RENAISSANCE PERIODIZATION
SCIENCE IS STRONGER

HOW MUCH SHOULD I TRAIN?

AN INTRODUCTION TO TRAINING VOLUME LANDMARKS

Dr. Mike Israetel / Dr. James Hoffmann

About the Authors

Dr. Mike Israetel holds a PhD in Sport Physiology, and is currently the Head Science Consultant for Renaissance Periodization. Mike was formerly a professor of Exercise and Sport Science in the School of Public Health at Temple University in Philadelphia, where he taught several courses, including Nutrition for Public Health, Advanced Sports Nutrition and Exercise, and Nutrition and Behavior. He has worked as a consultant on sports nutrition to the U.S. Olympic Training Site in Johnson City, TN, and has been an invited speaker at numerous scientific and performance/health conferences, including nutritional seminars at the U.S. Olympic Training Center in Lake Placid, NY. A co-founder of Renaissance Periodization, Mike has coached numerous athletes and busy professionals in both diet and weight training. Originally from Moscow, Russia, Mike is himself a competitive bodybuilder and Brazilian Jiu Jitsu grappler.

Dr. James Hoffmann is a consultant for Renaissance Periodization. He is also the former Program Director of the Exercise and Sport Science program and the women's Rugby team coach at Temple University in Philadelphia, PA. While at Temple, James taught courses in strength and conditioning theory, strength and conditioning practice, exercise physiology, and biochemistry. James earned his PhD in Sport Physiology under Dr. Mike Stone of ETSU, where he focused on the application of sled pushing to sport performance enhancement in Rugby players. As the team's assistant coach and Head Sport Scientist, James has coached numerous Rugby players at ETSU, where he was also the head strength and conditioning coach and weight room manager. Originally from Chicago, Illinois, James is a lifelong athlete, who has achieved high ranks in competitive Rugby, American Football, and Wrestling, and is currently pursuing Thai boxing.

About Renaissance Periodization

Renaissance Periodization is a diet and training consultation company. RP's consultants, including the authors of this book, develop diets and training programs for every kind of client. RP works with athletes who are 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 of a company that delivered the absolute best quality of diet and training consulting to its clientele. By hiring almost exclusively competitive athletes that are also PhDs in the sport, nutrition, and biological sciences, and/or Registered Dieticians, 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 produces self-coaching diet and training templates, publishes numerous books and articles, and produces instructional videos on diet, training, periodization science, and all matters involving body composition and sport. To date, RP has helped over 100,000 people improve their fitness and health, with more success stories accumulating every day.

Visit us on the web at: https://renaissanceperiodization.com

Find us on Facebook at: https://www.facebook.com/RenaissancePeriodization/

Find us on Instagram at: https://www.instagram.com/rpstrength/?hl=en

The authors would like to thank Szoták András for his incredibly perceptive editing of this book's first draft. We'd also like to thank Broderick Chavez of Evil Genius Sports Performance for his insights on several of the deeper training implications of our work.

TABLE OF CONTENTS

INTRODUCTION

If you want to get more muscular, leaner, more fit, or better at any sport, you've got to train. This is not a controversial idea. It's also pretty well known that you've got to train pretty hard: that training has to be challenging for best results. The question is - exactly how much to train to get best results? Well, that one doesn't have nearly the same consensus, and is the very question that lead us to write this book.

Here are a couple of common answers to the volume of training question:

A. "Enough to get what you want."

B. "As much as your willpower permits… winners give it all."

C. "Just enough to steadily progress. Chasing the maximum will get you burned out or hurt."

D. "The middle road is best: not too much, not too little."

Quite the diversity of answers, some of which you may have come across yourself. When we were working as sport scientists and supporting coaching staff, these were typical axioms we heard from coaches and athletes alike, but none of them were satisfactory to us. As we will explore, some of these answers don't make much sense, and the ones that do are still not completely correct.

Say you picked answer A, and that "what you want" is to be the next Lebron James in basketball. Unless you're one in a billion, there's no amount of training that will do that for you. Even if there were, how would you plan your training week? Getting that good at basketball takes years even for the very talented. So, given answer A's logic, how many years would you conclude that you need to train to get to his level? As you can see, the problem with this answer is that it's both too vague and unrealistic.

The trouble with answer B is that it leaves no room whatsoever for limitations of recovery. According to this answer, if your willpower is strong enough to have you lift weights with maximal effort for 16 hours each day, this training strategy will make you the biggest and strongest you could be. In fact, this strategy will make you neither bigger nor stronger, because such an effort is almost certain to put you in the hospital with Rhabdomyolysis, exceeding your body's recovery capacity by an order of magnitude. So, this answer too isn't a viable option for even the most highly motivated athlete.

Answer C is considerably more nuanced, intellectual, safe, and appealing than A or B, as it sets up a way to objectively check if you're on the right track: if you're improving, you must be! Unfortunately, this answer is also too vague and unqualified, as very few people are training to just "make progress", without the qualifiers of "as quickly and optimally as possible". As such, answer C is a "throw spaghetti at the walls to see what sticks" strategy, that promotes any gains as success, rather than strategizing for the best or most efficient gains possible.

Answer D is measured, but plays it too safe to be intellectually honest. Yes, there is *some* wisdom in taking the middle road in some situations, but advising someone to "not drink too much or too little cyanide" isn't sound advice. We can't say that *the middle road exactly* is best, even though this strategy is justifiably cautious, aimed at avoiding extremes. Even if it turns out to be the best answer to our training amount question, exactly how much is that? The middle of the road between what two landmarks? Again, this commonly heard recommendation, like the others, comes up short.

As we consulted coaches on the intricacies of their program designs, we ran into a recurring problem that echoed the flawed logic of answers A and B. Nearly all of the coaching staff typically programmed the maximum work possible for their athletes. For instance, if the athletes had a certain number of hours of field work, and it came time to prescribe weight room work, it was typical for coaches to simply stack the weight room hours right on top of the field work, with seemingly no regard for athletes' recovery abilities.

We wanted to convey to these coaches that it wasn't productive to simply add as much total training as they could cram into their athletes' days. At some point, there was going to be more training than the athletes could recover from, and their performance would actually suffer instead of improving. We searched in vain for a succinct term or concept to communicate this reality to coaches and athletes. Finally, we decided that we ought to fill that void. Dr. Israetel came up with a term to describe this training volume 'ceiling'. Dr. Hoffmann quickly adopted this term as well, and became instrumental in its evolution and real-world application.

Thus, the concept of Maximum Recoverable Volume (MRV) was born. As it was defined, developed, and applied further, related concepts were derived and borrowed with modification from other fields, to answer the original question of "How much should I train?" with increasing precision and accuracy. This group of concepts - which we term the "Training Volume Landmarks"- are now such a useful part of our vocabulary, that we wrote this short book to share them with you. Our hope is to enable you, our readers, to consider these concepts and possibly apply them to your own training or coaching. Why would you do that? In short, to help you achieve what you likely wanted to achieve when you first started training or coaching: to get the best results in the shortest time possible.

As you read, please remember that while these concepts and specific recommendations are grounded in well-established science, much of this discussion is theoretical in nature. This means that we do not want you to think of anything written here as a hard and fast rule, extensively research-confirmed science, or infallible dogma. We'd much prefer to offer the contents of this book to you as a likely estimate of what's really going on in physiology, and hope you use it as food for thought that enables you to get the most out of your own training, and the training of those you help. Lastly, if you're new to reading about sport science, we highly recommend that you familiarize yourself with the basic terms and concepts of training theory before diving into this book, which assumes you know those concepts quite well. If you need an introduction or refresher to said concepts, we highly recommend our classic book, Scientific Principles of Strength Training.

To start measuring your training volume progression and applying the learnings presented herein to your training, Worksheet Templates for Volume Landmark Tracking the has been enclosed on pages 112-113.

- Mike Israetel and James Hoffmann

1 MAXIMUM RECOVERABLE VOLUME

Derivation:

While training intensity is a measure of how *hard* you train, training volume is a measure of how *much* you train. The definition of volume is largely dependent on what sport or physical activity is being described. Fundamentally, volume is the amount of physical work being done, where work is defined as average force multiplied by the distance over which it is exerted. Volume can be represented as the number of meters swum, miles run, kilometers cycled, hours trained in MMA practice, and/or the multiple of sets, reps, weight and distance of displacement of a barbell, among many others.

Volume is the scientific way of saying "how much" training is being done. So, for any athletic ability, the question becomes: "How much volume will lead to the best gains over time?" Due to one very fundamental rule in physiology, the "as much as possible" class of answers to that question can be written off as wrong from the get-go. That rule is this: under any given set of conditions, the body has only a *finite ability to recover from training.* Recovery is defined as "a return to the performance ability level existent prior to the current dose of training." So, if you usually run a 6:30 mile, and you've healed from squatting-induced soreness and are back to running 6:30 or faster, we can say that you are "recovered" in the technical sense. Of course, if your thighs and glutes are still burning from those squats during your next run, and you only manage an 8 minute mile, you haven't recovered, illustrating that sufficient amounts of training volume will inhibit one's ability to do so.

Since the body has a finite limit on its recovery ability, it stands to reason that training which exceeds the body's ability to recover is not training that will produce the best gains. In fact, if recovery is not made, *by definition*, the individual just got worse at what they were training for! Whatever other principles you use to inform your training program design, this one is a sure thing: do *not* chronically exceed the recovery ability of the individual(s) being trained!

Because it's a bit laborious to explain all this every time you might like to communicate it, we've developed a term - and even an acronym! - for this concept. You may have heard of it as "MRV."

Definition:

Maximum Recoverable Volume (MRV) : The *highest* volume of training an athlete can do in a particular situation and still *recover*.

A deeper look into the principles of training program design can give us an even more precise definition of MRV, which is even more useful for getting the best long term results. We know that in order for gains to be made at optimal rates, training must be overloading. In order to be overloading, a training stimulus has to be both within the maximal threshold of the system and/or ability being trained, *and* be higher in magnitude than recent historical overloading stimuli. In oversimplified terms, this means that training must be hard, and that the next training session must be harder than the last: overload and progressive overload.

If we don't have to meet that second condition of overload, we can train in absence of a full recovery. Say you squatted 300lbs on average in your last leg workout, and 315 is your all-out best effort for those sets and reps. But, during the current workout, you only squat 290. Can we really say that the workout with 290 wasn't overloading at all? No: it's still partially overloading, in that it meets our first criteria of being within the maximal threshold of the system, that is, challenging and disruptive enough to stimulate meaningful and dependable gains (as ten pounds less on a near maximum squat is still 'hard'). In fact, any stimulus approaching about 90% of most systems' maximum abilities is usually challenging and disruptive enough to yield some gains. To cause the *best* gains, however, that following stimulus has to be greater in magnitude than the one prior. So, a stimulus that's "easier than last time but still very hard" will result in gains, but will not result in the *best possible* gains. Further, if you haven't recovered from your last stimulus - regained your full abilities - it is by definition difficult to impossible for you to make the next stimulus both hard and *harder than the last.* Very simply put: if you have not recovered enough to squat what you did last time around, how the hell are you supposed to squat more this time around?

Let's take a look at Figure 1 to further understand how to meet both conditions of overload. The first box in Figure 1 illustrates the training paradigm in which successive microcycles - the small circles - are both below the overload threshold and decreasing in stimulus, which means such training is not overloading by any definition. The second box illustrates progression in stimulus strength, but none of the microcycles enter into the overload threshold and thus while progressive, this training setup is not overloading either. Box 3 illustrates a paradigm in which all training is above the overload threshold, but gets easier over time. Such training is partially overloading because it meets the threshold condition but not the progression condition. Box 4 represents fully overloading training. All stimuli are within the overload threshold and are progressive in nature, which is most likely to lead to the best outcomes over time.

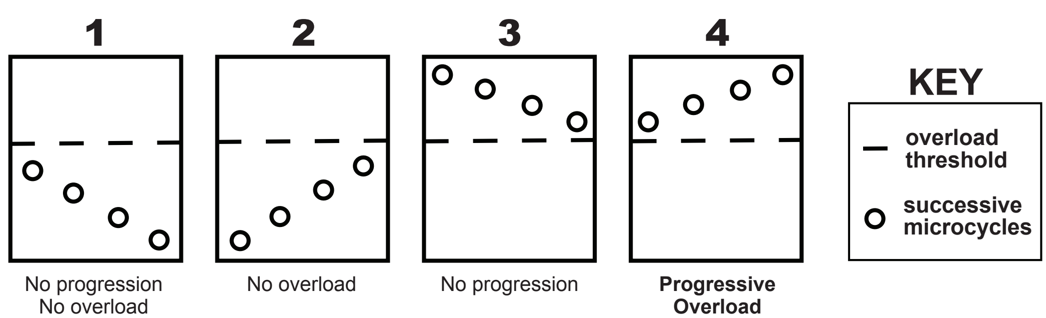


Figure 1. Full and Partial Overload: Box 1 illustrates a training program in which successive microcycles (the small circles) are both below the overload threshold and decreasing in stimulus. Box 2 illustrates progression in stimulus strength, but none of the microcycles cross the overload threshold. Box 3 illustrates a program in which successive microcycles are above the overload threshold, but decreasing in stimulus. Box 4 illustrates a program in which all stimuli are above the overload threshold and are progressive.

Yes, in the very short term, you can still manage an overload, potentially even a progressive one, without recovery of ability. In the longer term, however, by which we mean more like days and weeks, recovery must occur to allow for full overload – and thus best gain rates – possible. Given this, we can now redefine MRV more specifically:

MRV : The *highest* volume of training an athlete can do in a particular situation and still *recover* to present a full overload in the next training timescale.

To recap, presenting a full overload, that is, one that's both challenging and progressive, is critical to getting the best rates of gain in ability. As a result, chronic elevations of training volume above MRV are counterproductive, and hence ill advised.

But wait, what is a "time scale?" Well, we can't just ask how much training you can do and still recover without specifying exactly when we are planning to measure your recovery. It turns out that *when* you measure recovery matters a lot. For instance, if you measure ability immediately after most any training session, recovery will not have happened yet, causing your results to come back "unrecovered". Does that mean training makes you worse?! Actually, yes, it does, but only in the very short term. Once you've had rest, sleep, and proper nutrition following most reasonable training sessions, your abilities return back to baseline. So, as you can see, the point at which we measure recovery is critical to rendering MRV a useful concept. Though a few checkpoints will do, the most useful time to measure recovery is *right before you plan to overload again*. Because overloading is the central process of training and the one that necessitates recovery, recovery must occur during the interval between two overloading training sessions, which target the same system or ability. Since most sessions are scheduled to repeat on the microcycle (about a week of training in most cases), it's usually most productive to formulate MRV in microcycle terms, as follows:

MRV : The *highest* volume of training an athlete can do in a particular microcycle and still *recover* to present a full overload in the next microcycle.

Is it possible to consider MRV on other timescales? Of course. An exercise-scale MRV is "the *highest* volume of training an athlete can do in a particular exercise and still *recover* to present a full overload in the next exercise." We can envision doing so many sets and reps of squats in the first exercise that performance in the second exercise, say deadlifts, can no longer achieve overload because of the massive fatigue induced by the squats. This would be an excession of exercise-scale MRV. A session-scale MRV is "The *highest* volume of training an athlete can do in a particular session and still *recover* to present a full overload in the next session." If you trained deadlifts so hard on Monday that on Tuesday you can't overload on bench because your back is too fatigued to set up a proper arch, you have exceeded your session-scale MRV. On the longer timescales, we can have mesocycle-scale MRV, which would be defined as "the *highest* volume of training an athlete can do in a particular mesocycle and still *recover* to present a full overload in the next mesocycle." Say you had an awesome accumulation phase, which is the actual overloading training of a whole mesocycle of training. But then, imagine you decided to cut short your deload following accumulation, and consequently became too fatigued to have a productive overloading next mesocycle. In this scenario, we would say that you've exceeded your mesocycle-scale MRV.

We could list definitions of MRV for still other timescales, such as the season, the macrocycle (several mesocycles strung together for 4-12 months of training for a specific goal) or the year, all of which are certainly theoretically interesting and useful concepts. But, fundamentally, the most meaningful presentation of overload is from microcycle to microcycle, mainly because most athletes and coaches use the training week as both their most well planned and most fungible training timescale unit. Thus, we will be referring to MRV in its microcycle timescale from here on out, unless otherwise specified.

Within this definition and timeline, the ability to generate a full overload does not necessarily imply that a complete recovery of actual physiological systems must occur between microcycles. In fact, chronic and accumulated fatigue from other training sources make that virtually impossible in most training situations, considering that most athletes train multiple times per week, with multiple modalities. In some cases, a full and complete physical and psychological recovery from a deadlifting session or wrestling practice may actually take much longer than the length of the microcycle itself. The good news is that we can still meet both criteria of overload even if a true and complete recovery has not been achieved. When we say 'true and complete recovery," we are referring to the dissolution of *all* damage introduced by *all* training: full repletion of glycogen, full repair of all tissue damage, return to homeostasis in all systems after disruption, and so on, rather than simply the ability to perform as prior. In other words, being recovered enough to generate a full overload should be thought of as more of an operational range of training states, as compared to the unicorn of being completely, holistically recovered. Some days, athletes may be carrying more or less training fatigue than others, and that's perfectly ok, as long as they can meet the criteria of overload for individual training sessions, which is to "be able to perform at or above the previous cycle's levels of ability."

PHEW! That's one hell of a definition. Alright, so why is MRV so important to know and understand?

Importance:

All of this talk about MRV had better mean that MRV is a vital concept for us to both theoretically understand and utilize in training. Indeed it is. In this section, we'll illustrate the centrality of the MRV landmark. To start, let's see how MRV's importance can be categorized into general program design, personalization of program design, recovery monitoring, and recovery intervention.

1. General Program Design

The most obvious importance of the MRV concept stems from its usefulness in structuring program design. More specifically, the strength of the MRV concept lies in its delimiting the program structures that can be considered for application. Any program that has excessive volumes of training should be automatically suspect, out of consideration for the MRV reality. Overload is difficult, if not impossible, to present when training above MRV. Overload is critical to long-term progress. Thus, any training that exceeds MRV for a repetitive and continuous stretch is less than optimal (Figure 2). To put it more bluntly, training above MRV for long periods is a good way to dependably make athletes worse and/or get them hurt.

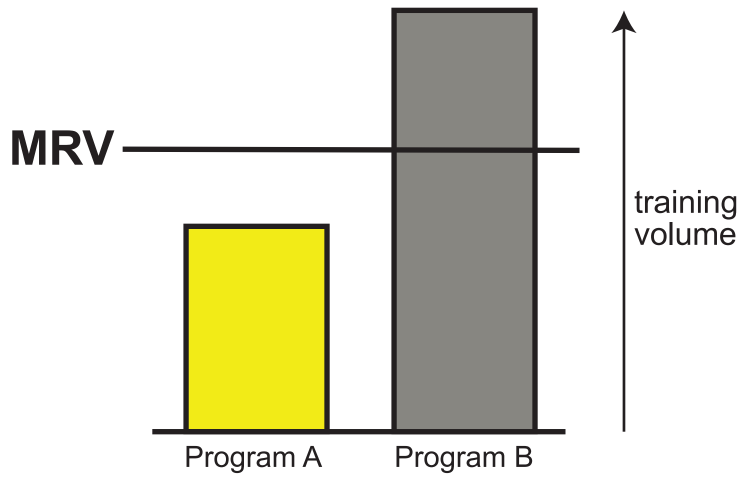


Figure 2. Excessive Training Volumes: A and B represent two training programs of different volumes. The training volume in program A might work to improve performance (assuming there is enough volume to result in adaptation). Training program B is almost certain to decrease performance as it exceeds MRV.

If you ask your coach: "How long is practice today?" and he replies: "As long as it takes to learn the drill," that's bad news for the athletes. If their complaints about being exceptionally and consistently sore from the combination of sprint drills and high rep lifting that their coach introduced a couple of weeks ago go unheard, that's increasingly problematic. If a body part we're trying to grow starts to stall out, and our recourse is to add volume to the lifts for that body part, we need to reevaluate our training practices.

The design of any training program should incorporate a max volume amount, and underscore that exceeding this upper bound for too long or too often is unproductive at best, and counterproductive and risky at worst. This utility of MRV is why we coined and started using the term to begin with. Coaches we were consulting would occasionally want to add some new training element to the team's program, be it conditioning, lifting, or more technique practice. When we were presented with such propositions, our job was to communicate to them that doing so was ok, only so long as they simultaneously reduced some other training to keep their athletes from under-recovering from too much volume. We might ask an eager coach: "Well, that would be over their MRV, so where can we make some reductions to fit in this new priority?" The MRV term was critical in enabling us to structure ideas and communicate these important concepts to coaches. The clearly defined MRV concept allowed us to educate coaches about training volume limitations, so they could lead their athletes to continual performance gains. Once we explained MRV to coaches, the vast majority intuitively grasped the concept and began to use it in their training. In other words, believe it or not, they stopped assuming that more was always better.

