategies in elite lifters while training at 2/3 of your MRV and missing whole training sessions

To avoid this mistake, focus on the important principles/priorities first. Within each principle, focus on the important, fundamental components. For example, before you concern yourself with the details of progressions, ask if an overload is being applied at all. Once you know it is, then the details of moving up 5 or 10lbs a week can be not only become more relevant, but more worthy of your limited time to program.

6.) MOBILITY WORK TO THE EXTREME

Mobility is the intersection of strength, flexibility and technique. You are mobile for an activity if you have both the range of motion with



good technique and you're strong through that range of motion. When powerlifters do "mobility work," what they're doing is really either flexibility or technique work, and mostly the former. So, how flexible do you have to be for powerlifting?

The answer is; enough to complete the lifts with proper technique! In other words; not terribly. There is some merit in pushing the flexibility bounds for sumo pullers so that they can get their hips closer to the bar, and some merit for arching maximally in the bench to limit range of motion and improve the leverages of the lift. If you can squat to below parallel without rounding over, aside from minor shoulder details you're probably pretty well off in flexibility for squatting. Larger lifters with back muscles so big that arches are prevented and conventional pullers simply don't need to be very flexible in the grand scheme.

Of course some people will absolutely have trouble getting even in the very basic positions and will need lots of flexibility work to get there and possibly stay there. But what about flexibility past the point of need? Is there a benefit?

Unfortunately, it's not that there is a benefit to excessive mobility work, it's that there are several costs:

- Too much flexibility can come at a tradeoff of stability especially for weaker lifters, increasing the chances of losing technique and getting hurt.
- Time spent on mobility work can be better spent either resting or training for size, strength, or power.
- Flexibility training (particularly tissue disruption like stretching and foam rolling) likely interferes somewhat with beneficial adaptive processes set in motion by weight training, possibly hindering gains.
- Performing flexibility work before training (mobilizing before the session) can decrease force output, leading to poorer performance overload ability

Like with many things if not all things, there can be too much of a good thing, even mobility. If you're mobile enough to do the lifts with good technique and you're not an exotic arch or wide sumo connoisseur, don't do any more mobility work than you are now, and especially not before hard training.

7.) TRYING TO DO POWERLIFTING, CROSSFIT & EVERYTHING ELSE WHILE EXPECTING GREAT RESULTS ALL-AROUND

Especially beginner lifters occasionally suffer from the misconception that an athlete can get better at all sort of activities at the same time, and that engaging in several athletic pursuits simultaneously does not interfere with progress in all of them. Luckily, beginners are actually correct in at least the first of these assumptions for themselves. That is, beginners have such a powerful ability to recover and adapt relative to their training loads as well as being able to receive an adaptive stimulus from so little training that they often indeed can progress at powerlifting, bodybuilding, and adventure races at the same time. They might even throw in a crossfit workout or two now and again and get better at that too!

However, intermediate lifters will be able to detect the effects of training modality incompatibility in their actual lifting if they try anything of the sort beginners can get away with. Gains will come much slower if lots of other physical activities are engaged in by the lifter. The fundamental reasons for this interference are:

- Energy taken up by other physical activities could have been used for recovery from and adaptation to powerlifting training.
- Energy taken up by other physical activities could have been used for more productive and overloading powerlifting workouts instead.
- (you'll notice that the combination of the above two factors; recovery ability and work capacity, is really a limitation on the MRV now available for powerlifting).



- Molecular signaling pathways and the adaptations they elicit often compete directly with one another, as endurance adaptations tend to directly reverse and crowd out strength adaptations.

The story with advanced lifters is worse still. The levels of overload required to make them better and the small margin of recovery ability they have left after those overloads have been recovered mean that even small amounts of extraneous physical activity will interfere with progress. Anything more than minor physical activity may stall progress altogether in the advanced lifter, or actually cause regression.