As a coach, athlete or sport scientist, you may find that this axiom of "more is better" comes up again, and again, and again, in training circles of all kinds. We believe this is for two reasons. The first is that there is an element of truth to it. When coaches look around, and see hard-working athletes outperforming lazy ones season after season, their first conclusion may be to instruct their athletes to constantly do as much they can. The failure to see the ceiling for the "more is better" axiom is where coaches fall short. Secondly, these anecdotal prescriptions are coupled with a culture probably as old as sport itself: one that praises hard work, pain, and suffering to reach goals. Few coaches want to be known as the easy coach; conversely, many would love to be known as a hard-nosed contriver of various sport-related tortures. Again, while it is understandable and justified to associate hard work with results, the problem is that this unrefined cultural understanding fails to recognize the limitations of the association between "pain" and "gain". Blame passing can likely be held accountable for feeding the failure to recognize that harder work does not indefinitely produce better results. After all, if the athletes burn out with the hard coach, it's easy to blame them for lack of effort, motivation, or for their lifestyle choices. This culture extends to athletes just as much as coaches, which means that most athletes will also be quite happy to blame anyone who burns out, themselves included. What they will almost never blame is their training program, for potentially being "too hard." Ugh, that feels lame to even write, let alone experience! This "hardcore" culture is so entrenched in us that even sport scientists like ourselves have felt its pressure, despite knowing better.

In your own use, just remember that, at its core, MRV means there is such a thing as "doing too much," and whatever kind of training you practice, program, consult on, or witness, it is best to have that understanding reflected in its design. In the context of programs that train multiple attributes especially, we must remind ourselves that time, effort, and recovery ability are finite resources. We simply cannot keep adding training without taking those same resources away from other aspects of training or recovery.

2. Personalization of Program Design

How much is too much for you? Certainly not all individuals or teams will have identical responses to the same program or share the same MRV? In fact, they absolutely will not. There is a large variance in MRVs between both individuals and teams of individuals, and we will get to the reasons behind that variance in a later section. For now, just the fact that there *is variance in MRV* means that it should be heeded in program selection and design. If you try to DIY an exact replica of a pro bodybuilder's program, what happens if his MRV is way above yours, and thus most of his program is way too much volume for *your* best gains? If you create training programs for others, how do you know that the sets and reps you've chosen for them aren't too much? Just because you can recover from a given stimulus, does not mean *all* of your clients or athletes can. Conversely, some of your clients or athletes might be able to handle more than you can in your own training. Population differences also exist. For instance, if you are used to training teams at the high school level, and then transition to your first collegiate job, or if you are used to training Division III athletes but score a Division I job, can you be sure that the training amounts that worked for your prior team will work for your new one? You will likely need to adjust for MRV differences in all of these cases.

Does this mean that if you have athletes or clients with the same goals, or on the same sports team, that each of them needs completely unique programs? Absolutely not. In fact, their programs will probably be much more similar than they are different. Among otherwise very similar programs, however, what will likely differ from person to person will be the volume of training needed.

Using methods that will be described in detail a bit later, it's entirely possible to discover the MRV for yourself, your client, or a whole team average. Finding MRV, knowing it, and updating it as it changes are critical steps on the path towards consistently better results. If you don't know your MRV, or the MRV of the athletes you're training, you risk some very serious drawbacks.

3. Recovery Monitoring

There are technicalities to finding your MRV, but for now, suffice it to say that it's going to have a lot to do with determining your level of recovery. If you are recovered, then it's very unlikely that you trained over your MRV, given that insufficient recovery is the result of exceeding it. If, however, you find yourself not sufficiently recovered, there is now a distinct possibility that your training volume is too high for your best gains to occur. Sure, chance events here and there can impede recovery in the short term even with chronically appropriate training volumes. For instance, the stress of an academic exam can lower physical performance, but doesn't automatically indicate that the whole rest of the month-long training program was excessive. On the other hand, recurring recovery deficits are a sign that perhaps you are exceeding your MRV.

The MRV concept makes regularly monitoring recovery status a very important feature of training program design, because a chronic condition of under-recovery can no longer be characterized by phrases like "good training is supposed to beat you up", and must instead be interpreted to mean that optimal gains are *not* being made and that something must be adjusted.

4. Recovery Intervention

When optimal gains are not being made, reducing training volume is one solution to the problem. The other option for promoting recovery is to simultaneously increase recovery interventions. If we look back at the MRV definition, volume isn't the only variable at play, as rate of recovery is just as important. So, do you hit your MRV when your volume is too high for the degree of recovery you're capable of making? Or, rather, is your degree of recovery not high enough for the volume you need to be training at to get better?

Going back to our Lebron analogy, what if it took a hypothetical 22 hours of training a day for 5 years for you to attain Lebron's level of basketball aptitude? Impossible? Impossible is nothing, if you wear enough Adidas gear, and really buy into their slogan! In all seriousness, what if aliens came down to earth and put world peace and clean energy on hold, to give you a pill that let you completely recover, physically and psychologically, from 22 hours of training a day, indefinitely. Yeah, you'd pretty much have a realistic roadmap to becoming a basketball great! And it had nothing to do with lowering volume, but got you within your MRV by expanding your recovery. The point is that any time your goal is to be within your MRV constraints, which should be nearly always, you don't necessarily have to lower volume at all times to get there if you can raise recovery abilities instead. But how can you do that? By sleeping enough and sleeping well, relaxing and resting enough, eating enough and well, and properly designing the details of your training structure, among many other interventions. For the purposes of this discussion, unless your recovery intervention is perfect – in most cases unlikely – you always have the option of raising your MRV by improving recovery, versus by only lowering training volume.

But why mess around with recovery interventions if you can stay just shy of your MRV by lowering volume? Certainly, lowering volume is much easier than having to go to sleep at a set time each night and watching your diet. The catch is that, provided you can recover from and adapt to it, more training *is better:* there's that seed of truth in the old "more is better" axiom.

Only when there is a recovery deficit does that cease to be the case. This means that you should *want* and *try* your very best to apply the recovery modalities in order to raise your MRV as high as possible. This is because the higher your MRV, all else being equal, the more you can train, and the more you will improve. Only *after* recovery is well taken care of should you, as the dedicated athlete or coach, push to lower training volume when MRV is still being exceeded. Put another way, the very best athletes have to train *so much* to get better, that only their consistent application of recovery modalities allows them to stay under their MRVs, and hence optimally improve over time.

In a perfect world, we would never have to lower volumes, because our recovery would be infinite and instant. Or, if recovery rate and training volume and/or intensity were static, constant values, we would reliably know our MRVs, and never risk exceeding them. But, here in the real world, at any given time, multiple factors affect both the impact that training has on recovery and the quality and quantity of our recovery abilities. For that reason, MRVs can be wildly different, not just between individuals and teams, but for a single individual, between different demands of the training program, and under different physiological and psychological circumstances.

Sources and Nature of MRV Differences

If MRV were an exact and stable value for all individuals across all situations, training science would be a lot easier! Unfortunately for us, MRV changes quite a bit, depending on several factors, some of the more prominent of which are discussed below. This discussion is split into factors that are largely genetic in origin, those that have more to do with individual histories and lifestyles, factors that differ between or within training programs, and factors that tend to change predictably over the course of an athlete's training career. Most of the examples refer to muscle growth as the main characteristic being trained, but the principles work in very similar ways with any other sport or ability.

Genetic Factors

1. General Genetic Recovery Factors

The physical processes in the body that lead to recovery are influenced by your environment, but based in your genes. No matter the environment, some folks just have better genetics for recovery. Whether that's because they have higher testosterone levels to stimulate recovery machinery, because they have more, or faster, or better-functioning recovery machinery, or some combination of these, some people just have the genetic predisposition towards more effective recovery. For some, this means they can recover faster, for others, it means they can recover from more at any given time, for still others, it means that they can recover more completely, and for some lucky individuals, it can mean all three. It's not going to do anyone any good to worry about basic genetics, because these cannot be changed. What is important to consider, it that if you or someone you're training is trying to keep up in training volume with someone else, and simply cannot, it may be the result of genetic differences, rather than shortcomings in programming or recovery methods. All you can do is your best with the program you're following and your recovery, and be realistic about *your* MRV.

2. Muscle Fiber Type

When exposed to a comparable amount of training for size, strength, power, and other characteristics, faster-twitch muscle fibers take longer to recover than slower-twitch fibers. The irony here is that fast-twitch muscles do grow much more in response to training. You might imagine that gifted bodybuilders would have super high MRVs, and thus be able to train a ton, which would explain their results. In actuality, the best bodybuilders are usually fast-twitch dominant, making them more responsive to growth stimulus, and enabling them to produce the large, developed musculature seen on body building stages. But, because of their predominantly fast-twitch muscular composition, they can't train nearly as much as you would think. Lucky for them, because they are so growth-responsive, they don't have to. As with recovery genetics, remember that you don't have a big say in your fiber type. Thus, individual fiber differences also play a role in dictating how much training volume one needs. This is another reminder that more does not necessarily mean bigger or better. Training within your own MRV, however, will allow you to get your biggest and best.

3. Muscle Architecture

There are several factors related to muscle architecture that influence MRV differences between muscles within the same individual. For instance, the architecture of the attachment of muscle fibers to the tendons plays a role in force production potential. The more force a muscle can produce, the more damage it can incur, and therefore, the more recovery is required. Other architectural aspects of muscles dictate how susceptible they are to stretch under load, such as the points of attachment and insertion for that muscle with relation to adjacent bones and joints. Stretch under load is extremely fatiguing, so the more stretch under load a muscle is physically capable of undergoing, the more fatigue the muscle can accumulate. For example, the side delts are nearly impossible to stretch under load to any meaningful extent. Thus you've probably never had consistently sore side delts, and have probably been able to trash them with countless sets, only to see them bounce back again. The hamstrings, on the other hand, are pretty ideally positioned for extensive loaded stretching, and as a result, withstand so much damage during hip hinge moves like stiff legged deadlifts, that they expectedly have a significantly lower MRV than the side delts. Of course, cross sectional area and fiber length also play roles here.

Muscle architecture contributes to inter-muscle differences in MRV, but the important thing for the athlete or trainer to remember is that not all muscles should be trained at the same volume, even though they belong to the same individual.

4. Limb Ratios and Lengths

This one is pretty simple. If an athlete is 6'5" with long legs, this person's squat can cover twice the total distance of someone who is 5'1" and has short legs. Thus, the shorter individual might be able to do 20 sets of squats per week and still recover, while the taller athlete is struggling at 10 sets. All else being equal, while they may be doing different amounts of reps or sets, given their divergent physiology, these two athletes are actually doing the same amount of work! So, if you have a big range of motion on an exercise compared to others on account of your build, be wary, and expect your MRV on that exercise to be lower than average.

5. Sex

Females are more likely to have smaller muscles that produce less force, have shorter limbs than most males, and, for several other reasons, just don’t take on as much homeostatic damage from training. For many sports and fitness characteristics such as speed, power, strength, hypertrophy, and so on, on average, this gives females a relatively higher MRV. This means that females will be able to recover from training programs that, on paper, look like they could kill most men. Thus, when training athletes of different sexes, differences in MRV need to be taken into account. One can assume that, in general, males will be able to train at intensities that produce more damage with less volume than females, and hence typically have lower MRVs. Trainers should also be mindful of extremes, however: a very tall, primarily fast twitch female with poor genetics for recovery might have a lower MRV than a very short, light weight, primarily slow twitch male with excellent recovery genetics. This would be a rare and extreme case, but, as is coming to light, determining MRV based on any singular factor is probably not well informed, so it’s wise to consider all aspects that can impact MRV levels.

Personal History/Lifestyle Factors

1. Previously Established Work Capacity

For our purposes, work capacity is the ability to resist the effects of fatigue and maintain performance during exercise. As such, someone with a high work capacity can perform more volume at, or over, the overload threshold, than someone with a lower work capacity. For example, if your mission is to train your legs, and you are doing high rep squats, you and your new training partner might have the goal of doing 6 sets of 10 for an effective stimulus. While you might be able to hit all of the sets of 10 at your overload weight, your partner might not be as fit, and may start to experience lower back cramps after only 2 sets of 10, rendering him unable to continue the workout. So far, we have discussed the ceiling for effective training volume, that is, recovery ability. Now, we come to considering the floor of the range of effective training volume. In order to be able to train productively, one has to be in good enough shape to train. In order to be able to train hard at your MRV and benefit, your work capacity – your ability to perform sufficiently intense work at needed volumes – also needs to be sufficiently high.

Just as they play a big role in determining recovery ability, genetics also determine work capacity. A less obvious and often overlooked but *huge* factor in work capacity and MRV, however, is the level and type of activity one was accustomed to before beginning current training.

If an athlete comes to, say, bodybuilding from a background of powerlifting, for example, his work capacity and thus MRV are likely to be quite low. In the case of powerlifting, he would be used to doing low volumes, so even moderate volumes typical of bodybuilding would tax recovery and work capacity like crazy. Consequently, building up his MRV will take some time. On the other hand, if an athlete comes from an endurance sport background, let’s say distance swimming, the typical workouts of an average bodybuilding program might seem unimpressive and easy. Entering a new sport, a competitive distance swimmer would likely have a very high work capacity and high MRV from the get-go.

The big implication of this is that MRV can be quite different based on how an athlete has trained in the past and/or recently. This is important, as it means that we cannot just assume that all beginners to hypertrophy training have super low MRVs. Very many no doubt will, as many beginners will be coming from sedentary backgrounds. The lesson here is not to assume without knowing the individual's broader and more recent history of training.

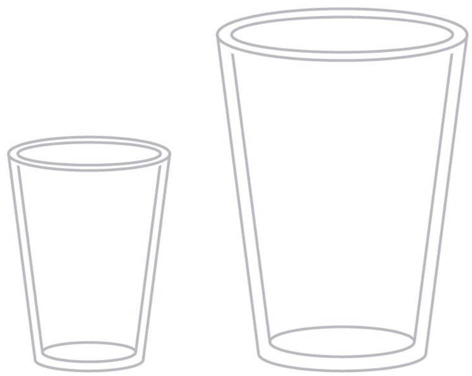
This historical transfer of MRV also applies to phasic training differences in a periodized plan. For example, after 2 months of high volume training, MRV will be higher than it would after 2 months of low volume training, due to the developed work capacity required by the former. Individuals and coaches should be mindful that MRV will be reduced after a low volume phase, and that programming should be adjusted accordingly.

Let's get a bit more in-depth on work capacity: how can differences in work capacity affect how much hypertrophy you can get from your program? The answer is a bit complex. Recall that we must consider both the floor – work capacity – and the ceiling – recovery ability – in the MRV equation. In addition, we must consider secondary effects of work capacity increases. First, even if you are in good enough shape – as in, you have the work capacity – to do 4-hour workouts, this does not necessarily mean that you can consistently recover from that much work. Further, many of the same molecular mechanisms that increase your work capacity also limit your growth potential, like increases in AMPk pathways and related endurance adaptations. Remember too that increased fatigue resistance is often associated with decreased growth potential when it comes to muscle tissue. So if you're considering picking up high volume endurance cycling to raise your leg MRV so that you can grow more, you might want to rethink your strategy. However, developing some degree of underlying work capacity is critical to meeting your recovery ability, and thus setting your MRV as high as it can be. An example of handicapping your MRV via underdeveloped work capacity would be if you are gassing out after 4 sets of 8 in the squat. In this case you are probably far short of your MRV, and, unless you're training your legs every other day or more, there's not a chance in hell you're doing enough work to maximize your growth. Work capacity in this example could be increased by continuing to push training volume, but also by losing some body fat, perhaps via regular cardio training. As your work capacity climbs with such modifications, it will allow you to actually train up to your recovery abilities, and grow the most muscle you can.

2. Recovery Modality Application

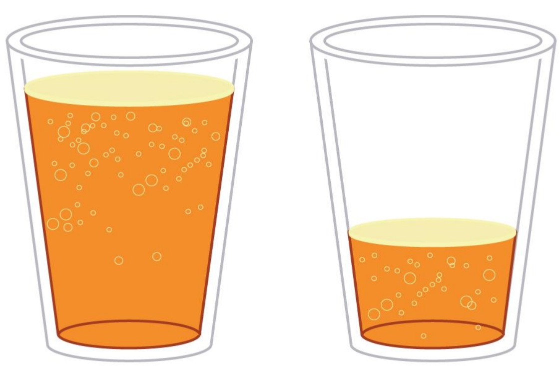
If you think of your MRV as a glass of beer, the size of that glass is your recovery capacity. The amount of beer you have on hand to pour in is your work capacity, and the amount of beer you can have in the glass at any one time is the amount of training you can do and benefit from.

Size of Glass = MRV



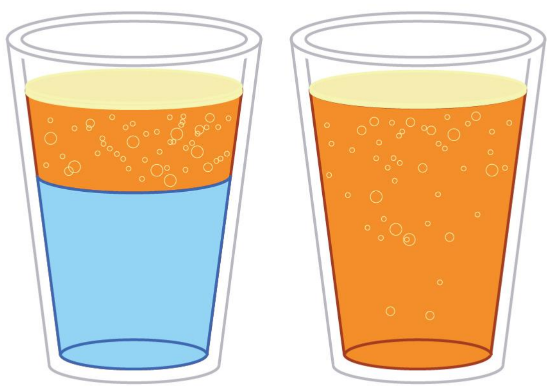
Amount of Beer Ready to Pour = Work Capacity

Amount of Beer in Glass at Any Time = Beneficial Training Volume



So, how do you boost the size of the glass? Well, you make sure to do the best you can with nutrition, sleep, relaxation, and supplementation. By eating an isocaloric or hypercaloric diet with enough carbs, protein, and micronutrients, you help maximize your recovery abilities. (A *hypo*caloric diet phase will temporarily lower your MRV, because less energy intake is bound to reduce work capacity, among other things, and you must adjust training to accommodate). By getting enough sleep and avoiding high, prolonged stress, you give your recovery mechanisms their best chances and longest durations to work. We all know that some advanced professional athletes also use less widely accepted sport supplements to boost their recovery, sometimes at great costs to their health. All of these recovery modalities make the glass bigger, so you can pour more of the "beer" of productive training in without it spilling over.

Hold on though: aren't we missing another important facet? Yes: life stressors that are outside of your training also count. Relationship stress, too much running about at work or school during the day, navigating traffic, having to carry around a heavy backpack and the like all add disruption to the system. Sadly, these non-training related disruptive stimuli don't actually help you get more jacked or better at sports! Think of them as 'water' in our beer glass: if beer is the productive training that makes you bigger and/or better, then extraneous physical and mental stressors that add fatigue without stimulating benefit are what waters it down. Yeah, you can fill your glass with tons of water and just a splash of beer, and have no room left in the glass for any more beer. You'll be super fatigued and have run out of MRV: no more room for training! But how much actual benefit did you gain? How much beer? Barely any. That's barely any growth or improvement!



The trick to a high and usable MRV is to have the biggest glass, the most beer possible on hand, and as little water as possible to dilute the mix. In other words, to optimize your gains, you want the best nutrition, sleep, rest, and relaxation, the highest work capacity that doesn't impede your growth machinery, and as few stressors as possible. If you don't believe us, get a construction job, and see how much more difficult it gets to recover from your weight room or sport training work!

3. Non-Specific Physical Activities

The ideal environment for muscle growth would be one in which your muscles were not called upon to do anything outside of leisurely activities and weight training, allowing you to "save" them for the hard training. In this utopian scenario, muscles are either getting smashed up in training, or resting and recovering at their fastest rates. This means that you can essentially fill the entire MRV glass with productive work that grows the muscle. However, physical activity demanded of that muscle, which might *also* be required for specific sport performance outside of weight training, can contribute fatigue and decrease potential growth. Let's take a sprinter, for example. A sprinter needs to fill their MRV with both sprints work and weights work for their legs. Makes sense, but if you want max hypertrophy, is there anything wrong with this approach? Well, how much does sprinting grow your legs? Unlike relationship stress or something else negative, sprinting will result in *some* growth, as in, greater than zero. For every sprint done, however, that's some weight room training you cannot do, because you have taken up some of your total MRV with sprints. While sprint training *and* weight training both grow muscle, if you want to be your biggest, you had better do nearly all weights and no sprints, because per unit of volume, or rather, per fraction of your MRV, weights do the job of muscle growth better than sprints. On the other hand, if your sport is sprinting, taking the hit to total growth potential in exchange for performance in your sport is a good trade off.

Bodybuilders at a high level have caught onto this, and outside of training hard and doing some necessary cardio, they more or less try to not use their muscles for anything else. That's the right way to do things if you want to max out your MRV for hypertrophy.

The moral of this story is that whether you want to be the best bodybuilder, sprinter, tennis player, or the best kickboxer you can be, you've got some trade offs to make when filling your MRV glass.

Training Program Factors

1. Exercise Type

The kind of training you do, both in the gym and in sporting contexts, can tax your recovery systems more or less, resulting in higher or lower MRVs. In general, for resistance training, barbells seem to tax the physiology the most, dumbbells second, and machines the least, with some variance between different machines. Much of that difference depends on the amount of eccentric load that the training modality lets you experience. For instance, many machines limit eccentric load exposure, whereas free weight and especially plyometric exercises emphasize it.

On the subject of eccentric loading, eccentric contractions do the most damage to muscles, and thus tax recovery the most. So, for example, lowering deadlifts under control taxes recovery much more than dropping them, and also stimulates more growth. So when a program designed for you recommends 10 sets of deadlifts a week, it's smart to ask whether those need to be lowered slowly, as that might greatly affect your MRV for deadlifts.

Exercises that have high ranges of motion, and especially those that produce a lot of tension under stretch, also require more recovery. In contrast, unstable movements are not nearly as taxing to recovery, because they highly limit force output. To illustrate with a fun example, let's compare two exercises, set for set. The first will be an exercise with high stability, high range of motion, high tension under stretch, and using barbells. The second will be an exercise with low stability, low range of motion, no loaded stretch, and using machines. An actual example would be deep barbell squats with a tight set up, in great weightlifting shoes, on a hard grip floor, versus one-arm, partial ROM cable lateral raises on a bosu ball. You can't do too many sets of the former without paying for it with high fatigue, but, as for the latter… does it even have an MRV? So what does this mean for the effect of each of these exercises? Well, we know that overload and MRV are very closely connected, so we would expect only a negligible amount of fitness improvement from the latter move.

Let's now put this information in the context of designing a training program. If you're setting up a leg training program and you are using mostly squats and lunges, you might want to keep the sets a bit on the low side, in anticipation of higher per-set fatigue levels from these exercises. On the other hand, if your program has more machine work and maybe single-leg work, you can open up a bit more and do more sets, because excessive fatigue is less likely, using those exercises. You'll get much better at estimating fatigue levels from various exercise choices as you become more experienced and gain the common sense that comes with a long training history under your belt. Say you're only able to only start with about 6 total sets of barbell bent rows in Microcycle 1 of your program, because they're so fatiguing. But if they are machine or cable rows, as many as 9 sets to start might be realistic. Simply always use your best judgment about anticipated responses to create your programming. Importantly, your programming should also be flexible, allowing for quick adjustment if and when you find you have misjudged. Maybe you thought you were going to be able to rock 10 sets of machine shoulder presses in your first week of training, but they actually ended up destroying your delts -- maybe you used a new machine, or your technique has changed to include more ROM. In this case, you should probably keep the set numbers the same into week 2 and possibly even week 3, so that you don't blow past your MRV and render your training useless!

2. Program Novelty

Any time you change most anything from mesocycle to mesocycle, the sheer novelty of variation will challenge your recovery systems in ways they are not as used to, which may initially lower your MRV. So, any time you switch exercise types, exercise orders, rep ranges, or cadence styles such as paused, slow eccentric, and so on, your MRV will drop a little, typically 1-4 sets per body part per week. This value might be higher if multiple variables have been altered. Over the next couple of weeks after updating your routine, your MVR will return back to usual levels, but it will not do so instantly. So, if you haven't done lunges in a while, but are used to 10 sets of squats a week, don't just start with 10 sets of lunges: that might bury you! Try 6 sets and work your way up, anticipating the novelty-mediated temporary reduction of your MRV, instead of being needlessly surprised by it every time. Figure 3 below illustrates this point.

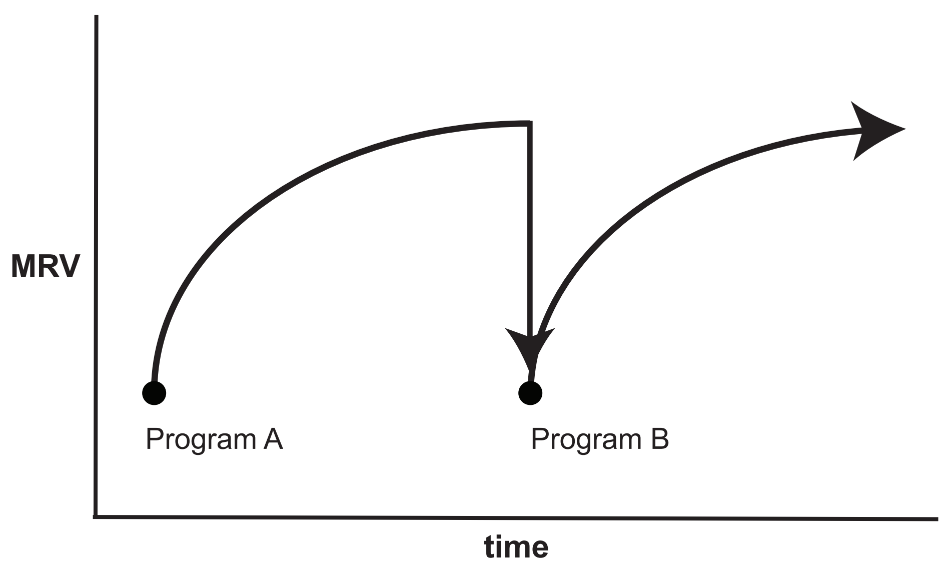


Figure 3. MRV and Novelty: Program A represents a new training program with a low MRV. As an individual trains for weeks on program A, efficiency goes up, and damage proclivity goes down, so MRV rises. If and when the training program is markedly changed by switching exercises or rep ranges (program B), MRV will fall, and take weeks to bounce back to previous levels.

3. Absolute Intensity

This metric simply refers to how much weight you're using. The closer you get to your 1RM - the maximum weight you can lift for a single rep - the more fatigue you get, rep for rep. At the extremes, that's even true set for set. So, if you compare how many sets of 15 reps versus how many sets of heavy doubles you can do in a program, you'll quickly find that even though the 15s are wildly more volume, the sheer intensity of the doubles probably lowers their recoverable set numbers below those of 15 rep sets. Lucky for us, as Greg Nuckols, (summarizing current research) points out in The New Approach to Training Volume, within sets of between 5 and 15 reps, the volume and intensity effects largely cancel each other, and the number of sets is the only factor we need to compare. But if you venture outside this range, be prepared for large weight increases to be a big factor. So, if your usual MRV is around 20 sets, don't expect to be able to survive 20 sets per week of heavy triples, as these might be much more fatiguing due to the greatly increased weight being lifted.

This also reinforces the idea that we should always individualize our programs, as opposed to just do what our lifting buddies or teammates are doing. No matter how you spin it, even if matched for relative intensity, lifting 600lbs is inherently more disruptive than lifting 400lbs. Thus, absolute intensity is a major consideration for individualizing MRV.

4. Proximity to Failure

Also known at times as 'relative intensity', proximity to failure is a measure of how closely you approach failure in every set, and it affects your MRV. In fact, one of the reasons that all-sets-to-failure programs aren't ideal is that they generate so much fatigue from such low volumes that they become unsustainable over time. On the other hand, while very easy to recover from, sets that stay more than 4 reps shy of failure don't seem as stimulative for growth. So where's the sweet spot? Probably somewhere around an average of 2 reps from failure for the mesocycle, starting around 4 reps shy, and moving closer to failure as the mesocycle progresses. What this means is that, at the beginning of your mesocycle, you can stay about 3-4 reps shy of failure on all lifts. Every week or two, you can push the sets a bit further. Try 2-3 reps from failure at first, and then 1-2 reps, and so on, until you're either 1 away from or at failure by the final week of progression. Before this last week, if you haven't accumulated enough fatigue to necessitate a deload, this week of training to failure at high volumes is almost sure to result in enough to require a deload. On your deload, you should stay *very* shy of failure, at most within 5 reps of it, so that you can drop the most fatigue, and then start back at 3-4 reps shy of failure on week one of your next mesocycle.

5. Psychological Arousal

Psychological stressors add to fatigue just like physical ones. And one of the biggest stressors is the psych-up for all-out training. Not only does all-out training mean that you're likely using heavy weights and close to failure proximities, but that you're also using mental energy that will produce fatigue. In fact, higher rep concentric speeds lead to higher fatigue, and rep speed tends to elevate during psyched-up training. It's not just the reps themselves that are fatiguing. The seconds, minutes, hours, and, with heavy leg sessions, days of psyching ourselves up before hitting the gym can also be quite fatiguing. And, because you don't just fall right off the workout buzz immediately after the sets are done, the high remnant levels of fight or flight hormones present in the blood for up to an hour after training can contribute to a delayed reduction of fatigue.

A *big* takeaway here is that psych-ups should be very sparingly used in sport training. Use them *only* as you need them. If you need to psych up to do the sets and reps you have programmed, do it. But if you can get through the work with a calm focus on technique instead, that's much better, as it will let you do more work with less fatigue and get more benefit. In fact, outside of your pre-deload week, when you're closest to failure lifting the heaviest weights and doing big multi-joint moves like squats, deadlifts, rows, and so on, psyching up should be avoided by the dedicated athlete. Let's not waste the mental energy getting psyched up for week 2 pull-downs. Instead, it should use it strategically for the hardest training sessions and sport competition itself. Again, a calm focus on technique is usually a *much* better option for sustainable results. Sure, quiet concentration may not impress regular gym goers or fellow athletes as much as huffing, puffing and red-faced screaming, but it's the way to go, provided that you would prefer your physique and/or sport performance do the impressing.

Training Career Development Factors

1. Training Age

As you train for weeks, months and years, your physiology undergoes predictable changes. Those changes include long term increases in both work capacity and recovery ability, which combine to raise your MRV. Beginner trainees get beat up and sore - and, as we'll see, also get good results - from rather minimal work. In fact, within the first several weeks of training, MRV can be so low as to be overreached by protocols of less than 10 sets per body part per week, which is one reason many training studies don't detect much hypertrophy until subjects are over a month into the training process. On the other hand, trainees with over 5 years of consistent training under their belts can recover from considerable workloads, and advanced athletes that have been training for a decade plus can have downright legendary MRVs, capable of training volumes that would cripple most others. As you accumulate experience, you can count on your MRV to increase. And it will, until and unless you run into three other career development factors that can lower it. Let's check them out next!

2. Proximity to Career Peak

The closer you get to the peak of your abilities, the harder your body's systems have to work to recover you from the massive overloads that are required to make you improve. You have to work harder in training to produce those overloads, and harder in recovery to heal from them. In fact, some recovery systems might not be able to keep up with the highly developed performance systems of the same body. Close to a career peak, both the potential for further gains and the ability to recover become a struggle. While those individuals close to their career peaks might be able to handle the highest intensities they ever have, their MRVs might actually dip a bit. In plain terms, the workouts they are doing are such a challenge to their recovery systems that recovery might lag, resulting in decreased MRVs. Sooner or later, the amount of work that needs to be done to stimulate any gains at all will push up close to and over MRV, creating the most fundamental limiting factor in career improvement. We will elaborate on this phenomenon a bit later.

3. Muscle Size

One of the reasons that athletes near their peaks can be challenged in recovery is that their muscles are so large. Big muscles need big healing, and, the bigger the muscle, the more healing time and resources it requires. Exotically big muscles may outpace the ability of the blood supply and GI system to support speedy recovery. This applies both to individual muscles and to the body as a whole. Someone who's 250lbs lean will have a tougher time recovering from overloading training than someone who's 150lbs lean, and the smaller lifter's rear delts will heal faster than his quads, because of muscle size differences. This inverse relationship between muscle size and MRV is evidenced by some of the biggest bodybuilders doing fewer weekly working sets than you'd expect, and many of them confirming that they used to do more working sets and even total volume (sets x reps x weight x distance) than they do now that they're massive.

How does this square with the idea that you should be trying to grow the most muscle over time by increasing volume? Well, at some point you can become so big, that the volume needed to continue to provide a volume overload is beyond your MRV. At that point, you can't increase volume anymore, and you're stuck with increasing only intensity, or using techniques like metabolite training. Of course, at some point you also can't add any more intensity, so metabolite techniques are the only thing left. This is a reality for some top bodybuilding pros.

4. Strength

Just like with muscle size, stronger muscles and stronger lifters produce more force, use more of the nervous, muscular, and connective systems and tissues, and thus incur more significant demands on recovery systems. Most top powerlifters train with surprisingly low volumes when they are at their best, and that's not by accident. At the weights they are using, higher volumes would be over their MRVs. What this means for you is that, as you get stronger and stronger, don't be surprised if, set for set, your MRV doesn't go up as quickly as you thought it would from just accumulating training experience. And when you get *very* strong, be open minded to the idea that you might not be able to recover from as many working sets of many exercises as you used to, even though the mathematical volume you can recover from might have gone up.

There are almost certainly other factors that alter MRV that we haven't mentioned, but we've likely covered all of the most impactful ones. Now that you're pretty well versed in all things MRV, let's take a deeper look at how the MRV concept can be used in training!

Examples of MRV Use

We would love to be able to provide specifics on the average MRV values for various pursuits, sports, goals, and fitness characteristics, but we simply don't have the data to do so outside of just a few applications. What we can do is illustrate how knowledge of MRVs might be used in some very general ways, in a broad range of sporting applications.

Speed Training

When training athletes of any sport type, but primarily those interested in speed qualities, it's important to ask two questions:

1. In a given training phase, how much does adding more speed work subtract from MRV and thus, how much is too much, once enough speed work has been added to soak up all recovery ability?

2. How much does other work, like weight room strength and power work, mobility work, plyometric work, and so on affect the MRV for speed training?

How do we know we've exceeded our MRV for speed training? If your ability to reach your highest velocities - to run the times expected of your level of preparedness during that training phase - is consistently subpar at a time during which you're training plenty, it's very likely your MRV for speed has been surpassed. Speed work is quite fatiguing in itself, and because of this we see quite a few speed programs tending towards rather low total training volumes. In addition, speed is *very* sensitive to volume encroachments from other physical demands. So if speed training is the goal, total work in the entire training program must be relatively low. Put more formally, the MRV for speed training, in summed direct and indirect work, is generally amongst the lowest volumes in all sport training.

Power Training

Power, like speed, is very sensitive to fatigue from both its own training and other sources. While not quite as sensitive as speed in most cases, it's still much more sensitive than most other fitness characteristics. At the same time, though slightly higher than speed MRV, power MRV is still relatively low compared to strength MRV. We see power decrement with volumes that wouldn't be remotely near strength MRVs. Does this mean training for strength reduces power indefinitely? Luckily no, but when strength training volumes are used, and they exceed power MRVs, as they almost always do, power cannot be expected to rise at its fastest rates. By getting stronger, power can still go up, but more slowly in the short term, if the training volume is over power MRV.

Because of the reliable effect of strength increases on both speed and power, the most useful element of knowing both speed and power MRVs isn't necessarily to use them as benchmarks that are not to be exceeded in speed and power training. We can expect speed and power to take a backseat during strength training and not improve much, due in part to strength training volumes exceeding their MRVs. While they are taking a backseat, strength is going up, and when the time is right, closer to competitions, training volume can be brought down, and speed and/or power training can once again take priority. The benefits of power and speed training are also relatively short lived compared to those of strength training, so training them exclusively too far in advance of a competition or too often may also reduce their potency in competitions, when it's actually time to be fast and explosive. The approach of training mostly for strength early in a speed or power macrocycle and only later transitioning to speed and power-specific training guarantees that speed and/or power will be improving all the way through training, but can be peaked when it's time to show them off. This way, we get the best combination of long term increases in speed and power via strength, and can transition to focusing on these several months or weeks before a competition, so as to maximally express them during.

Strength Training

Strength training MRVs tend to be considerably higher than speed or power MRVs. This is because speed is very fatigue sensitive, yet peak force production (strength) is not nearly so. Because power relies on both speed and strength, it's right there in between the MRVs for the two. Since peak force outputs are not overly fatigue sensitive, programs that combine strength training with other training demands can often stack on quite a bit of other training without interfering much with strength recovery and thus MRV.

That said, strength MRVs are still not as large as you would expect with hypertrophy training, because strength training requires a high level of exertion which causes a lot of fatigue accumulation. Because strength training - actually lifting huge weights in training - requires a high level of ability, fatigue cannot be so high that such ability is thwarted, rendering the athlete incapable of lifting the weight needed for their strength training. For this reason, the MRV for strength training is low compared to that of hypertrophy training.

Hypertrophy Training

How do you "recover hypertrophy?" And what the hell does that even mean? You actually don't "recover hypertrophy" since hypertrophy, unlike strength, power, and speed, describes the physical adaptation instead of a fitness characteristic that can be expressed. You do, however, want to sufficiently recover so as to present another hypertrophy overload in the next microcycle. Since the most productive hypertrophy training intensity averages somewhere between the 60-80% 1RM range, decrements in the ability to perform the prescribed number of repetitions with such weights can be seen as a failure to recover, indicating excession of hypertrophy MRV.

Some of Dr. Israetel's extensive writings on hypertrophy MRVs can be found on The Hypertrophy Training Guide Central Hub page of the RP blog. Hypertrophy training usually has a pretty high volume tolerance compared to other modalities, and is itself not nearly as fatiguing rep-for-rep as strength training. However, it's very possible to exceed hypertrophy MRVs, and quite a few athletes do so on a regular basis. This becomes especially likely when one combines other training modalities, like endurance, speed, power or gymnastics technique work with hypertrophy work. Now, who would do something like that?

Fitness Sport

Ahhh, that's who. By combining nearly all of the known fitness characteristics and testing all of them at one time, fitness sports present an unusual challenge for sport scientists seeking to organize training in a logical manner. Because speed and power MRVs are so much lower than endurance, hypertrophy, and strength MRVs, just training every quality in random arrangement would hurt those low MRV fitness characteristics the most. But there *are* strategies that can make gains in speed and power occur faster and to greater heights, some of which follow:

- Not training *all* fitness characteristics as hard as possible at the same time, but rather focusing a couple, such as speed and power while keeping the others on the back burner, then switching to training hypertrophy and endurance, for example, while keeping the rest on the back burner. Because the maintenance of fitness characteristics is so much easier than improving them (a concept which we'll discuss later at length), a great approach would be to lower overall training volumes for speed and power phases so as to get them below speed and power MRVs, get gains in those qualities, and then raise volumes to gain in hypertrophy and endurance.
- Because speed and power are more fatigue sensitive than strength, hypertrophy, and endurance, it's a good idea to have workouts focusing on them earlier in the training week, when fatigue is low, and saving the other workouts for later in the training week.
- Similarly, any given training day should see you train speed and power qualities at the beginning of a training session, before training the others, so that you can get the most out of all.

Technique Sport

Don't all sports require the application of techniques? Yes, but some much more than others. Speed, endurance, and barbell sports are on the very low end of the technique spectrum, as most of the performance in those sports is determined by the athletes' fitness characteristics rather than their technical prowess.

Most team sports, court sports, mat sports, and field sports - really, most sports - have a much heavier technique component than the ones so far listed, and this requires some special considerations around their MRVs.

The most important concept to understand with technique sport is that the MRV of that sport isn't derived solely from practice for the sport itself, but rather the sum total of *all* physical training involved, including drilling, conditioning, and weight room work. So if you're already training close to MRV and you want to expand on any one of those subcategories of training, you'll have to pare down on one or some combination of the others first.

Secondly, more technique-heavy and thus fitness-characteristics-light sports like tennis or golf are less fatiguing in technical training, but performance therein is more sensitive to fatigue from other kinds of training. Golfing itself is not very fatiguing, and adding hours more golfing might still fit into the MRV for golf technical ability. Adding just a bit too much weight training, however, could easily exceed sum total MRV very quickly, as the "volume effect", or the fatigue effect of weight training, greatly affects the recovery and performance in golf training itself. In simple terms, imagine trying to make a perfect putt with arms that are stiff and sore from upright rows. This is one of the reasons why athletes in high technical sports or those going through very technique oriented training phases must carry much less fatigue than athletes in other sports, and are best served by integrating ancillary modalities like weight training very cautiously and slowly.

Endurance

Not only is endurance work not very fatiguing per unit of time, but endurance athletes also tend to have the kind of physiology that promotes recovery better than that of any other athletes. Excellent blood perfusion, slower twitch average muscle fibers and smaller muscle size are a few examples of this. In addition, endurance ability is *not* as fatigue sensitive as nearly all of the other fitness characteristics. This means that the microcycle MRVs of endurance athletes are often measured in dozens of miles or kilometers. Endurance athletes also see MRV increases through their entire careers, as their work capacity is so fundamental to their performances. Because the causes of endurance fatigue are often more peripheral than central, including lost glycogen and damaged muscle, proper nutrition has probably the biggest MRV-raising effect on endurance athletes as compared to athletes of most other types of sports.

2 MINIMUM EFFECTIVE VOLUME

Derivation:

At this point, we've beat the MRV horse to death. On the bright side, we're now comfortable with the idea that, in any scenario, some amount of training is going to be too much, and that regularly going over this limit will not lead to the best gains. This may tempt us to draw the conclusion that "less is always better", because we're so afraid of exceeding our MRVs. We do less, and our training improves. Should we try decreasing our training further still? Or is there a downside to dropping training volume too low?

You better believe there's a downside. At some point, you will be doing so little training, that it won't be enough to improve! When you first begin training in nearly any sport or ability, pretty much *any* training gets you better. After the first weeks or months of easy gains with barely any work, however, your progress slows and eventually stops... unless you do more. This is of course a natural extension of the Overload Principle. As you get better, what used to be challenging to your adaptive systems becomes merely normative, and progress decelerates, then grinds to halt. As a quick example, imagine that you just got your dad into lifting weights for the first time in his life. How many working sets of lifting a week does dad have to do to progress? Well, even one set a week will do the trick for a while! Now, imagine giving that same single set to a professional bodybuilder at the tail end of his career. Even if we made it heavier weight to accommodate for his greater strength, will that one set per week make him grow? If only! To grow at his level, the bodybuilder will have to move heaven and earth each week!