Interestingly, this seems to fit quite well with the development of dedication through a lifter's athletic career. Beginner lifters are not usually the most dedicated to the sport, as they tend to be young as well as just exploring their interest in powerlifting and many other physical pursuits. Intermediate lifters have invested the time required to at least earn the somewhat dubious distinction of "intermediate." But that's not wholly meaningless, as it likely implies they have at least a moderate proclivity for focused effort in the sport, and are also likely invested enough to knowingly drop other physical hobbies to enhance their powerlifting performance. Advanced lifters are almost always fully invested in the sport, and will usually do a good deal of "whatever it takes" to keep improving. If "whatever it takes" means doing less other physical activities, this usually isn't the toughest pill to swallow.

8.) THE FALLING FEMALE WEIGHTCLASS

The determination of "best weightclass for body type" is not the most straightforward calculation. Frame size, eventual muscle size, and formula results must be taken into account. On top of that, sheer preference is very likely to enter the equation, as not everyone wants to weight the 365lbs that is potentially their "optimal formula result competition weight" (and if you're over 6'2, it likely is at least that much!)

While sheer personal preference regarding appearance, health, or just plain nuisance (dieting sucks) is totally fine in helping determine your weightclass, we must be very clear when our calculations involve such preferences as well as only physical inputs of bone size and limb



leverage. Yes, it's totally fine to lift in a weightclass that might not be the best for your performance if you wanted to be the very best possible lifter you could at all costs, but it helps with clear thinking and informed decision making when you can objectively point out the preferences that led to your decision separately from the physical factors.

The ability to make this distinction is important in at least one common case; the falling female weightclass. Many (not all) female lifters have two main priorities in their involvement in the sport of powerlifting;

- a.) Compete well, get the best possible in powerlifting success
- b.) Look as attractive as possible

Males of course have the same constraints (to be addressed in the next section), but with females, the tendency to value priority b is often higher. While most female lifters understand that priorities a and b are often at odds with each other, some do not. Some female lifters are under the impression that the hotter they look, the better they'll do at powerlifting. Some of the often male coaches in powerlifting are of no help, as they tend to promote their female lifters seeking further gains in attractiveness at the expense of their performance. After all, a team of super-hot female lifters usually doesn't have trouble getting attention. Whether that's the desired kind of attention for powerlifting teams to be getting is an altogether different question.

Due to cultural and likely genetic reasons (female smaller than male considered attractive is a cultural universal and likely has genetic roots), most females prefer to be on the smaller side of the appearance spectrum, and thus tend to gravitate towards the lighter weightclasses. And there is absolutely nothing wrong with that, so long as it is consciously admitted and not conflated with a quest for performance. The problem is that for a small but substantial minority of female lifters, the admission of competing attractiveness goals has not been made. Females the world over have (and are right now, as you read this) convinced themselves that they need to drop from the 123's to the 114s to get better at powerlifting. If this is in fact the case on purely physical grounds, great. But if the quest for lower and lower weightclasses occurs due to a desire to be attractive masked as a desire for higher formula performance, some unfortunate consequences may result.

Female lifters that are seeking attractiveness knowingly have only the usual pressures to deal with (boyfriend tells you you'd look hotter if thinner, favorite celebrity is thin, peer pressure from girlfriends, etc...).

However, females that are under the misconception that they'd be better lifters the lighter they got are under additional pressures from coaches, teammates, competition results, and their own drive to succeed in the sport. Coaches that needlessly push weight loss for attractiveness under the auspices of competitive enhancement are especially nefarious in this phenomenon, as they are violating the lifter's trust that their advice is solely to make the lifter better at the sport while keeping them safe. In reality, their advice to keep dropping weight is often neither good for performance nor mental and physical health. The added pressure of weight loss from competitive aspirations can lead to a drop in perceptions of self-worth, self-efficacy, and self-esteem. This pressure can also lead to depression and eating disorder development in more extreme cases.

Now, if you really will be better at a lower weightclass, at least that pressure has a payoff. If you're not going to be better and instead keep dropping weight under that illusion, then the payoff of the weight loss (thought to be added perceived attractiveness and competitive enhancement but in reality only the perceived attractiveness) is lower than you had calculated and may not be remotely worth it.