Past the beginner stage, everyone has to do more than just a bit of training to continue improving. Ergo, everyone has a theoretical volume of training that, if they train below, will hinder their ability to progress.

Definition:

Minimum Effective Volume (MEV) : The *lowest* volume of training an athlete can do in a particular situation and still *measurably improve*.

First, let's establish what it means to "measurably improve". Whatever variable we are focused on, training at or above the MEV for that variable must *measurably* increase the magnitude of the variable in *such a timescale that is relevant to the sport's/endeavor's demands.* So, if we've got a training program for all but exceptionally advanced bodybuilders, and it yields us only 1 pound of muscle per year, we can comfortably say it's *not* at or above our MEV. This is because if you call 1lb of muscle per year "effective," you need to circle back to the expectations and demands of whatever you're gaining muscle for. Now, that doesn't mean we can just write off any gain rate we think is insufficient large because, in an ideal world, we would have wanted more. In a *very* technical sense, even the 1lb of muscle per year is at or above MEV, as *any* gains technically are. But a very applicable recommendation is to only count MEVs at levels above what's minimally relevant to the sport in question, in relevant timescales, and especially outside of the measurement instrument's error bars. One pound of muscle across a year is simply not enough to elicit significant, measurable performance enhancement for any sport we can imagine, and is probably well within the standard margin of error for any means of measuring muscle mass.

So, to measurably improve we must:

1. Increase the magnitude of the measured variable.
2. Do so in a timescale that makes the change relevant.
3. Ensure that the change is larger than the noise or error expected when measuring the variable in question.

Let's look at this another way, this time using 1lb of strength gain rather than 1lb of muscle gain as our example. If you added 1lb to your maximum squat over a year, all three of the conditions for measureable improvement are violated. First of all, the lightest weights most competitions offer are the 1/2kg plates, and those usually only for record breaks, which is still more than a pound! So your so-called "improvement" wouldn't even result in a PR on the platform! In fact, you would be hard pressed to find a weight setup where you could measure this small an improvement. Secondly, if it takes you one year to put a pound on your squat, most of your competitors, even at the highest levels, have put on at least 5lbs, and some more than 20lbs in that time, leaving you well behind. If you're only adding 1lb to your squat in a year, it's not just that the timescale of adding this weight isn't sport-relevant, but that *you as an athlete* might no longer be with gain rates that slow! Lastly, how can you be sure you actually added 1 lb of strength? Maybe, though we don't recommend it, you test your squat every month. Since testing it a year ago, you've done 11 other tests, and, on the 12th, you were 1lb stronger. Fine, but we know that preparedness levels are sensitive to mood, gym conditions, nutritional status, personal motivation status, technical crispness, and lots of other known and unknown variables. So, when your squat is an *average* of 300lbs, some months it will test at 295lbs, some at 305, and everything in between. So, a 1 lb PR cannot legitimately be called a PR, since it falls within the noise of testing that is generated by all of the external and internal factors that influence performance on a given test. Can you be sure that the extra pound this year was due to actual improvement in ability versus just a better than average alignment of favorable maxing conditions? No, not really. For something to count as a true "max" or "PR" or "minimum improvement," it should be *outside of your normal performance variance.* So, if you can bench 200lbs for sets of 10 consistently three months deep into a chest hypertrophy program, before which you struggled to hit 8s, then, yes, you've likely improved and are at MEV or above. But if you usually hit 10s and you got an 11 on one of the sets once, don't go quitting your day job just yet.

A final word on the definition of MEV is this real world tip: if you have to wonder whether you're improving, and thus whether you're over your MEV or not, you may be going wrong in one of the following areas. Either you're measuring with the wrong tool, or on the wrong timescale - possibly one that's too short between your current and last measurement - or, perhaps you're *not* above your MEV in any meaningful sense, if at all. If you have to ask if you're improving, the answer is, you probably need to reexamine your training.

Importance:

The MEV landmark is not just intellectual fluff. It's got serious implications for the organization of sport training, and paves the way for still other important volume landmarks.

1. Program Minimum Volumes

Once you know there *is such a thing* as doing too little to progress, you're going to make sure you avoid utilizing, recommending, or designing programs that prescribe too little training. It's been said that you get from a program only what you put into it, and that's quite true. However, if the program doesn't let you put in enough work to progress, you won't get much out of it either, so it's best to avoid it in the first place.

If you like a program or a certain training structure and you want to use it, make sure you scale it to meet your MEV, so that its structure can actually yield effects for you. If you are training a team of athletes, understand that not everyone will have the same MEVs. In fact, a reliable generality is that more experienced athletes will have higher MEVs than less experienced ones, so you can prescribe more training volume for the more senior members of the team and less for more junior ones, and modify as needed based on individual MEVs. The only reminder here is to take into account newbies' history in other sports, as this might affect MEV for the current sport.

Interestingly, some programs prescribe such low volumes, that their extreme forms are below nearly everyone's MEV. For instance, in some circles, HIT - high intensity training - in its extreme forms has seen the recommendation of 1 set to failure per body part per week of training. This basically means pretty much everyone who's been training for more than 2 years will actually regress on such a program, never mind gaining! This is not to say that *all* forms of low-volume training are below MEV for everyone, as some lower volume programs are indeed above most (or some) individuals' MEVs and therefore effective. Our advice is to simply be on the lookout for training with insufficient volume, and not take for granted that all programs are guaranteed to exceed all MEVs.

2. Conservative Training Backstop

As evidenced by the necessity for the MRV concept and discussed in earlier chapters, the common sport culture misunderstanding of the adage "you can never do too much" promotes excessive effort. In contrast, there is also a significant portion, albeit still a minority, of sport coaches, top trainers, and athletes that espouse minimalism in training. This minimalist training strategy rarely comes from an embracement of laziness, as the culture of sport over-workers would have you believe, but rather from an aversion to injury.

Since injury is admittedly devastating to sport progress, and since higher volumes of training, especially ones exceeding MRV, are inexorably linked to higher injury rates, it's not an incomprehensible position. But if the recommendations for minimizing training volume to prevent injury are too extreme, such philosophical adherence can end up promoting a lack of improvement. In other words, too little training will almost definitely decrease injury risk, but, at some point, this will be at the cost of making any meaningful progress.

In extreme cases, a radical commitment to low training volumes comes off as a sort of faux wisdom. "Oh, high volumes of training, I used to do that way back when… let me know when you get hurt and I'll steer you in the right direction." And that wisdom isn't entirely faux, because yes, MRV is a real thing, and going *too high* is in fact a bad idea. Compensating by dropping too low and avoiding even the neighborhood of MRV isn't much better, however. The educated sport practitioner or seeker of fitness would do well to steer clear of both of these fallacious training extremes.

3. High Level Athlete Training Demands

To be discussed in detail in Chapter 7, MEVs increase throughout a training career. The longer you train, the better you get, and hence the more it's going take to make you even better. Without encroaching too much on the discussion of that later chapter, suffice it to say here that high-level athletes will often need truly monumental levels of workload in order to improve. Such levels can be so high that those helping in their sport preparation may at times wonder if the athlete really *needs* that much training? That's a fine question to ask, because it can lead to the discovery that the athlete is training above MRV too often, and could in fact benefit from backing off. But if your reference frame is mainly that of beginner or intermediate athletes, you should be aware that, by comparison, the amount of training some advanced athletes might need - and have the genetic and training-based MRVs to survive - may seem obscene. This awareness that MEV increases throughout an athlete's career should help logically assess whether or not advanced athletes are on the right track with training volumes.

4. The Need for Preparatory Phases

In order to benefit from training, you must be able to recover from it, so for a given volume of planned training, you had better be eating, sleeping, and taking care of other means of recovery. In other words, make sure your recovery capability is keeping your MRV up. Recall that MRV is the intersection of both recovery ability and *work capacity*. So, oddly, if you train hard enough to overdo it, you're at less risk of overdoing it!

Well that sounds fine, right? Who wants to overdo it? But, wait: what if your work capacity is so low, you can't do enough work to hit your MEV? Now we have a serious problem. Luckily, it's not a super common problem, because those athletes who tend to have the highest MEVs are also in the best shape. This isn't always the case however, especially when it comes to training that involves other limiting factors.

For especially advanced athletes, a certain level of difficulty, endurance, speed, or technical exertion in their training is mandatory to make them any better. For example, a wrestler coming back from the offseason might not be in shape to wrestle at his normal speeds and utilize his full, demanding arsenal of moves. Wrestling as well as he needs to in order to improve is possible, but, at his already high level, he will only be able to attain this requisite level for improvement for a fraction of each session.

In other words, his MEV for wrestling is so high, that he's not in good enough shape to attain it. For this reason, the best thing for him would be to do a several-week conditioning phase with wrestling-specific drills that increase his work capacity, before he resumes regular "live" wrestling training. After this, by the time live wrestling training resumes, he'll be in good enough shape to avoid slowing down or altering his game, and thus avoid adapting to a new, less dynamic, and ultimately less effective game, just to get through practice.

In endurance athletics, a great example is that of the training volumes required to increase the lactate threshold. For high-level runners, lactate threshold (LT) training is accomplished by going just under, around, and just over the point at which muscles start to accumulate lactate, or “get the burn”. This training is likely the most effective for improving endurance ability for high-level competitors, so it’s critical to the training process. But when you first start LT training after a bit of a layoff, you might get shin splits before you even reach the MEV for LT improvement! A phase of training that focuses mostly on slower exertions but for high distances will build work capacity and make hitting above LT MEV a non-issue, paving the way for new gains without being hamstrung by shin splints.

You’re probably starting to see the pattern here: it’s often critical to begin a training program with a preparation phase, which gets the athlete in the shape needed to handle the training that will improve him or her.

In modern periodization, most sports have general preparatory phases such as described above. And, in the technical sense, one of the main goals of such a phase is to raise the athlete’s work capacity, so that the systems important to performance can be trained above MEVs, enabling progress to occur.

5. The Golden Training Zone

If MEV is the smallest amount of volume you need to make gains, and MRV is the most volume you can take on and still recover from, then we’ve just made one of the most critical revelations about the volume landmark concepts. Namely, we’ve found the zone of training volume in which pretty much all gains are made. Training below MEV won’t produce results, nor will regularly training above MRV. Training between them, however, is where all the benefit is. If you know those values for a given athlete, you can abandon a huge amount of guesswork in training program design, and be assured that, at the very least, training volume is configured for best results. Figure 4 illustrates this point.

Is there a specific part of that range that produces the *best* results? Maybe, but we’ll reserve that discussion for Chapter 3.

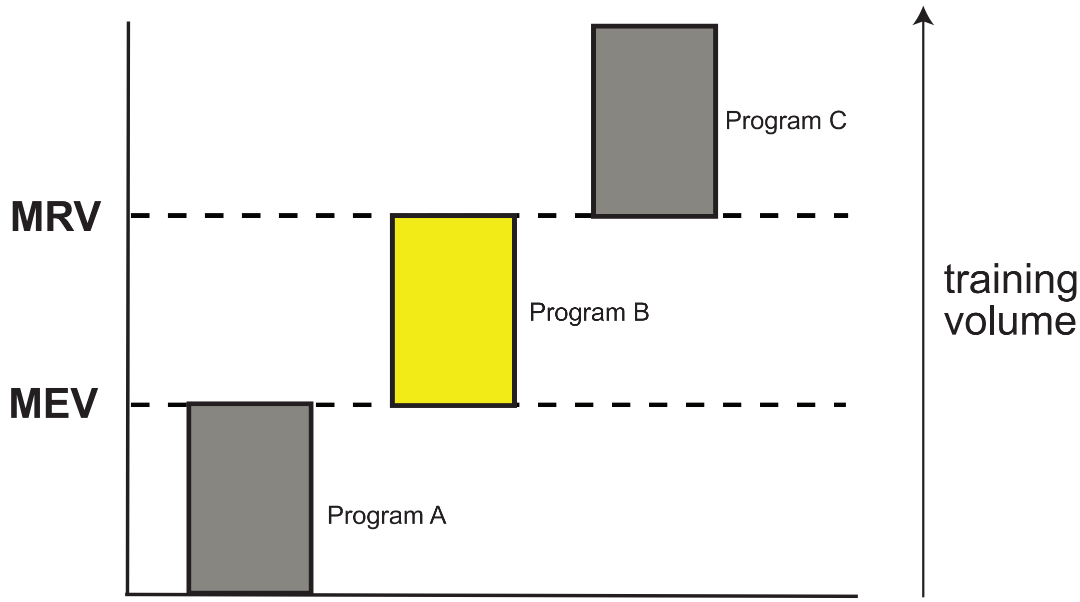


Figure 4. The Golden Zone of Training: Training volumes lower than MEV (program A), by definition won't result in appreciable performance gains. Training volumes in excess of MRV (program C) will also fail to result in gains, because they are impossible to recover from. Volumes between MEV and MRV (program B in the figure), will be where gains do occur.

Sources and Nature of MEV Differences

Just as with MRV, MEV is a dynamic variable that differs from athlete to athlete as well as within an individual, across different circumstances and between different muscles. Let's take a look at some of the more important sources of MEV variability.

Genetic Factors

1. General Genetic Adaptation Factors

While having a naturally high MRV is a very good thing, it's the opposite with MEV: the lower the better for this landmark. First of all, individuals with genetically low MEVs are just more sensitive to training. They improve with very low volumes of training, so the amount of training they have to do to improve is lower than that of most of their peers. This gives them two distinct advantages in the training process. First of all, they can do less and get more, which is great, because they don't have to worry nearly as much about fatigue accumulation, and thus about delaying the overload process to allow recovery from that fatigue. Secondly, because their MEV and MRV are going to be further apart on account of their MEVs being lower, this gives them the ability to do longer overload progressions that start at MEV and end at MRV. Thanks to this extended progression length, such athletes will be able to undergo and benefit from longer accumulation:deload paradigms, and thus benefit from more training time in which to actually improve. In other words, a higher ratio of accumulation to deloading means more weeks spent training versus recovering over the training year than those with higher MEVs, and therefore more opportunity for improvement.

2. Muscle Fiber Type

As we've learned earlier, faster twitch fiber types tend to correlate with lower MRVs because of the amount of disruption they are able to endure, and the slower dissipation rates of their accumulated fatigue. The good news is, faster twitch fibers also tend to respond more quickly to training, especially hypertrophy and strength training. In other words, faster twitch fibers tend to exhibit lower MEVs. So, while someone with predominantly slow twitch fibers might need to do at least 12 sets of chest per week to begin growing, a person with predominantly fast twitch fibers might only need 8 sets per week, which will certainly come in handy, especially given the lower MRV which also usually accompanies such fiber types.

3. Muscle Architecture

Just like with MRV, there are two factors at play here. The first is the internal design of the muscle. Some muscle types, for instance, multipennate muscles (with multiple converging connections to tendons and more parallel fibers), are designed to produce super high forces, and can thus get a lot of stimulation from relatively low volumes. Meanwhile, other muscles types, such as fusiform muscles (spindle shaped muscles that taper at their ends) are designed a bit more for velocity production, and don't really put out a ton of force, so they might need a bit more of a stimulus to change, especially when the desired change is their growth. Secondly, muscles originate and attach at different points, and some are in a better position than others to generate force and be stretched under load, an independent stimulator of hypertrophy. As previously noted, your hamstrings stretch quite a bit under load during stiff-legged deadlifts, but your side delts stretch only slightly under load during upright rows. These two factors combine to dictate different MEVs for different muscle groups, explaining why you might be able to grow your hamstrings from just 6 sets a week of strict stiff-legged deadlifts, but might need more than 8 sets a week of upright rows to grow your side delts.

4. Limb Ratios and Lengths

Individuals with longer limbs generally have to move over more distance in pretty much all weight training and a variety of sport training moves. Thus, on average, MEVs of longer-limbed and taller individuals tend to be a bit lower than those of ones with the opposite characteristics. This is due to the larger amount of physical work and additional stretching that taller folks have to do when making most movements. For example, if a 4'8" individual does deadlifts, she may need 6 sets of them to do enough physical work to hit her MEV. But a 5'11" individual might need only 4 sets to get the same stimulus, because she moves the bar that much further each time, due to her height. The shorter person, given the leverage benefit, may be able to lift relatively heavier weight, which will close that distance in MEV somewhat by adding the stimulus of increased intensity, but usually won't close it completely. If you calculate total work done, taller athletes almost always do more, even accounting for strength differences. Even in cases where strength differences completely obviate workload differences, the higher degree of stretching for lankier individuals usually still lowers their MEVs (if counting by sets and reps) compared to those of their stockier counterparts.

5. Sex

Males are more sensitive to many kinds of training due to their much higher concentrations of testosterone. Thus, for any given training age, and especially in relative volumes of sets and reps, females can have higher MEVs than males. As such, after 5 years of training, a male of a certain size and weight might have MEV of 8 sets of quad work per week, while a female of similar characteristics might have MEV of 10 sets. (The power of anabolic hormones to lower MEVs is evident in studies on exogenous testosterone administration, which at moderate supraphysiological doses leads to hypertrophy *without any training*. For those keeping score at home, that is in fact an MEV of *zero*!)

Lifestyle Factors

1. Recovery Modality Application

What effect does how much you're sleeping, eating, and resting have on your MEV? Well, if you think about muscle growth in oversimplified yet fundamentally correct basics, it's a balance between catabolic, or muscle-wasting signals, and anabolic, or muscle-building, signals. Catabolic signals can result from a low calorie diet, excessive cardio, high levels of cumulative fatigue, alcohol consumption, chronic sleep deficiency, and others, all of which facilitate muscle loss. That means that the more of these catabolic signals you are dealing with, the more anabolic signals you have to put in so as to keep the *net result* positive and grow muscle. These anabolic signals are spearheaded by training, but are also assisted by nutrition, proper rest and sleep, a chronically relaxed psychological and physiological state, and hormonal profiles. Thus, the more your sleep, nutrition, and recovery are properly applied, the less total training you need to get enough overall anabolic signaling, and hence hit your MEV. Simply put, the better you apply the recovery modalities, the less you have to train to make gains.

Remember, though, that the recovery modalities also raise your MRV, so they give you the *opportunity* to train even harder to make even more progress. In this way, recovery modalities basically increase your MEV-MRV window, thereby widening your golden window of beneficial training. This means that you can get away with doing less and still progressing, but also that you can do much more, and get that much more gain all the way through your training.

Of course, the opposite effect from a poor recovery modality application is the narrowing of your MEV-MRV window, and thus, not only do you have to do more to progress, but you can recover from less, which means that your ability to provide progressive overload will be that much more hampered, resulting in shorter stretches of productive training and a higher need to constantly minimize excessive fatigue.

2. Non-Specific Physical Activities

While a small amount of physical activity outside of your training can help reduce fatigue and enhance recovery, excessive amounts of work or recreational activity, such as working as a mover or taking frequent dance classes, and many seemingly innocuous undertakings in between, can interfere with progress. The way these activities interfere is manifold. First of all, such activities can tire you out for your training, thereby lowering your training intensity, which will have to be overcome by higher than usual volumes, and thus higher MEVs, to stimulate gains in hypertrophy to the same extent. For speed, power, and other more intensity-mediated fitness characteristics, such compensation with volume isn't even possible because improvements in these characteristics are so intensity-dependent. Likewise, low energy will directly affect training results, by precluding sufficient volumes of training at requisitely high intensities. Secondly, such activity can be directly catabolic, and lead to muscle loss, which of course has to be counterbalanced by more training, again leading to higher MEVs. Lastly, such high levels of activity can in some cases shift fiber types to exhibit slower twitch characteristics, which can in turn raise MEVs, especially for size, strength, and power training.

Training Program Factors

1. Exercise Type

Not all exercises, especially in the weight room, have the same effects on MEV, particularly if you define volume as the number of sets or reps of an exercise you do, and compare exercises accordingly. Rep-for-rep, some exercises are more stimulating than others, and thus offer both higher fatigue levels but also higher degrees of stimulus, the latter of which implies that you don't need to do as many of them to grow. Such exercises therefore have lower MEVs. More stimulative exercises seem to be those that allow for heavier loading, take the muscle through a longer range of motion (especially if they offer stretch under tension), and require more activation and control on the eccentric component of the lift. This means that, in general, the inclusion of more free weight, barbell, and basic machine movements, such as the smith machine and plate loaded leg press, will translate into a lower MEV than dumbbells, cables, and more advanced machines. The latter end up reducing the amount of eccentric work required and therefore raising MEV. A quick and handy application is when training on the road without access to barbells and such, you'll have to use more volume on dumbbell and/or cable machine work to get a comparable training effect.

2. Program Novelty

If you have been doing the same rep range or exercise order scheme for a while - longer than 6 months as an intermediate lifter, for example - over that time, training significantly declines in how effective it is per unit of volume, and thus your MEV rises. The good news is that when even small changes to those variables are made, MEV falls back down, and thus strategic variation can spur new gains. The trick is to not abuse this effect, because there is good reason to believe that directed adaptation is important to progress, and that switching up training variables too often or too much is likely to lead to suboptimal improvement over time. To maintain long-term gains and regularly lower MEV, it is likely that the middle ground between novelty and staleness is best. As an example, most lifters training for muscle size might benefit from switching exercise selections and/or rep schemes between every 2 to 5 months.

3. Absolute Intensity

Heavier weight, faster running speed, and/or higher jumps are going to stimulate adaptations in their respective systems more easily than lower intensity training. Thus, when the weight is heavy and the movements explosive, MEV is lowered. This knowledge comes in very handy for times when you might not be able to allocate as much time as you'd like to training. If you are short on time, but would still like to ensure effect, make sure the intensity is on the higher end of what you'd normally do in that training phase, and your chances of eliciting adaptations will increase.

4. Proximity to Failure

It is almost certain that, for a variety of reasons, most body systems adapt to the highest degrees - or, in advanced trainees, adapt at all - under conditions of homeostatic disruption. In other words, when systems are pushed to their limits, they tend to adapt the most significantly. Adaptations can likely occur under less strenuous conditions, but the magnitude of such adaptations is bound to be lower than those made under strenuous conditions (in everyone except perhaps beginner athletes). Proximity to muscular failure, and, in fact, proximity to best effort performance in cardiovascular or any other type of training, is thus very likely to cause more adaptations, rep-for-rep, step-for-step, and stroke-for-stroke than training that is further inland of the system's current limits. In other words, training that is relatively more difficult also lowers the MEV. Now, it also lowers the MRV, so it's important to recognize that balance, and design training programs with both of those factors in mind (more on this in the next chapter).

Training Career Development Factors

1. Training Age/Proximity to Career Peak

MEV climbs with training age, for the simple reason that overload requirements for further gains grow as the body's systems adapt, and what used to be overloading is eventually considered routine. The more you train, over months and especially years, the higher your MEV gets. So, while a novice runner can see significant adaptations from running only 10 total miles per week, an elite runner may not even be hitting MEV or seeing any gains in ability at 20 miles per week, which may only represent a portion of her total weekly running distance. When you evaluate or design training programs, you can expect this, and plan for it by incrementally raising the average training volumes of the program over time. Don't simply assume that what used to work will continue to, but rather, assume that more will be needed with time. The good news is that, for a long time, MRVs will continue to rise as well, keeping your MEV-MRV interval wide, and thus giving you plenty of room for progressive overload application. At very advanced levels, unfortunately MEV will continue to rise as MRV slows, stalls, or, in more extreme cases or older age, begins to fall. This will start to close the interval between MEV and MRV in which the most productive training occurs, necessitating some more complex strategies for continued, steady improvement. We'll touch on some of those strategies in later chapters.

2. Muscle Size

Looking at this variable in pure isolation, bigger muscles have higher MEVs, because there is more tissue to stimulate. If you summed the total work from your rear delt workout and tried using that total work for your quads, you'd be done training halfway through your warm up. If you're counting only by sets and reps, or only by working sets per week, bigger muscles often have seemingly lower "relative MEVs", as counted and compared by sets, instead of sets x reps x weight x distance. This is because those other factors, like weight being lifted or the distance it's moved, abundantly compensate for the volume discrepancies. Comparing individual muscles over time, training age takes precedence, and bigger muscles tend to have higher MEVs for that reason. The increasing strength of muscles tends not to be powerful enough to offset this until very late in career development.

3. Strength

Just like muscle size, strength is a difficult comparison because of so many confounders. Stronger muscles tend to have lower MEVs than you'd expect, because the intensity of effort lowers MEV. In contrast, the training age of the individual wielding such strong muscles is likely also higher, and so this factor tends to raise MEVs.

There are almost certainly other factors that alter MEV that we haven't mentioned, but the most impactful ones should now be covered.

Examples of MEV Use

We would love to be able to give specifics on the average MEV values for the different kinds of pursuits, sports, goals, and fitness characteristics, but we simply don't yet have the data to do so outside of just a few applications. What we can do is illustrate how knowledge of MEVs would be used in some very general ways, in a broad range of sporting applications.

Speed Training

Speed training has very low MEVs, and, as mentioned in the last chapter, low MRVs as well. Speed has such low MEVs that in many cases, it can improve without any direct speed training at all! In new beginners, simply adding muscle improves speed, due to the overwhelming increases in force production. In beginners and intermediates, strength increases alone can fuel speed increases, due to continuous force production increases (in the absence of the contradictory neural effects of hypertrophy training which counteract explosive qualities like speed and power). For intermediates and even many advanced speed athletes, power training alone can improve speed abilities, and, in fact, after a hypertrophy base has been established, the vast majority of training over the career of a short-distance sprinter or jumper will involve strength and power training. Direct speed training can absolutely develop speed, but only very small amounts of it are effective, and much beyond that begins to improve speed endurance instead of top speed. A take home message from this is that even high-level sprinters and jumpers will spend a lot of their time developing strength and power. Meanwhile, their actual speed or jumping workouts will be of relatively short duration: maybe 30 minutes of actual hard training 4x a week, that focus largely on technical refinement and strategy, with only some time spent on direct speed work.

Though a bit outside the direct scope and purpose of this book, please be reminded that speed training is very threshold-driven. You don't get faster by jogging or even by half-sprinting. Proper sprint training, while very low in direct volume, needs to be very close to maximal abilities, be it in sprinting, jumping, or a related skill, to have any effects in all but the most novice of athletes. In simple terms, you'll get faster from running *hard* for 5 total sprints, than running very submaximal sprints of the same distance for dozens of reps.

Power Training

Almost everything about MEV that was said for speed training applies to power training, just to a lesser extent. You can observe the low MEVs characteristic of power training by watching weightlifters and throwers train: the majority of their sessions are spent sitting around! If you are a fan of "grinding" and doing tons and tons of work, either save it for another phase, like hypertrophy, in power development, or put that motivation into producing high intensity efforts for the small bursts in which they are appropriate, or choose another sport. Power training is characterized by very intense efforts interspersed with long rest times, as opposed to tons of volume. This is in part because low MEVs make high volume of power training unnecessary, and in part because low MRVs make them some combination of unsustainable and counterproductive.

Seems like it would be easy to talk athletes into coming to grips with the idea that, to be their best, they need to train hard, but not as much as they've perhaps been accustomed to from other sports. Unfortunately, often this isn't the case. Two distinct examples of either needlessly or counterproductively excessive volume come to mind: American Football training, and Fitness Sport training. Many athletes in these two sports could vastly benefit from restructuring their training based on their MEVs and MRVs for the various requisite fitness characteristics.

American Football culture rewards hard work to a great extent, and this is fundamentally a good thing, as we have discussed in prior chapters. Again, however, this attitude can be taken too far. This is particularly the case in the approach to both speed and power training, wherein the coaching staff, without much protest from the athletes, programs excessive volumes of training, in attempts to enhance power and speed, often with the stated or implied goal of also enhancing "mental toughness". A training program will often include tons of reps, tons of sets, sprints that are too long in duration to train top speed qualities (100m+ sprints, for example), and more calisthenics than remotely reasonable. This degree of training volume is needless at best and counterproductive at worst. While football training should be very intense and very technical, the preeminence of speed and power in determining outcomes means it should not be a sport in which high training volumes are often used.

In Fitness Sport, you'll find just about some of the hardest working athletes out there. And that work ethic comes in really handy for the repetitive efforts and endurance work that is such a big part of the sport. All too often, however, these fitness athletes will bring that same love of high volume training to their weightlifting training, in their attempts to increase their power characteristics. Instead of stopping at several sets of triples in the snatch, which is the likely sweet spot between MEV and MRV for power development, they tend to extend set numbers and even rep numbers far beyond, and basically change the training from one that meets their goal of improving power, to one that improves muscular endurance, of which they already get plenty in their other training!

There are certainly other sport examples as well, but without going on for too long, outside of limited basic preparatory or hypertrophy phases, due to their lower MEVs and MRVs, most speed and power sports will simply not be characterized by very high volume training, no matter how intuitive such training may feel to coaches and athletes alike.

Strength

Strength training is very much in the middle of the volume spectrum. The MEVs of strength training depend on the characteristics of the individual engaging in it, particularly with regard to two - often related - qualities: the fiber type of the individual, and her absolute strength. Once again, individuals that have a higher proportion of fast twitch fibers tend to have lower MEVs, as such fiber types tend to be more responsive to strength training. Stronger individuals will also have lower MEVs, because each unit of volume they do is so much more intense. Consequently, as often seen in female divisions and lower weight classes, advanced strength athletes with more slow twitch fibers and not very high levels of absolute strength can have quite high MEVs, possibly upwards of 15 working sets per body part per week. Meanwhile, very strong athletes that are fast twitch dominant can have very low MEVs, sometimes as low as 5 working sets per body part per week, or even fewer. Mind you, MRVs tend to track similarly, so these two types of athlete don't necessarily differ much in MEV-MRV interval size.

Hypertrophy Training

We've written extensively about the MEVs of hypertrophy training on the The Hypertrophy Training Guide Central Hub page of the RP blog. Worth a mention here that using proper variation, especially in exercise selection and repetition range every several mesocycles, can keep MEV lower than it would otherwise be if the exact same programming was used for longer stretches. Variation can also enhance hypertrophy training, specifically by extending the MEV-MRV interval, and allowing for more opportunities to progressively overload.

Technique Sport

Athletes in sports that require multiple moves, like grappling and wrestling, can make the mistake of trying to train too many moves at one time, within the same training week, for example. What this does is keep the training of *all* moves below MEV, and really just amounts to review for individuals that are already fairly advanced. A better approach is to focus on several techniques at a time, potentially for several weeks, and thus train those techniques of focus in volumes above MEV. Those techniques will improve, and then a new set can be rotated in also trained above MEV, thus improving all-around game in a leapfrog fashion.

Fitness Sport

While beginners in fitness sport tend to have low MEVs, the advanced can have MEVs that are very high, particularly because they have to be simultaneously good at so many fitness characteristics. In fact, this means that, for many advanced athletes, the sum of all of the MEVs for the required abilities in the sport can outpace the total system MRV. This means that, between MEV and MRV, not all qualities can be trained productively at the same time, and priority phases may be needed to emphasize some qualities while deemphasizing others at any given time throughout the training year.

Endurance

No sport category has MEVs as high as endurance training. In fact, if they are not attending to the recovery modalities of sleep, rest, nutrition, properly structured training, and so on, even intermediates in endurance training can risk their MEVs bumping up into their MRVs. For many high level intermediates in endurance sport, the key to advancement is getting in the habit of being very diligent about recovery modality application, so that their MRVs make room for overload application over their MEVs. For this reason, besides a focus on the overloading components of the training process, any coaching or consultation of higher level endurance athletes must be very focused on proper recovery modality application as well.

3 MAXIMUM ADAPTIVE VOLUME

Derivation:

By understanding MRV and MEV, we already have quite a bit of good insight into training volume recommendations. For any given ability, training with volumes under MEV doesn't seem to make sense, as, by definition, this training volume is not sufficiently stimulative to cause net gains in ability. On the other end, MRV implies that much training above this marker is sure to at least begin to violate overload abilities, insofar as lack of recovery leads to a reduction in abilities over time. Because overload can no longer be presented, the ability to make gains starts to be seriously impeded.

So, just from the study of these two landmarks, we can infer with some confidence that *nearly all* productive training, or training that directly leads to improvement, lies somewhere between the MEV and MRV. The question then becomes, where exactly between them does the *most* productive training volume lie? And what would we call that landmark?

Definition:

Maximum Adaptive Volume (MAV) : The amount of training that, in any one unit of time, yields the greatest adaptive response.

Seems pretty straightforward at face value. If there's a minimum effective amount of training we can theoretically do, and there is an amount that is too much for recovery and improved performance to occur, there has to also be an amount somewhere between these that yields the best possible gain rates. Quickly though, for completeness of thought: why doesn't training either *at* MEV instead of below it or *at* MRV instead of above it yield the best possible gains? Why does MAV have to be between them?

Sidebar: The MAV marks the point at which gains are the highest they will be throughout the current mesocycle of training, but *does not* define the magnitude of those gains. The question of *absolute* gain rates is a bit outside of the scope of this book. Here we are concerned with finding the best rate of gains *relative* to all others within a given timeframe. What that will translate to, in absolute terms, depends entirely on the individual, the situation, and the training, nutritional, and recovery inputs. Suffice it to say that when you train at your relative highest rate of gains, or MAV, this will also yield the highest absolute gains you are capable of under those conditions and at that time.

MEV is the *minimum* effective dose. If you plan your training to stay as close to the MEV for as long as possible, you will get… drumroll… the *minimum amount of gains possible.* Short of stalling or regressing, if you're interested in getting, literally, the worst gains ever, more power to you. Its likely that this goal will fail to resonate with most readers, however, so let's proceed with the understanding that our goal is in fact maximum, not minimum gains.

So training at MEV is out, but what's the problem with training right at MRV? This sounds a lot more appealing: you're pushing your body as hard as possible, which can be quite cathartic, and, it's reasonable to assume, also productive. If you've done all you could do in the context of consistent recovery, then you don't feel the need to second-guess yourself. Therein lies the problem, however. Training *right at* MRV saps all of your surplus physical resources reserved for training, and uses them up for recovery. Where does that leave resources for the processes that cause adaptation? Nowhere, it seems. When the stimulus is just too big, the body's systems are designed to recover you first, and "think about adaptation" second. If you overwhelm those recovery systems, or rather, use them to their fullest to merely return to past states of ability, they won't be likely to provide you with any adaptation. In fact, the reality that adaptation isn't occurring is rather inherent to the very definition of MRV. If adaptation was occurring, after recovery, you would return to a *higher* state of ability in the your next training, not just to the same level of ability as before. The fact that *recovery* is generally defined as 'a return to past states of ability' and nothing more, both defines the MRV concept, and confirms that, at MRV, no clear, long term gains are possible. In other words, if we want more than a return to our previous selves - If we want to instead to progress and better ourselves each training cycle, that means training under our MRV.

So far, by the process of elimination, we've concluded 3 things about the theoretical, and still rather mystical, MAV landmark:

- It's somewhere between MEV and MRV, where almost all gains are sure to be found
- It's not *at* the MEV for any extended length of time
- It's not *at* the MRV for any extended length of time

Not bad detective skills so far. Let's see if we can further tease out MAV. Here's another clue: a feature of MAV that must be attended to is its mobile nature. Say what? It moves around?! Yep, that it does.

The Overload Principle states that for training to be most effective, it has to be within the maximal threshold of the system, as in hard, and progressive, the latter meaning that it should get harder over time. If our training is hard, meaning above MEV, but remains around the same midpoint between MEV and MRV without moving, it's in violation of the progressive feature of the Overload Principle. Thus, by definition, this non-progressive training is not yielding the theoretically maximal adaptations. So, while MEV and MRV also move around depending on the work capacity and training state of the athlete, and how efficient they are becoming with their techniques and the like, by its very nature, MAV is guaranteed to move throughout the training cycle. The Overload Principle dictates that training must get harder for adaptation to occur, which dictates that the MAV must increase over the course of a mesocycle. Assuming that the first microcycle was at MAV, the MAV will climb higher and higher with each training microcycle that follows. This is because, after each microcycle, what was enough volume to cause maximum gain rates is no longer enough volume, so more must be done. Now we're really onto something. We know that MAV is found somewhere between MEV and MRV, and that it's unlikely to hang around at either one of those extremes for long, or to hang at *any* point for longer than a microcycle. As aforementioned, the Overload Principle mandates that it go up throughout the mesocycle. From all of this, we can infer that throughout a mesocycle, MAV directionally increases, from around MEV to around MRV.

Now, we're left with a few questions about the MAV:

- How low, or close to MEV, does it typically start? In other words, to get the best gains possible over the whole mesocycle, how close to MEV should we start our mesocycles?
- How high, or close to MRV, does MAV typically get before the end of a mesocycle? In other words, provided we want the best gains over the mesocycle, how close to MRV should we end our progressions?
- An "adaptation curve" is the curve formed by graphing the magnitude of gains - in muscle growth, for example - made over time, in which the time course is a whole mesocycle. For example, if you grow half a pound of muscle each microcycle for 4 microcycles straight, the area under the curve is 2 total pounds of muscle grown. The question about MAV then becomes: what is the shape of the adaptation curve over those distances between MEV and MRV, so that we can train under the highest points and cover as much "area under the curve" as we can, in order to yield the greatest product of gains rates x time, aka the highest net gains possible?

Let's work through some ideas to help us get closer to answering these.

Defining the Breadth of the MAV Landmark:

Let's start by assuming that MAV can be defined as occupying the entire range between MEV and MRV. That is, it starts at MEV at the beginning of the mesocycle, and works all the way up to MRV by the end. While this might look immediately correct to some, others will be more skeptical. Why eek out the small gains of going all the way down to MEV, when maybe starting higher on the curve is a good idea? Why risk the injury or overtraining in approaching MRV, when maybe stopping lower on the curve is a good idea? Why not stay safely in the mid-range, where you're most likely to get the highest adaptations without treading close to either extreme?

These are all very good questions, and ones we've thought about considerably.

First thing's first: why not simply train from MEV to, say two thirds of the way to MRV? The big advantage here is that it would reduce the risk of the unplanned or poorly managed breaching of recovery ability (Non-Functional Overreaching), overtraining, and injury by a large margin. While doing so is actually recommended in some special cases, for most athletes, such advice is likely suboptimal on the net balance, for at least the following 4 reasons:

1. Area Under the Adaptation Curve

By stopping way short of MRV, you're basically trading off garnering further adaptations that you would attain if you kept going in favor of deloading and repeating the current cycle. This basically means you miss out on the tail end of the adaptation curve (see Figure 5).

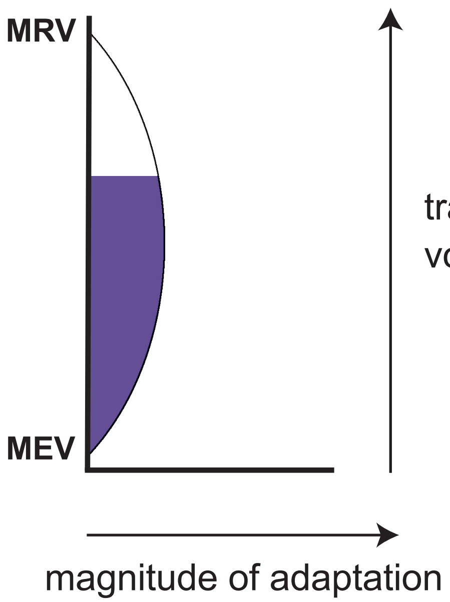


Figure 5. Stopping Far Short of MRV: The area underneath the curve represents potential adaptation resulting from training volume (purple shaded area) while the y-axis represents training volume performed. By stopping far short of MRV (end of purple shading), considerable potential gains from training are forgone (the unshaded area under the adaptation curve).

The seemingly good news about this cutoff is that, being at the tail of the curve, deloading and restarting doesn't appear to lead to much missed gain. The bad news is that this requires you to have to deload more often. Because you don't make gains during a deload, and any instances in which you do mandate that you approach or surpass your MRV just prior to deloading, the more often you deload, the less total "time to gain" you get in any given macrocycle of training. So, by cutting off earlier and having to deload more often, you shorten your overall gain intervals over the long term.

Now, a counterargument to this is that, by cutting off well before MRV, the deload can be shorter than it would need to be if volumes increased all the way up to MRV, and a shorter deload means that you'll be starting your next training cycle that much faster, and shouldn't doing that prevent any potential loss of gains? The practical application of this is very difficult. Since deloads are usually done in week-long segments, it's going to be very tough to engineer a training program that only deloads for 5 days, or something to that effect, and thus reclaims lost training time that way. It's possible, but definitely not without its difficulties. At the very best, even if a shorter deload can be utilized, other problems remain.

Training is a long-term process, and multiple consecutive microcycles of training establish a momentum that is costly to halt. After multiple sessions, you've found the groove on your new exercises, gotten accustomed to your sets and rep schemes, and raised your ability to do high workloads without unnecessarily risking damage due to novelty. Just when you've hit this groove and are ready to bust through all-time PRs, you have to shut it down, deload, and restart the process. Because it interferes with training momentum by requiring an early return to minimum effective volumes, this strategy might be foregoing gains that are simply not possible within shorter, less voluminous stretches of accumulation.

2. Homeostatic Disruption

While muscle growth, strength enhancement and other factors improve from training, they do not improve from simply going through the motions. Fundamentally, improvement occurs after overload that challenges the system and leads to the adaptations that prepare it for next time such a stimulus is presented. From a perspective of evolutionary biology, it's unlikely that adaptations, metabolically expensive as they are, would come easily, and much more likely that systems really have to be thrown off of their normal functional parameters to catalyze change. This is even more likely to be true for advanced systems, as in, those that have experienced their fair share of training. Such systems and abilities are likely to need more impetus to make their best adaptations, impetuses that are perhaps disproportionately large relative to the absolute abilities of the system.

In more simple terms, getting better, especially if you're already good, may very well require at least the occasional superlative stimulus, and, more often, stimuli that are *extremely* disruptive. From the volume perspective, this likely means that the "MEV to two thirds of the way to MRV" strategy will lead to increased loss of potential gains as the athlete gets better and better with training. This can be visualized in a potential change of adaptive curve shape between MEV and MRV, such that the curve's peak shifts towards MRV – in other words there is more area (adaptation potential) closer to MRV for advanced athletes. In short, for the more advanced athlete, superlative volumes that really challenge the physiological systems and produce adaptations are closer to MRV.