In summary, know why you're losing the weight and competing at the lower class. If it's to look like what you think is better and you're in good health, fine, so long as you understand that it might not be the best decision for your powerlifting performance. But if it's supposedly to enhance performance when it's really not, that illusion can lead to psychological and possibly health consequences.



9.) THE MALE BLOAT PROJECT

A lot of girls want to get smaller, but a lot of guys want to get huge. And everything needs to be big. Shoulders, arms, legs, biceps, even calves!

For the most part, this is not a problem for powerlifting performance, so long as the “vanity muscles” are trained with the understanding that they will not make you much better at the sport, and by taking up lifting time and energy, might make you a bit worse or not as good as you could have been.

Another issue in male lifting circles is that some guys seem to think that the bigger they get, the better they will lift. Eat big, lift big, as the saying goes. There is a lot of truth in this, but some caveats apply:

LEVERAGES

Getting much bigger can alter leverages. This is both a blessing and a curse in various lifts. Bigger guts can push directly down on legs at the bottom of the squat, creating more intra-abdominal pressure and even some rebound force. On the other hand, this can round the lower back and increase the chances of injury. Bigger midsections and thighs can push your center of mass further back from the deadlift bar, which usually stalls or even reduces performance on the lift. In the bench press, more tissue means less range of motion, and in most cases, lots of weight gain is the surest way to increase your bench.

SHORT TERM BLOATING DOWNSIDES

Carrying a large bloat (subcutaneous water content) used to be the holy grail of equipped lifting because a bigger bloat allowed gear to fit tighter and pushed up numbers, especially if your gear was measured for your bloat and wasn't too small. For raw lifters, however, big bloats cause more trouble than they solve, as high blood pressures tend to make fainting after big lifts more common and the extra weight and leverages can throw off proprioception and body awareness, leading to technique disruption with the highest loads.

STAYING REALISTIC WITH MUSCLE GAIN RATES

In the long term of weight gain, it's important to stay focused on muscle gain. Though some people can gain 30 pounds per year and keep it on no problem, even 10 pounds of muscle gain per year is very impressive and only likely for relative beginners. By gaining weight slowly (only 1-2lbs per week during gaining phases) and periodically dieting the added fat off, mostly muscle can be gained in the long term, ensuring

not only a great total, but a great formula result without the added non-contractile fat tissue being carried around. It's tempting to want to be huge now, but size comes over years, not months.

HEALTH AND QUALITY OF LIFE CONSIDERATIONS

Many males are notorious for voluntarily putting themselves in harm's way for egotistical pursuits and glorious accomplishments, even when the glory is mostly their own perception. There is absolutely nothing wrong with trying to get as big as you can, and the authors of this book would be some of the biggest hypocrites (literally as well as figuratively) if we wrote otherwise. However, it's important to keep in mind what you're trading off when you're trying to get big. The bigger you get, on average, the lower your life expectancy becomes. There are very few 70 year olds who ever used to weigh over 300lbs. There are also more minor concerns such as sleep apnea, which while safe if controlled, still means you have to sleep with a machine on your face. Lastly, the issue of physical comfort. Giant people have trouble fitting into most places, buying clothes, getting into and out of cars, and all kinds of other nuisances. If the serious concerns are known tradeoffs and the nuisances sources of comedy, that's totally fine... just know what you're getting into.

10.) GYM TOYS

Training tools of various sorts can be an important methods of generating effective training, especially when they are used to enhance directed variation (leg presses, pec decks, etc...). However, not all tools are created equal, and some gym equipment is so limited in its effect that use of it can almost on principle be called fallacious.



Three big offenders come to mind. The first two offenders are Bosu Balls and Wobble Bars.

Any time an exercise becomes less stable, force production declines and proper overload can no longer be supplied. Thus, any modality that highly disrupts the stable application of force is likely to be highly ineffective. Importantly, the kind of stability required under maximal loads is likely specific to maximal loads, so these modalities almost certainly don't even help you maintain technique under heavy weights as they are sometimes advertised to do.