There are arguments that such big challenges are not required for gains to be optimal, but such arguments tend to hold a lot more merit in reference to beginners and intermediates than they do to intermediate-advanced and advanced athletes. It needs to be recognized that physiological systems of the well trained will not adapt optimally if their boundaries are not regularly explored. The next point is on just that.

3. MRV Raising

One of the benefits of regular, long-term training is that your MRV goes up with time. By increasing your MRV, you are able to train with chronically more volume, and thus obtain reliably better gains. If you never approach your MRV, however, how fast will it increase? It may very well still increase, but it would be a violation of the Specificity Principle - which simply states that you improve precisely on that which you train most often - and is incredibly unlikely that MRV would increase as quickly as it could if you regularly approached it in training.

By failing to approach your MRV, the two-thirds cutoff strategy likely reduces the speed at which your MRV increases over time, robbing you of a considerable degree of potential gains.

4. Functional Overreaching

The last but definitely no less compelling argument against stopping way short of MRV is that of Functional Overreaching (FO). FO is the well-described and documented phenomenon of the benefits of taking a system slightly beyond its short-term capacity to recover. When such a foray is made, and followed immediately by a planned recovery phase (like a deload or an extended phase of low volume training), it has been shown to increase abilities in that system beyond what's typically possible with normal overloading training. This increase in abilities comes at a delay (about as long as the recovery phase that follows the overreaching phase), and is termed "delayed supercompensation" in the sport science literature.

FO has been demonstrated to work well for athletes in multiple sports that rely on endurance, speed, power, or strength. Direct evidence for its possible utility in hypertrophy training is still pending, but some indirect evidence is available. For example, it has been shown that satellite cell proliferation, which can generate new muscle tissue, is higher after very damaging training than it is after more normal training.

Does this mean that you need to train "balls - or ovaries - to the wall" all of the time? It doesn't. It *does* mean that in most circumstances, likely including hypertrophy, stopping too far short of MRV means missing out entirely on the benefits of FO, and thus missing out on some net gains.

To recap, stopping training at up to the two-thirds mile marker of the way to MRV can impede training momentum, preclude some of the most productive training, reduce MRV increases over time, and prevent the plethora of FO benefits. For these reasons, stopping far short of MRV is likely not a productive strategy for most athletes, especially considering that the main driver behind promoting this two thirds strategy is the aversion to risk of overtraining or injury, which can be greatly reduced by proper planning, movement technique execution, and fatigue monitoring.

Alright, so maybe avoiding the top end of the MEV-MRV range isn't generally the best idea, but what about avoiding the bottom end? Quite a few athletes have protested that training down in the lower ranges is too easy and boring, and not challenging enough for best gains. So why even dip all the way down to MEV? Why not simply start closer to the middle of the range, somewhere around one third of the way between MEV to MRV?

Here are at least 4 good arguments against this practice in most cases:

1. Short Term Fitness Gains

When you start a mesocycle, your MRV isn't super high, because of the novelty of the movements, the rep ranges, or the tempos. Even if your mesocycle is a repetition of the previous one, with the only change being higher intensities, the deload just before it will have lowered your MRV somewhat, by slightly reducing your work capacity. By training at the low end of the MEV-MRV range, you actually raise your fitness – your specific work capacity - and thus your MRV, while avoiding accumulation of very high fatigue. At the very least, you gain the adaptations of training during this early phase, as your fitness increases counteract the fatigue increases. As a result, you essentially gain some adaptation-generating training time that you would not enjoy in absence of these fitness adaptations. Now, if you cut it short right after this first third of the process, you would never cash in on that higher MRV. But, if instead you follow all the way through on the MEV-MRV range, you end up getting those early gains, including the net extension of the length of the adaptive curve. Why not get the early gains, the middle gains, and the late, MRV-adjacent gains all in one!?

2. Area Under the Adaptation Curve

If you stop two thirds of the way on the road from MEV to MRV, you can possibly do a shorter deload and still salvage at least the total adaptations you get over the multiple mesos of the training year. No, the mesos are not as long, but the deloads are shorter too, so these might cancel each other to some degree. This shorter deload length can occur because you never approach the highly fatiguing MRV-adjacent area of the curve. That, however, is not at all the case with training that starts one third of the way up that curve, and reaches all the way to MRV. In fact, the only training you miss out on with this strategy is the *least* fatiguing training. Because you end up going to MRV just the same, your deload is not likely to be reducible in length. Since this strategy has you cutting off the beginning of the mesocycle, or the MEV-adjacent end, you have now shortened the length of the accumulation phase. A shorter accumulation phase leads to more frequent deloads and means that you actually get less total adaptation over the course of the training year, which isn't very defensible if optimal results are your goal! (See Figure 6).

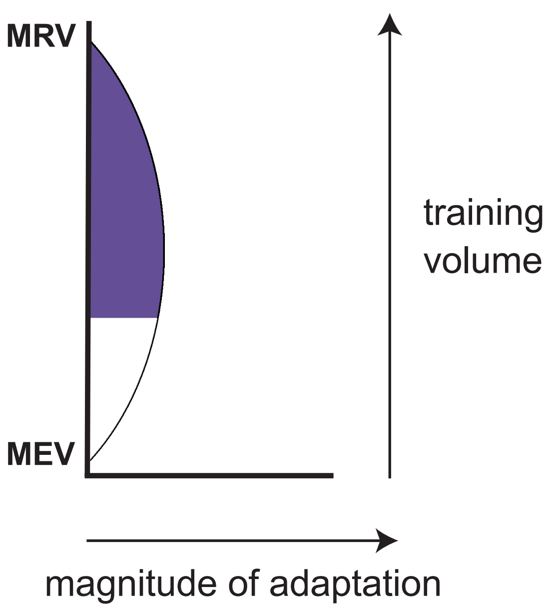


Figure 6: Starting Far Above MEV: The area underneath the curve represents potential adaptation resulting from training volume (purple shaded area) while the y-axis represents training volume performed. By starting training far above MEV, considerable potential gains from training are forgone (the unshaded area under the adaptation curve).

3. Low Risk Gains

What is the nature of the gains made in the lower third of the way between MEV and MRV? Well, they aren't huge, but they are also about as fitness enhancing as they are fatiguing, so they are unlikely to impede the rest of the mesocycle in any way. Additionally, they are made with lower volumes in a low fatigue environment, so the chances they lead to overreaching, overtraining, or injury are very low, the lowest that overloading training can have.

If it's your desire to eliminate this part of the training process, then you're really arguing for the elimination of comparatively easy gains of the safest variety. These gains also do not interfere with the other methods, like getting closer to MRV, so these methods can still and also be employed later. For this to be a worthy trade off, gains obtained closer to MRV would have to be *much* bigger than those obtained just above MEV, and that is rarely the case.

4. Elevated Injury Risk

Research has demonstrated that one of the dangerous times for training-induced injury is when athletes come back from a low volume phase, like a deload, and get right into higher volumes of training without easing in. Relatedly, you would be doing just that by skipping the early phases of the MEV-MRV training window. In addition, even if injury doesn't occur, the degree of muscle damage resulting from high volumes that were not worked up to might be very high, because you - and your muscles - are unaccustomed to that training. As you'll recall, this is likely to result in more resources being diverted to mere recovery, and hence fewer towards adaptation. Easing into training can obviate these downsides, which is exactly what starting all the way down at MEV allows.

Lastly, there are those who don't see the need to move through the whole MEV-MRV spectrum, and prefer to try and stay safely in the middle (Figure 7). They do this by keeping volume fairly constant, micro to micro, in an attempt to get the highest rates of gain until a deload is needed, then getting right back into that middle range again.

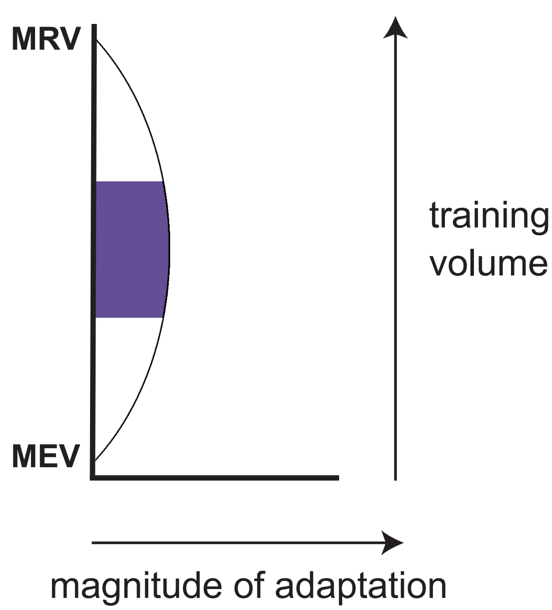


Figure 7: Focusing on the Middle of the Adaptation Curve: The area underneath the curve represents potential adaptation resulting from training volume (purple shading) while the y-axis represents training volume performed. By targeting the middle of the adaptation curve, potential gains from both the lower and higher volume ends of the adaptive spectrum (the unshaded areas under the curve) are left on the table. Or the bench, as the case may be.

Though this strategy looks clever at face value, let's recap how this "stick to the middle" approach will likely hold you back from best gains:

1. Missing the Low End of the MEV-MRV Spectrum

Missing the low end of the MEV-MRV spectrum subjects you to making the errors described in points all four points of that section above.

2. Missing the High End of the MEV-MRV Spectrum

Missing the high end of the MEV-MRV spectrum subjects you to making the errors described in points all four points of that section above.

3. Lowered MAV Upon Phase Commencement

Is your MAV really in the middle of a phase of training when you start it? Unlikely. At the very least, the deload you're just coming off of has exposed you to lower volumes, and thus increased your sensitivity to volume. This means that your MAV will be close to your MEV anyway. This effect is magnified if various features of your new mesocycle differ from your last, including but not limited to rep ranges, exercises, techniques, and tempos. Each difference or novelty means that less volume has to be done for best gains to occur. At the same time, your proclivity to sustain high levels of damage from a given volume is up, putting your true MAV at the beginning of a training phase very close to or at MEV. What this means is that between MEV and MRV, the adaptation curve would likely not have the sharper peak (as shown in Figure 8, A). Instead there would be more area under the curve closer to MEV and a flatter curve overall (Figure 8, B).

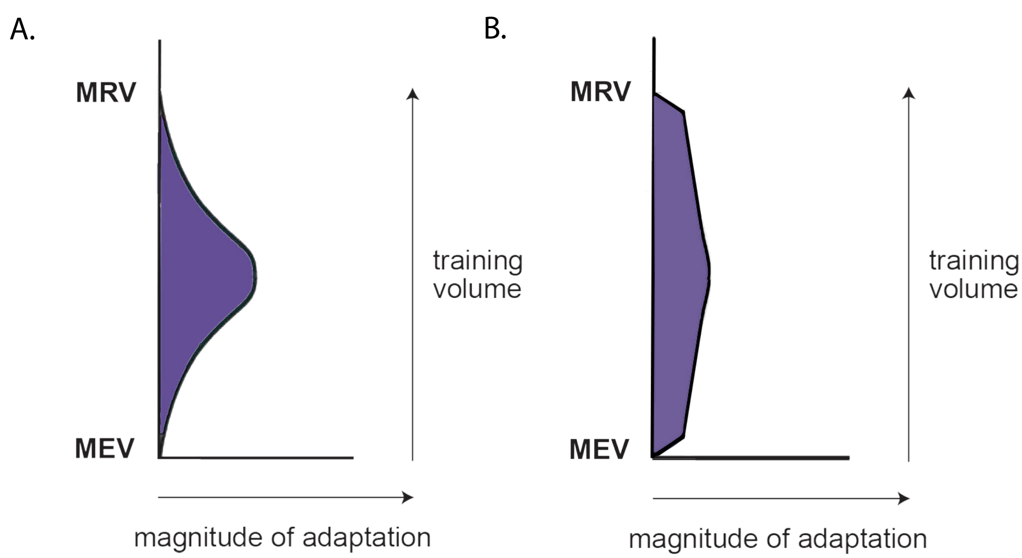


FIGURE 8: Perceived Versus Likely Shape of Adaptation Curve: A. Represents the assumption that most of the gains in training between MEV and MRV occur in a narrow band, thus restricting MAV to some intermediary value between MEV and MRV. **B.** Represents the more likely shape of the adaptive curve with gain rates much more evenly distributed between MEV and MRV. This makes MAV more of a range than a point.

4. Chasing Overload

Starting in the middle has its problems, but staying in the middle is nearly impossible. Because overload generally requires volume increases, your highest rate of gains (MAV) when in the middle of the MEV-MRV range will no longer be that value in the next microcycle. More must be done for adaptations to continue occurring at their best pace, and adding more and more and more is going to draw you away from the middle and into the high end of the MEV-MRV curve. As such, chasing MAV is mutually exclusive from staying in the middle. And if you don't chase it, you're accepting lower gain rates than optimal. Thus program novelty increases adaptive curve area on the MEV end and chasing overload extends it on the MRV end, resulting in a flatter curve and a wider window of adaptive potential. This reflects the likely reality that MAV doesn't peak drastically in the middle of the MEV-MRV spectrum, but actually remains relatively constant for most of it.

5. Volume Progression as Overload

Volume progression in itself is an overloading variable. The simple act of increasing training volume - versus or in addition to intensity or velocity, for example - is itself the *cause* of gains in many training situations. That is, increasing volume is not just an adjustment that must be made to supply sufficient intensity or velocity for maximum adaptive rates. That volume can itself to be used for overloading is a feature in programs whose goals are hypertrophy, work capacity, and basic endurance. In fact, especially in hypertrophy, work capacity, and, in some phases, endurance, volume increases are likely bigger drivers of adaptations than intensity or velocity increases. In phases of training which emphasize strength and/or power development, the volume progression rate can be much lower, since low fatigue levels are so important when progressing with intensity and power. In some situations of strength or power program design, sets and reps might actually need to fall to lower fatigue, and thereby allow for intensity overload to occur while mitigating intensity's high contribution to fatigue. In other words, your 3x5 might be heavier than your 5x5 by enough that it actually generates as much fatigue despite its lower volume. So if you try to do a phase of 3x5, 4x5, 5x5, and your intensity also climbs with each volume progression, you might experience exponential fatigue increases. Since you need to be strong enough to complete the last microcycles of a strength phase, wherein you'll be lifting the heaviest weights relative to the preceding microcycles, such fatigue levels might be unaffordable. You might then opt for 4x5, 4x5, 4x5 instead, to let the rising intensity, instead of added volume, to account for all of the fatigue increases. You might even have to drop the overall volume to counteract the intensity increases, and do 4x5, 3x5, 3x5, to get the highest intensity effects and the biggest strength increases before you deload. Notice that there is no drop in volume in the last microcycle here, since there's a deload immediately after, and overreaching is ok given the coming low volume recovery week.

Presented another way, the MRVs for strength and power training might be so low, that the total breadth of MEV-MRV is much shorter for them than for hypertrophy, work capacity, or endurance training. So you still go from MEV to MRV in strength training, but that trip is accomplished mostly, if not solely, through intensity increases that contribute to volume increases, versus volume increase for their own sake. In the case of very high intensity increases from micro to micro, your MEV and MRV might actually both fall throughout the phase, leading you to use lower volumes with each micro. This is to help maximize recovery so as to also maximize intensity increases, and thereby ensure the ability to do them. You still start the phase at its MEV at the time, which will be high in the beginning, and still end up at the MRV at the end, which will now be even lower than the MEV was at the beginning of the phase! And, amazingly, you end up going *down* to chase those numbers. Give that some thought, because it's quite a counterintuitive concept!

Those complexities aside, if intensity or power are the main drivers of your program's overload, you might be able to keep volume more stable through the accumulation mesocycle, though it will likely still travel the full MEV-MRV range, just a smaller one. If volume is a big driver of your results, however, you had better not be keeping it stable by attempting to stay in the middle all mesocycle. Speed and power are typically trained at or very near competitive periods, and thus will not generally follow the same FO protocols for volume as seen in preparatory phases. The volumes are typically very stable and do not accumulate to FO levels seen in hypertrophy training, simply so that speed and power can be expressed in training or competition.

To summarize, while the exact MAV is likely to live somewhere just above MEV and just below MRV, in most cases, getting the highest total amounts of adaptation throughout the whole mesocycle hinges on training beginning very close to MEV and ending at or around your MRV. In other words, the likely grand view of MAV is that it basically occupies the entire range between MEV and MRV, and most mesocycles should be designed to work through that whole range. In a later chapter about volume landmark changes over the training career, we'll examine some possible modifications/exceptions to this general rule.

Importance:

The importance of understanding and knowing both the concept and the personal application of MAV is self-evident. By highlighting which training is maximally adaptive, the MAV concept allows us to target such training during the accumulation phases of our mesocycles and, quite simply, ensure that we are getting the best stimulus, at least from the volume portion of the equation. Additionally, knowing and understanding how MAV changes throughout an athlete's career allows us to proactively adjust volume, to ensure that we're at least attempting to make the best gain rates at every time point. In so doing, we can now increase the chances of optimizing athletic performance to the max when the athlete reaches his peak.

Sources and Nature of MAV Differences

Because the MAV is found in the interval between MEV and MRV, simply referring back to discussions on the sources and natures of MEV and MRV differences can take the place of a mostly redundant conversation here. If you'd like to know how a variable, let's say, sex, affects MAV, please simply refer to its effects on MEV and MRV, and apply the same to MAV! In the case of sex, females will usually have higher MEVs and MRVs when comparing similar training ages, so they typically need more volume than males, especially as counted in set numbers, to accomplish the same relative degrees of hypertrophy, strength, power, and speed training. Endurance training volumes for males and females actually seem rather equivocal, with females benefitting from similar absolute distances but with slower paces.

There are two points of interest in the discussion of MAV differences, however, that we would like to note on their own. The first point is a rewording of a detail mentioned earlier, but it's a very important detail that we'd like to emphasize. The MAV is the range or point in or at which you get your best gains. That is *not* the same thing as, and, in fact, is very different from, the *actual rate of those best gains*. In other words, the "best gains you are capable of making" is a very different idea than "the best gains someone else is capable of making." And the training volume being used plays only a small part in determining the actual magnitude of those gains.

Other factors, such as hormone concentrations and fiber types determine gain rates at least as much as volumes do, if not more.

Let's take fiber types for example. Individuals who have predominantly faster twitch fibers will gain more muscle from heavy resistance training than those with slower twitch fibers predominating (see Figure 9, below).

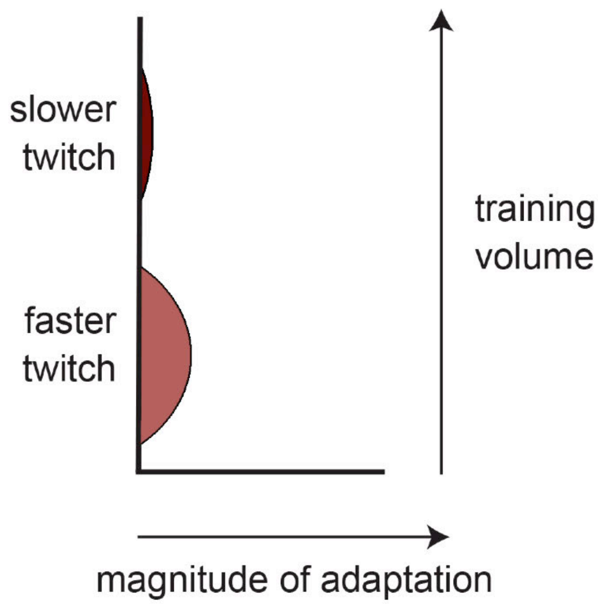


Figure 9: Hypertrophic Adaptation with Respect to Training Volume and Muscle Fiber Types: Faster twitch fibers (lower, dark red curve) have greater adaptation potential at lower volumes of training compared to slower twitch fibers (upper, lighter red curve). Even when slow twitch fibers are exposed to very high volume training, adaptation potential does not reach that of fast twitch fibers. (This graph is idealized. For simplicity, relative volumes of training and overlap are not represented.)

As you can tell from the figure, and as expected, the slower twitch individual has by far the higher MAV, but the magnitude of gains he's getting in his MAV is not nearly as high as of the faster twitch individual. In fact, the very slow twitch fibers that contribute to his higher MAV reduce the magnitude of gains (height of the curve) during that MAV. This example strongly reinforces the advice to chase your own personal MAV, instead of being tempted to conclude that more training is categorically better. If the faster twitch individual attempts to train at the volumes of the slower twitch individual, his chances of exceeding his MRV are near certain, and he'll be way out of the ballpark of anything resembling optimal gains.

Another example of the discord between MAV and gain magnitudes is found in hormone level differences. For any two individuals that are identical except for a genetic difference in circulating testosterone concentrations, there will be qualitative differences in the shapes of their respective adaptation curves. First of all, higher testosterone levels make muscles more sensitive to training of nearly of all types, but especially speed, power, strength, and hypertrophy training. This means that, all else being equal, individuals with higher testosterone levels can be expected to have lower MEVs. Secondly, given its effects on neural drive, red blood cell counts, and essential effects on motivations to train and compete, testosterone plays a big role in recovery process enhancement and in work capacity increases. So, those with higher testosterone also have higher MRVs. But wait, there's more! Individuals with higher testosterone levels are also more likely to show higher gain rates in response to any given effective stimulus. What this results in is an adaptation curve that's both longer *and* taller than it would be without the presence of more testosterone (see Figure 10 below). So, not only do higher testosterone levels give you longer MEV-MRV windows in which to overload, they also lead to a higher gain yield in ability during each one of those overloading sessions. If you had any confusion as to how genetic or supplement-induced differences in testosterone manifest in training advantages, give these findings some thought.

As illustrated in Figure 10, not only do higher testosterone levels allow for adaptations at lower training volumes than usual (lower MEVs), they also allow for higher MRVs. This, in turn, allows for training progressions to either last longer, or make bigger jumps in stimulus from microcycle to microcycle. In addition, more adaptations are stimulated at each volume level with higher testosterone, raising the height of the adaptation curve and even further increasing the total improvement resulting from training cycles.

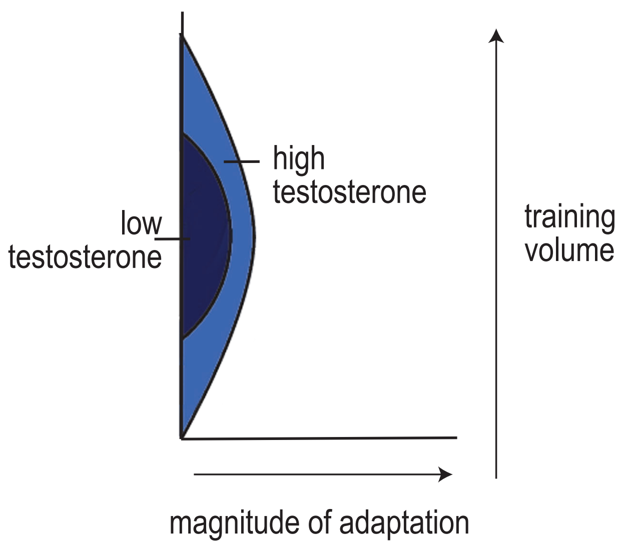


Figure 10: The Effects of Testosterone Levels on Adaptation Magnitudes: The dark blue curve represents the extent of adaptation expected across training volumes under low testosterone conditions. Under higher testosterone conditions (light blue curve), the extent of training volume conditions that will result in adaptation and the magnitude of that adaptation are increased.

The effect of anabolic hormones on adaptation curve shapes lead into the second point of interest: how can certain inputs or differences lead to an expansion or contraction of the MEV-MRV window, and thus have profound implications for adaptation?

A huge example of an input that can alter the adaptation curve is adherence to the recovery modalities. The abilities of sleep, relaxation, proper nutrition, and other related modalities to increase MRV have already been discussed. These same factors can also reduce MEV. Let's take sleep for example. Getting two hours less sleep every night on average will impede recovery time, which is sure to lower your MRV. Missing that much sleep over time will also lead to chronic elevations in catabolic stress hormones, such as cortisol. The presence of such hormones in higher amounts than usual gives a small but consistent catabolic signal to muscle tissue. All other inputs being equal, this means that you have to train *more* to overcome this signal, and thus MEV goes up. So, by missing sleep, you've both raised your MEV and lowered your MRV (see Figure 11, below), which leads to a huge reduction in how long you can overload before having to deload, and thus hinders your training productivity.

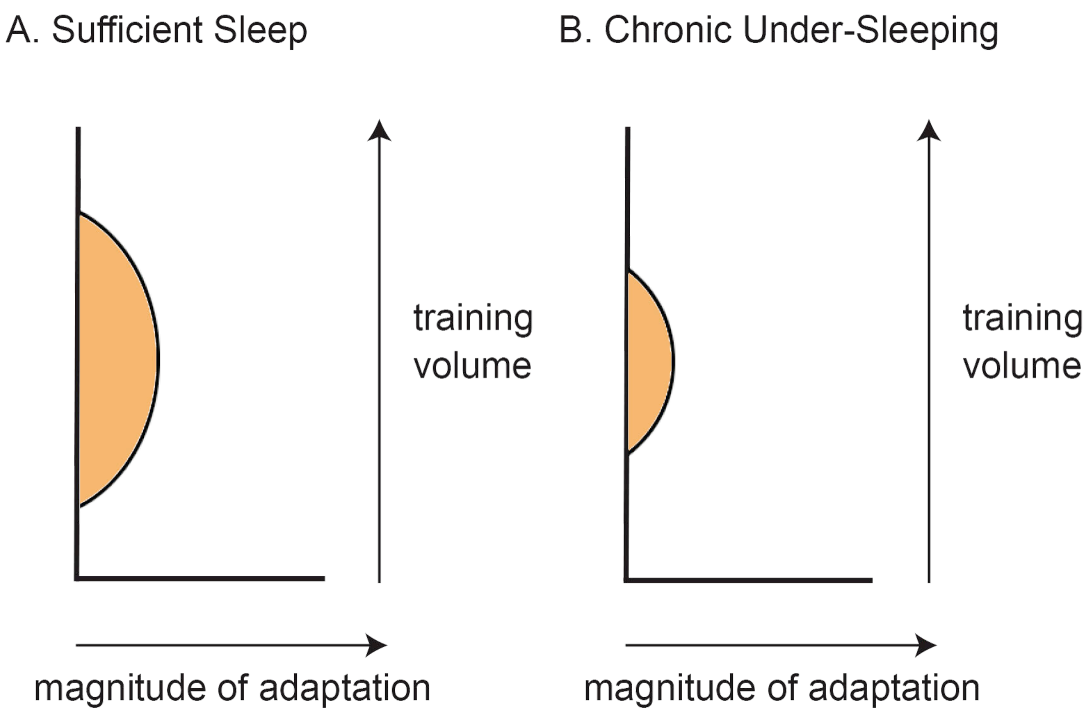


Figure 11: Adaptation Curve Alterations Resulting from Changes in Sleep Quantity: A. When sufficient sleep is a regular feature, low MEVs and high MRVs result, including high adaptation magnitudes at any point between the two landmarks. This results in a higher degree of overall improvement over the mesocycle. B. When sleep suffers, MEV goes up and MRV goes down, causing the magnitude of adaptation to decline at every point between them, and leading to substantially hampered gains from training.

In essence, any modality that lowers your MEV and simultaneously raises your MAV, be it training mediated, nutritional, or supplemental, is of great interest, because of the big effect it can have on improving your long-term performance outcomes.

Examples of MAV Use

Since much of the discussion on using MAV can be derived from earlier discussions of MEV and MRV use, in this section, we will focus on emphasizing a couple of points in the application of the MAV concept.

Because speed, power, and strength training are so intensity driven, as in, their stimulus relies much more on high intensities and their progressions than it does on high volumes and volume progressions, it doesn't make much sense to chase higher volume MAV windows in such fitness training conditions. More specifically, the same kinds of training that can raise MRV, like work capacity training, will also lead to muscle fiber conversion to slower twitch fibers, which will make gain magnitudes fall. So, what you end up getting is a rise in MAV, but a fall in the gain rates seen at any point along the adaptation curve. The best case scenario is that you get about the same total gains (area under the curve, see Figure 12), but now have to do more training to get them, and the worst case is that you actually get lower total gains from doing more work… no thanks! Thus, modalities to increase MEV-MRV windows in the speed/power/strength sports should be limited to those that are not training-based, but rather passive recovery modality based, such as improvements in sleep, relaxation, and nutrition.

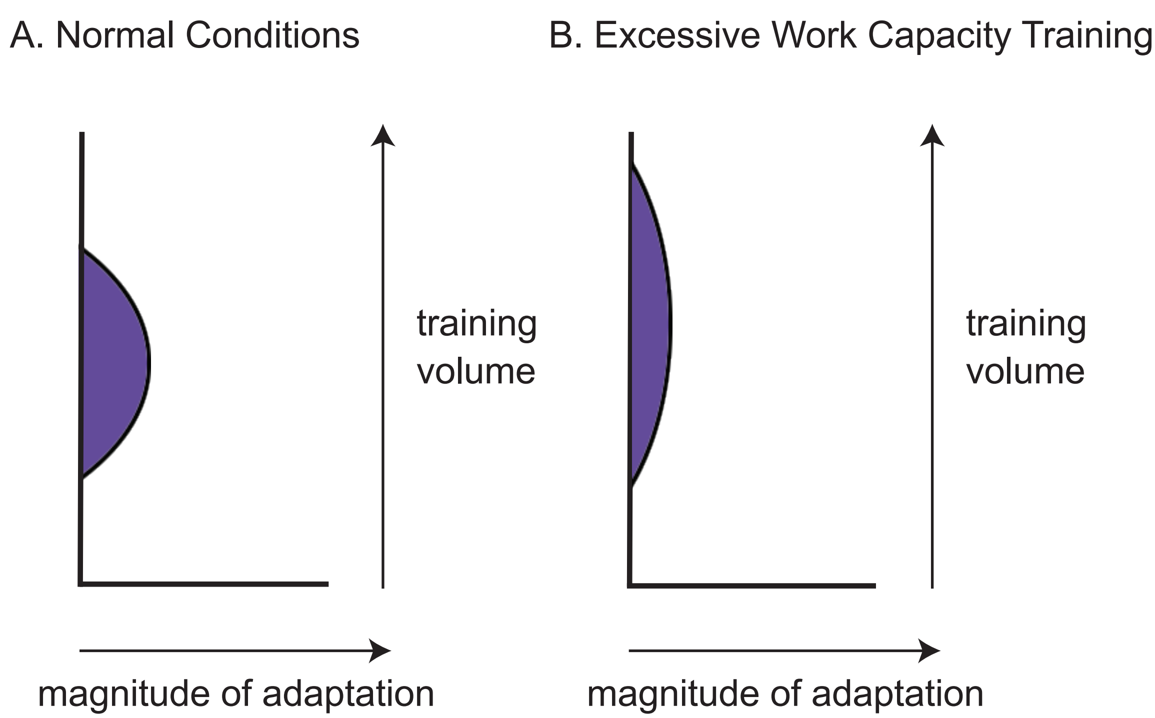


Figure 12: Effect of Excessive Work Capacity on Adaptation Curves: A. Illustrates a hypothetical adaptation curve under normal conditions B. Illustrates the effect of excessive work capacity training on that adaptation curve. Excessive work capacity training can allow for MEV to maintain and MRV to rise, but this comes with a concomitant reduction in the magnitude of adaptation (curve width).

On the subject of passive modalities that increase MRV and thus the MEV-MRV window, a major caveat is in order. There are certain recovery modalities that can promote recovery but actually interfere with adaptation. Examples include cold exposure, such as icing or the use of cryotherapy chambers, and NSAID use. By using these modalities, individuals can raise their MRVs, but, unfortunately, the magnitude of the adaptation curves will also drop, especially in the realm of hypertrophy. So, the use of such modalities should be judicious, lest the adaptation curve magnitude drops below the mesocycle average and the practice becomes counterproductive. This doesn't mean that the modalities have *no* uses, as they can in fact be used during tapers, inter-competition days and the like, to accelerate recovery when adaptation is not the most important goal. The use of these types of recovery modalities must always be weighed against their potential negative effects on adaptive magnitude. An example of the potential shift in the adaptation curve resulting from these recovery modalities is shown in Figure 13.

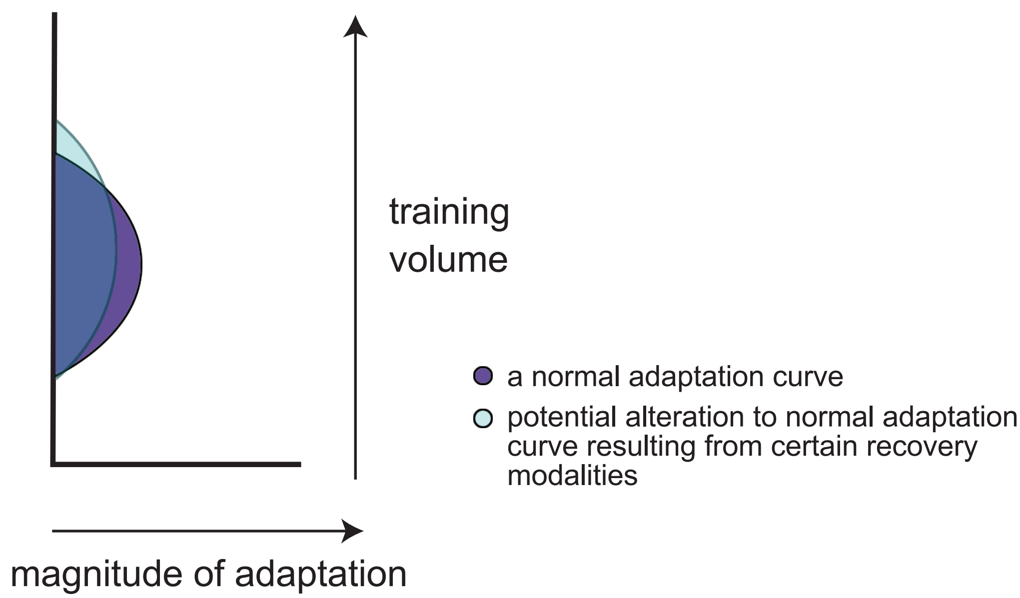


Figure 13: Adaptation Curve with Recovery Modalities that Interfere with Adaptation: A normal adaptation curve (purple) as altered by recovery modalities that interfere with adaptation (light blue). While recovery modalities such as anti-inflammatory drugs and cryotherapy (or icing) can in fact raise the MRV above usual levels, they can also reduce adaptation magnitudes. (Graph is not meant to represent these changes precisely. Both increases in MRV and decreases in adaptation are likely very small).

On the flip side of the training coin, volume-driven adaptations such as work capacity fitness characteristics (such as those needed for Fitness Sport), endurance, and, to some extent, hypertrophy, benefit from *any and all* methods that raise the MRV and lower the MEV but stop short of impeding adaptation capacity. This includes a big training emphasis on maximizing volumes and thus MRVs, as well as a big recovery emphasis, to lower MEVs and raise MRVs. In hypertrophy training, an interesting strategy may be to sequence three or four mesocycles of incrementally higher volumes, going from MEV to MRV within each meso, with one mesocycle of intentionally lower volume training. Volume increases over the three to four main mesocycles allow for both productive gains and the increases of MRV, to make room for more overload opportunities, and hence longer adaptation curves. Likewise, the lower volume phase that follows both conserves the gains of the previous three to four phases, and, in part by lowering fatigue and shifting fiber type averages to faster twitch, lowers the MEV of the next volume training phase to come!

So how do we design this low volume phase to ensure a retention of gains and abilities? Great question, and one we will attack in our next chapter!

4 MAINTENANCE VOLUME

Derivation:

So far we've identified a number of volume landmarks, all of which bring their own value to the understanding of training volumes, and afford practitioners the possibility of unique manipulations for best long-term results. We know not to exceed the MRV, other than in the pursuit of Functional Overreaching in the short term, not to expect results below the MEV, and that, for most athletes, moving from the MEV to the MRV over the course of a mesocycle likely produces the best gains, via utilization of the mobile MAV landmark. This question arises, however: are we always interested in doing hard training that produces gains? Odd as it might sound to ask, the answer is that we are not. Sometimes, we are only interested in maintaining the gains we have already made while we accomplish other training-related goals. These might be:

- Fatigue reduction: deloads, active rest phases
- Resensitization to volume: low volume phases
- Tapers: peaking for competition performance
- Phase Potentiation: potentiating various characteristics of multi-component sport through emphasis/de-emphasis phases

During the above phases we need training volumes to be low, but we don't want them so low that adaptations decline. Thus, we have a new, and, for the purposes of this book, final, training volume landmark to introduce: maintenance volume.

Definition:

Maintenance Volume (MV) : The *lowest* volume of training an athlete can do in a particular situation and still *retain his/her abilities*.

Of course, as with all other volume landmarks, the definition is ability and system specific, so that if we want to maintain our top sprinting speed, we might have to train with a very different minimum volume than if we are trying to maintain our highest marathon pace.

Importance:

Understanding, finding, and knowing maintenance volume is *very* important for several reasons. First of all, if your low volume phases are meant to resensitize your adaptive proclivities but are also resulting in lost ability, you're taking a couple of steps backward before taking some forward. Depending on how far you are below your MV, or how rapidly you're losing ability, you might be regressing more so than progressing. In this case, the effort to get a sensitivity increase may be more detrimental than helpful! The purpose of resensitization is to allow a smaller stimulus to have a greater effect on generating adaptation, but if the resensitizing costs you your previous adaptations, the net benefit is lost. MVs are also important to know for deload design, as deloads should reduce your fatigue but not your fitness. Lastly, tapering to peak is literally *defined* as "reducing fatigue while preventing losses in fitness," which is exactly what understanding maintenance volume helps us do.

In a later chapter, we'll explore the idea that, while MEV rises steadily with training age, MV does not rise to keep pace. Because MEV and MV are basically adjacent values for beginners, training much less than what makes you better makes you worse. This is no longer the case in advanced individuals, however, which has some very interesting implications for program design that we will also explore!

Sources and Nature of MV Differences

Just as with MRV, MEV and MAV, MV is a dynamic variable, and differs depending on the conditions of the athlete and the conditions of their training. Let's take a look at some of the more important sources of MV alteration.

Genetic Factors

1. General Genetic Adaptation Factors

While there is almost certainly some delineation between the genetic factors that predispose for gain rates and the ones that predispose for maintenance characteristics, this delineation is unlikely to be large. Thus, it is likely that individuals who tend to accumulate adaptations easily also have relatively low maintenance volumes. In other words, good genetics for gaining likely translate to good genetics for maintaining. A quick example is the effect of testosterone. Higher levels of testosterone cause a longer adaptation curve, or MAV window, by raising MRV and lowering MEV. Higher testosterone levels also cause each point on that curve to produce better gain rates when trained. Higher testosterone also lowers MV. As mentioned earlier, exogenous testosterone administration has resulted in net *gains*, let alone the retention of fitness characteristics, evidencing the connection between ease of gains and ease of maintenance.

In any case, whether or not it's caused by the same variation that leads to gain rate and MAV differences, genetic variation certainly also exists for MV. Thus, while some individuals will lose adaptations rapidly unless they continue to train with relatively high volumes, others will be able to hold onto most of their gains with hardly any training.

2. Muscle Fiber Type

Slower twitch fibers tend to turn over faster than faster twitch fibers at the tissue level. This means that slower-twitch individuals will need higher volumes of training to maintain gains, while faster-twitch individuals will need lower volumes to maintain. This effect is further exacerbated by fiber transitions, as lower training volumes tend to lead to transitions to faster-twitch fiber types. This means that, to avoid such an effect, slower-twitch athletes interested in performance in endurance and fitness sports need to train with a bit more volume even during maintenance phases, so as to retain the optimal fiber ratio for performance in their sport.

The fiber effect can also be seen in fiber-related fitness characteristics. Speed and power can be maintained with stunningly low volumes, due, in part, to the relative ease of maintaining faster-twitch fibers, while endurance and work capacity, as emphasized in Fitness Sport, demand relatively high volumes just to prevent declines.

3. Limb Ratios and Lengths

Taller and lankier people do more work with most standardized moves, and thus often have lower MVs than shorter, stockier people.

4. Sex

At the time of this writing, it is unclear to us how sex differences affect MVs. While females do have less testosterone, they also don't typically carry the same absolute level of adaptations, so perhaps these factors cancel each other to some extent.

Lifestyle Factors

1. Recovery Modality Application

The higher the input of recovery modalities, the less catabolic and adaptation-sapping the internal environment will be. Thus, the concomitant need for training volume to counterbalance catabolism is lower, and MVs fall. In other words, the better you are about getting good sleep and nutrition, the less you have to do to keep your gains. On the other hand, if your deload week is rife with sleep loss and under-eating, for example, you may be stuck between a rock and a hard place: either drop below MV by lowering your volume enough to reduce fatigue at the cost of retaining adaptations, *or* keep MV high enough to keep adaptations at the cost of seriously impinging on the amount of fatigue reduction that occurs. If you interpreted that to mean: "there's no way around proper sleep and diet on a deload", then you're reading it exactly as intended.

2. Non-Specific Physical Activities

This one depends highly on the ability being discussed. Training for speed, power, strength, and hypertrophy are catabolic in excess and increase MVs. While a small amount of general physical activity can actually help recovery along, this effect is seen most with hypertrophy, and other non-explosive qualities such as endurance. For those qualities, even a good bit of non-specific physical activity can actually lower MV, as it offers some small adaptive stimulus benefits. So, if you're a marathon runner, a good bit of activity preceding the competition day is probably beneficial on the net balance. As a high jumper, however, you want to lay off most non-specific physical activity in the days before your competitions, to save your faculties for this type of explosive performance.

Training Program Factors

1. Exercise Type

Exercises that are more disruptive and have higher eccentric components are more simulative, and thus translate to lower MVs. If you're on vacation, and only get to lift at a real gym once, stick to the compound heavy barbell basics, and save the cables and machines for when you have more time to put in more volume.

2. Program Novelty

There are really two questions about how program novelty affects the MV:

1. How does the new program affect retention of the old program's fitness characteristics of focus?
2. How does having a new program change the MV, if one were to pause the new program's accumulation phase, and go right into maintenance?