The third offender is the Kettlebell.

Kettlebells are not all bad. They are made of iron, which can be heavy and can be lifted to generate a stimulus. Using them for properly loaded exercises is just fine. The problem is, they usually don't come too heavy and if they do, they are much tougher to effectively handle than barbells and dumbbells. Using kettlebells for shoulder work is great, but if you're trying to using them for quad work, you're quickly going to run into problems of underloading. Most importantly, kettlebells are effective because they provide a resistance. An exercise that can be done with a barbell that is done with kettlebells is not on principle more effective... there is no magic to any modality including kettlebells... it's just weight with a handle.

11.) RANDOM DAY-TO-DAY TRAINING

“Felt like doing front squats after squats today.”

There is absolutely something to be said for noting priority areas and thus changing the program for weeks at a time. There is also something to be said for fatigue management and the need to take light sessions when needed ala autoregulation. However, this does not mean that programming should be designed the day of a training session and for training to be random. If you train at random, you get random results. The more you can intelligently plan your training for at least a mesocycle at a time, the better you'll do in the long run, period.

12.) MAGIC PROGRAMS, OR “PROGRAMS ARE POINTLESS”

On the one hand we have the following sentiment:

“Every program works if you train hard.”

On the other:

“Have you tried the new Sheiko Renaissance Elite Juggernaut Cube Psycho Texas Deepwater Westside Method for Natties?!?”

Programs work for only one reason; that reason, or rather, reasons are the principles they are designed around. A program is only as good as its principles, which means three things:

a.) It is close to meaningless to say that program design doesn't matter

As an overreaction to so much copywriting and salesmanship on the part of program authors, some have found popularity with the sentiment that the program you do doesn't matter... as long as you do it right and train hard, you'll see results. While beginners will find this advice the most true, that's only because beginners get stronger with any sort of training that is remotely related to picking up and putting down heavy things. Intermediate lifters will find this advice wrong at least half of the time when they stumble upon crappy programs or those not properly tailored to their individual needs that can no longer sufficiently challenge their more resistant physiology. Advanced lifters will find this advice to be almost wholly wrong for them, and will both have such particular needs in filling out weak points and such deep knowledge on their own body's

responses that they will almost always train with a customized program and rarely run any published system verbatim.

b.) Most programs can be effective if altered for individual differences

By altering just a few variables (described in detail in the chapter on individual differences), most programs are conducive to good results even for intermediate lifters. When this caveat is given with point a, the truth value of that point is greatly enhanced, though to be fair, if you change a program enough, it might start to look nothing like the original!

A PROGRAM IS ONLY AS GOOD AS ITS PRINCIPLES

c.) There are no magic programs that get you strong by name only

It doesn't matter who wrote the program and what it's called, the principles are what matter. German Volume Training sounds super exotic, but in reality any program can be given a similar effect if you just do more sets and reps! The feature of high volume is an element of overload, which is a principle that particular program gets right at least in relation to volume. It's not the name; it's the actual programming that counts. A lot of guys swear by DUP, but have no idea why it works. They could fall victim to future programs that market themselves as DUP in name only, but lack the meaningful volume/intensity variations within

the week to promote recovery/adaptation, which is why DUP works as well as it does. Sport scientists don't even like the term 'DUP' because they prefer to use the technical "intra-microcycle volume variation," which actually describes what's going on and gives a clue as to the mechanisms of the benefit. If you know the principles of training, you don't ever have to fall for gimmick programs with impressive names or authors... you just look at the program and decide if it concords with the principles (and to what extent it does or does not). Knowing the principles, you can make an informed choice about whether or not to try the program yourself or recommend it to others.

And on that very appropriate note, we close out this book. In fact, the paragraph above really puts quite well why this book was written in the first place. There is no "Renaissance Method," there are just the scientifically-founded and practically-backed principles of powerlifting training that can let anyone select, critique, and design effective powerlifting programs.

We hope you enjoyed the information in this book, and we wish you all the best in applying it to what has been referred to by Prince Vegeta himself as the only thing in this world that matters: Strength.