In scenario 1, because novel program features like different sets, reps and exercises stimulate different systems to some extent, and to a greater extents for less similar programs, they do not easily facilitate the ability to conserve the adaptations accumulated by the older systems. For example, while the flat bench press stimulates all of the pectoral fibers pretty evenly, an incline bench press stimulates mostly the upper fibers. How much incline benching, then, would one have to do to maintain *all* of the fiber areas of the pecs? Well, more now than before the incline bench press was introduced, because, to get up to the local MV of the lower fibers, the local MEV of the upper fibers might already be exceeded, due to the incline's emphasis on the upper fibers and away from the lower. So, the more different a program is from the one that came before it, the higher its MV will be, to account for the old program's adaptations.

In scenario 2, we just started a new program, and, for some reason, need to switch to maintaining that new program's fitness characteristics. Where do we set our MV? Higher than for an older program. Across a variety of fitness characteristics, it's been very well established that newly gained adaptations recede faster than older ones, and need higher volumes to maintain their current states.

3. Absolute Intensity

Harder training - faster, heavier, etc. - is more stimulative and conserves adaptations better, thus lowering MV. This is critical for all of the applications of MV like deloads, low volume phases and tapers, all of which rely on relatively high intensities to conserve gains, while bringing volumes down.

4. Proximity to Failure

Proximity to failure has a similar effect on lowering MVs to those of raising intensity. Unfortunately, training close to failure also usually has disproportionately higher effects on fatigue, and is thus inappropriate for most of the situations in which maintenance volumes are useful. At least one notable exception is the inclusion of failure training on vacations, during which even volumes high enough for conventional MVs are not possible due to time or facility constraints. In other words, if you only have a very short time to train, blast it as hard and heavy as you can, and push yourself as far as safety will allow!

Training Career Development Factors

1. Training Age Proximity to Career Peak

We will thoroughly examine the phenomenon whereby MV doesn't rise with training age nearly as quickly as MEV or MRV in Chapter 8. We will preface it here with the simple implication that, for advanced trainees, surprisingly little work must be done to keep them within striking distance of their best shape.

2. Strength/Size

Stronger individuals, along with those that have gained a lot of muscle over the years, have both the training age and higher intensity factors in their favor to keep their MVs much lower than would be expected. This reality often comes at a surprise to those who ask high level strength athletes questions like: "You must have to train all the time to look like this, huh?" The answer is usually some form of: "Actually, no: at this point, I'm able to maintain my physique without a ton of training. But, to improve it from here on out, I would have to train *really* hard!"

Examples of MV Use

Because we've already discussed much of how MVs are used in the definition and differences sections, here, we will discuss an interesting implication of MVs for the training principle of Phase Potentiation. Phase Potentiation is the use of one phase of training to make a future phase go better and achieve higher results. For example, building muscle mass in a hypertrophy phase potentiates a strength training phase that follows it, by providing the neural and architectural changes of the strength phase with more raw material (muscle) from which to milk higher forces.

One of the problems that Phase Potentiation has to overcome is that all fitness characteristics have decay rates. If you don't train for strength, at some point, no matter what else you do, strength is likely to decline. Kind of a no-brainer. Say you have a strength block, followed by some other block of training that relies on the new level of strength established by that strength block, but that next block does nothing to maintain strength. Consequently, the whole support system falls, and the phasic approach fails to yield improvements. This is kind of like if, by the time you finished the floors of a skyscraper, the foundation you built years ago had begun to decay, and you had to either abandon the project, or restart on the foundation. As a solution to this problem, why not train for strength in addition to whatever new characteristic we're training during the next phase? Because, if we do too much of that, and for some very sensitive characteristics, if we do much at all, we risk violating the Specificity Principle and failing to get good at anything as a result.

The good news for Phase Potentiation comes right from the MV landmark. Often times, the MAV training of a later phase is enough stimulus to meet the MV of an earlier phase! For example, the volume of a strength training phase is usually enough to maintain most, if not all, hypertrophy phase gains. In endurance sport, competition-pace training is usually enough to maintain the work capacity established several phases prior, and the lactate threshold established in the phase immediately prior. In technique training, live work is usually enough stimulus to maintain the basic techniques learned several phases back, and the combinations learned a phase ago.

This understanding of MV alignment from one training phase to another across sport disciplines allows us to pivot from one characteristic to another without abandoning previously trained characteristics to deteriorate. There are plenty of other phasic models that don't align the MVs of earlier phases with MAVs of later phases, but you've probably not heard of them, because, by failing to exploit this MV alignment, they also fail to work! For example and luckily, not many folks out there are trying to conserve size gains solely via speed training!

That speed example at the end brings up a final, interesting point. What are the implications for program design if some of the later phases don't actually conserve the earlier ones, or simply decelerate but do not prevent their decline? In general, the recourse is to limit the length of that final phase to an acceptable one that doesn't risk net performance loss, and to plan the earlier phases to time accordingly, such that the end of the last phase covers all needed competition or training demands. An alternative is to periodically go back and retrain earlier phase fitness characteristics, like doing strength training for a two week period to gain back strength, and thus buying time for another 3 weeks of power/peaking training afterward. Both methods are widely used, and their combinations are often applied in appropriate sport scenarios. An example of an appropriate scenario is one where you have to compete week to week, and might not be able to go back and do a higher volume phase during that time. But if you just hang in for another week, with proper phase timing, your season is over by the time adaptations would have started to decline.

5 FINDING YOUR PERSONAL VOLUME LANDMARKS

By this point in the reading, you can probably appreciate the importance of the volume landmarks, and their pertinence to designing and altering training. But just knowing that the concepts exist in the theoretical is not enough. To be useful, the concepts must be applicable to individual athletes or to teams of athletes, and to be applicable, the individual must know how to derive their own personal volume landmarks. As in: “What is *my personal* MRV, MEV, MAV and MV?”

In the following guides on how to estimate individual volume landmarks, we’re mostly going to use hypertrophy training to exemplify their estimation. Occasional references to strength training will be included as well, but references to other sports and fitness characteristics, such as endurance, will be less common. This is mostly for reasons of brevity, but also because much of our initial target audience for this book is hypertrophy and strength focused. However, while this is sport-specific for recovery, adaptation and maintenance, the general methods by which one goes about finding his/her volume landmarks are essentially the same for all sports and abilities. The good news is that the MRV for hypertrophy training is generally the most difficult to find, which makes deriving MRVs for other fitness characteristics fairly easy by comparison. More on this a bit later, but, for now, let’s dig into the recommendations for how to find your personal volume landmarks, starting with MRV!

Finding Your MRV

What is MRV? It’s the most volume you can recover from, usually defined as recovery from one microcycle to the next. What is recovery? In this context, it’s the return to your usual performance abilities within the fitness characteristic in question. In the case of MRV, you are “recovered” if you’re performing comparably in *this* microcycle to how you did in your *previous* microcycle. So, the way you know that you’ve exceeded your MRV is simple: you underperform in this microcycle as compared to the last one. Other details can add more color to the picture, but that’s the fundamental way to tell whether or not you’re over your MRV. If a drop in performance suggests that you’ve exceed your MRV in your most recent micro, but you did not experience a similar drop in the previous micro, you know your MRV is likely between the volume of the second-to-last micro and the last micro.

How would this work in the context of hypertrophy training? Before we give an example, let’s remember that hypertrophy training is fundamentally based on increasing weights, as well as total reps done at those weights, at an average of 7 to 15 reps per set. Your 5x10 PR on squats isn’t an exact indicator of how much muscle you have in your quads, but it’s a damn good one. And if that value goes up over time, you can almost bet that hypertrophy is largely responsible. So how do you know you’ve hit your MRV? Let’s say that your usual best effort on the bench press - where you’re maybe a rep shy of failure - on any given day when you’re recovered is

225lbs for 4 sets of 10. Let's say you do a 5-micro accumulation phase and it ends up looking like this:

Micro 1: 215 for 10,10,10
Micro 2: 220 for 10,10,10,10
Micro 3: 225 for 10,10,10,10,9
Micro 4: 230 for 10,10,10,9,8
Micro 5: 235 for 10,10,9,9,8,8,7

You deload after this accumulation phase, and then you look back at the mesocycle. Did you pass your MRV at any point? How would you know? Well, passing MRV means not being able to recover. Which means a performance drop from one micro to another. If you look at all of the adjacent micros and compare them to each other, does it look like performance ever dropped? Yes, the reps went down, but that's when the weight went up. And the reps dropped as an expected function of the weight increase, based on our initial performance benchmark. In other words, it's not likely that the MRV for bench pressing for reps - a good proxy for chest hypertrophy MRV - was exceeded, even with the 6 sets of benching in Micro 4.

Let's say we deload, and then want to continue the search for our MRV. What do we do now? Well, since we know we didn't hit our MRV with ~ 6 sets, it appears we must go higher. So we start a bit lower, and work past the old volumes:

Micro 1: 220 for 10,10,10,10,10
Micro 2: 225 for 10,10,10,10,9,9
Micro 3: 230 for 10,10,10,9,9,8,8
Micro 4: 235 for 8,7,7,6,6,5,5,4
Micro 5: 240 for 5,5,4,4,3,3,3,2,1

Notice that we raised the average weight being used in order to account for some of the adaptation gains in the last mesocycle and to expand this experiment from a search for MRV to a productive hypertrophy cycle as well. But notice what happened this time. Micro 2 was a full recovery from Micro 1. Micro 3 was a full recovery from Micro 2. But something definitely changed between Micros 3 and 4. The reps of Micro 4 were not as high as you'd expect if we simply extrapolated current rep strength to that load. It's definitely possible that the 7 sets of Micro 3 were just around the MRV for this particular individual in these particular conditions, and that the 8 sets of Micro 4 were now in excess of that value. And, sure enough, the rep performance of Micro 5 is even more of a drop-off from usual abilities. You'd expect someone who can hit 225 for 4x10 to hit 240 for sets of 8 or so, not 5s and fewer. That's almost certainly under-recovery, which means that MRV of around 7 sets in this example is a distinct possibility.

But, before we can conclude that 7 sets is *very likely* the MRV, we have to account for and do something about two potential sources of estimation error, namely: acute fatiguing events and cumulative fatigue.

What if your training is going well, but then your boss announces: "We have to meet in my office next week for a *very serious* discussion." Worried about this looming "talking to," you spend the rest of the week barely sleeping, under-eating, and stressing your ass off. Your fatigue skyrockets, and your recovery ability plummets. Your training performance goes down the drain that week, and, assuming that you hit your MRV, you plan to deload starting on Monday of the next week due to decreased performance. On Monday, you finally have the meeting with your boss, fearing the worst. He rants and raves to you about how Phil, the firm's VP, quit on him without notice last week, and to your amazement, you're now being promoted to the VP position, which will double your salary and vacation time. You walk out of the meeting feeling like a zillion bucks. You're still super tired from freaking out all of last week, but you're infinitely relieved as well. So, given all of this information, do you think you hit your MRV? Well the true answer is that you can't be sure. It's possible that you did in fact hit it the week your boss brought up "the talk", causing your performance to decline, because, for all we know, your performance would have declined regardless of this incident. But, on the other hand, you may have been a long way off from your MRV, and the main reason you overreached is that the incident itself added a huge dose of fatigue. And, because fatigue is cumulative, it's simply not the case that once your anxiety was replaced with relief - poof! - all of a sudden, you're back to usual performance levels. Until you deload, your performance will still be reduced, because the fatigue summed from the weeks of training *and* the stressful incident lingers, and takes time to dissipate. The worst part is, you don't know how much fatigue was induced by that incident, and how much was induced by training, so you're still in the dark about your MRV.

Because acute fatigue events such as described above leave fatigue hanging around, it can take a full deload to disappear. The other problem for the accuracy of our MRV estimation is that fatigue is cumulative. Let's say you have an accumulation phase that begins with 3 sets of work and you raise your volume by a set each micro. But let's say your actual MRV is 12 sets per week, which would mean that it would take around 10 weeks of accumulation to reach it! But how much cumulative fatigue would be present by, say, week 10? That's ~ 8 weeks of accumulation training, the latter half of which would be particularly fatiguing. By week 10, you might have so much fatigue that your performance begins to drop off, and you never get to your actual MRV under more normal accumulation cycle lengths. You've now erroneously underestimated your MRV, because you ran such a long accumulation phase that cumulative fatigue sapped your recovery ability reserves, making your MRV appear lower than it is.

How do we obviate these two confounders: acute fatiguing events and cumulative fatigue? The answer is: we have to run multiple mesocycles of MRV testing. Each time we find our "possible MRV" for a mesocycle, we deload, and then repeat the next meso by starting a bit higher in volume and intensity than the last. After 2-5 such mesocycles, the likelihood of chance events infecting *every single run* is low, and the cumulative fatigue problem is reduced. The latter is due to the fact that, while we may have started some earlier mesos 5-6 micros of volume increases under our MRV, the more recent ones might only have been started 2-3 micros under our MRV. What would this look like for our bench press example? Well, after several mesos, your performance seems to drop somewhere between 6 sets and 8 sets. 6 sets represent the times you started the meso with only 2 sets per micro, and that other time you had that incident at work. 8s represent the time you had that amazing training cycle because your sleep and eating were super consistent, and the new position at your job was super rewarding and low stress. After that tight range of 6-8 becomes apparent and repeats itself over and over, it becomes pretty clear that your true average MRV is probably right around there somewhere!

That's the formal method, but do we have to be so formal about things and deviate so far from our normal training to find our MRV? Absolutely not. Fundamentally, we can get a great estimate by simply starting each training cycle with a volume we pretty much know for sure isn't pushing our limits, though is challenging enough to give us some gains. As the cycle progresses, we slowly increase volume until we're unable to recover, then deload, and then rinse, repeat. Two pieces of great news for this method: first, you find your MRV this way, and second, *that's how you're supposed to be training for hypertrophy anyway!* Once you do find your actual MRV and know it reliably, you can plan most of your mesocycles to end right at or just over that number for Functional Overreaching benefits, and that's that! As your MRV changes over time, say by going up slowly, you'll notice that you're not nearly as fatigued in that last week as you're used to being, so you might go an extra week here and there, or start the next meso with slightly higher volume, and see how things go. By doing that when you're not feeling maximally challenged in your last week, you're making sure to keep your training in step with your evolving MRV.

For hypertrophy, fitness sport, and endurance, this method works very well, because volume jumps are part of the training for these sports/characteristics. But what about the training for characteristics like speed, power, and strength, for which volume doesn't typically increase during the mesocycle, and might even slightly decrease to accommodate bigger jumps in intensity? It's much the same process, but adapted to tracking intensity instead of set numbers. For example, if you're doing sets of 3-5 reps every week for strength, you can start with 300lbs on the squat for 4 sets, and go up by 10lbs each week without adding sets. You'll eventually get to a microcycle that might have you drop from something like 330 for 4 sets of 4 with one rep left in the tank to 340 for sets of 3,2,1,1, with all of those being "no way I could do more" grinder reps. In this case, your MRV for around 330lbs is likely around 4 sets, and multiple re-approaches to that weight/rep neighborhood over the next several mesos will confirm this. Similarly with power, if you start reliably missing cleans and snatches at some volume/intensity intersection, then that's likely close to your MRV for that intensity. If your speed on the track starts to decline after a certain number of sprints per week, or a certain number of max-effort sprints, you know that you're getting a feel for your MRV!

To boil the search for your MRV down to the simplest principles possible: make sure to regularly challenge yourself in your training, and note when performance drops off. Always deload right after it does, as training above your MRV is a very bad idea for prolonged periods, and re-cycle back from lower volumes or intensities in the more explosive characteristics like power or strength, to resume working towards your limits. If you collect good data and keep good track of your training, you'll have a good approximation of your MRV.

Is it going to be an *exact* approximation? No way. But who needs one of those? MRVs will change little by little on a regular basis anyhow, based on the multiple influences described in Chapter 1. Hence, just getting a general understanding - like whether your MRV is at 10 sets per week of back work, or more like 15 per week - is going to inform intelligent training design.

Finding your MRV:

1. Start your mesocycle with low set numbers.
2. Add 1-2 sets per body part per week.
3. Note when rep strength drops below baseline levels. Deload.
4. Raise your starting volume by 1-2 sets per body part on your new mesocycle, repeat steps 1-3.
5. Repeat steps 1-4 two to four times, take the average sets per week at which step 3 occurs. This is your current MRV estimate.

Finding Your MEV

Knowing your MRV is a huge deal, because you now know the roundabout value above which your regular training volumes should not be programmed. But knowing your MEV is a close second in importance, because, by knowing this value, you can figure out the lowest volumes at which you can program your training. Between the two, we essentially have the upper and lower bounds of our training!

For many athletes, knowing “how low you can go” and still gain adaptations, isn’t as sexy a concept as the MRV, but it’s supremely important for a number of reasons. First off , if you find that your MEV was lower than you expected, you now know you can make gains at lower volumes than you thought. The biggest advantage here is that you can extend the longevity of your training career and reduce your overall risk of injury and overtraining, by using lower average volumes in each mesocycle than you thought you needed. Additionally, since you can start mesocycles with lower volumes, you can now extend your progressions for longer, and have a higher accumulation:deload ratio, which means more gains over the macrocycle. For example, if you thought you had to start your chest training mesos at 12 sets of chest work and work up to 20 sets, you might be able to get 4 weeks of volume/intensity accumulation out of that setup before needing to deload. But, if you found that your MEV was actually 8 sets per week, you might be able to train for 6 weeks without deloading, which is a hell of an advantage!

That’s all well and good, but how do you find your MEV? Finding this landmark is a bit less integrated into the training process than finding MRV, but worthwhile nonetheless. In essence, what you need to do to find MEV is to run a mesocycle at a given volume without raising that volume during the mesocycle. For instance, you can do a mesocycle for your hypertrophy MEV that looks something like this:

Micro 1: 8 sets of chest work (4 reps shy of failure)
Micro 2: 8 sets of chest work (3 reps shy of failure)
Micro 3: 8 sets of chest work (2 reps shy of failure)
Micro 4: 8 sets of chest work (1 reps shy of failure)

(Yes, technically reps and weights are going up during this meso, so there is still progression. But, because such progression will nearly always be a feature of every mesocycle, we can assume it’s constant, and factor it out of our assessment, focusing on set numbers instead.)

At the end of that accumulation, you deload and test your chest training abilities - multi-set rep maxes - and see how they compare to those of the phase that preceded this MEV test phase. If those maxes went up, because let’s say you hit more reps than ever in 5 sets of bench with 225, or you hit as many reps over 5 sets with 235 as you used to with 225, then you’ve improved the rep efforts, and hypertrophy was likely a contributor to that improvement. This means that 8 sets per week of chest work is at or above your MEV. Great, but what do you do with that? Well, you might just wanna do another normal mesocycle, with both volume and intensity progressions, to get some more growth. But, at some point in the next several months, you should again retest your MEV. We recommend running another mesocycle similar to the first test, but to lower the volume *a lot* from the first one. Why not by just a little? Well, because if you lower it by, let’s say 1 set per week and you still make gains, that’s another meso of training at a volume lower than MAV, and you still have to repeat it! For MEV-test mesos, we recommend lowering volume by a pretty substantial amount, with hypertrophy work reduced by about 3 sets per test. In this example, the next test meso would be with just 5 sets of chest work per week, followed by a comparison of performance, to see if improvement occurred.

NOTE: If you "have trouble telling" whether improvement occurred or not, and you're anything other than a very advanced lifter of 10+ years of training, then the test is likely *below* your MEV. MEV should be a clear and measurable indication of improvement for most athletes, not a vague hope that you got better. By doing objective recordkeeping on rep strength levels, determination of improvement shouldn't be too difficult.

Once you find a volume at which you don't improve in rep-strength over multiple sets, you've likely found a volume below your MEV. It is then recommended to start your normal training mesocycles at a value of volume just higher than that, perhaps one between this latest test of MEV and the one before it. As you continue to train, and over the months and years make many trips from MEV to MRV, note how your training is going in that first week or weeks close to MEV. If it's not even remotely challenging, or barely feels like a workout, or leads to zero pumps and no soreness or even short term stiffness for a day or two after the training, and *all* of those factors align, you might want to bump your MEV estimate by a bit. An even bigger factor is how you feel on Micro 2 of your training. If the training is up in both volume and intensity on Micro 2 and *still feels absurdly easy*, then your Micro 1 volumes are very likely to be below your true MEV, and your estimate needs to go up, perhaps to your current Micro 2 volumes. Such a consistent reevaluation of MEV is critical in preventing unintentionally chronic undertraining.

In speed/strength/power sports and characteristics, finding MEV is even more straightforward. Because intensity, not volume, increases are the biggest sources of adaptation in the training for these characteristics, you just lower your average volume with each progressive mesocycle and check if you're still making gains. Remember to keep your intensity progressions the same when lowering volumes. Lower volume by big fractions, so that you can quickly find MEV and not have to hang around there for too long. When you find a volume at which you don't make gains after deloading, your MEV is likely just above that. You can then hold your set numbers at that volume and make bigger intensity jumps every micro, thus working towards MRV, as expressed in weight x reps rather than just sets. Alternatively, you can work at any higher volumes short of your MRV, and make smaller intensity jumps. While bigger intensity jumps usually produce more results, they can also interfere with safe and proper technical execution. Hence, you might decide to train at a slightly higher volume, somewhere between MEV and MRV with volume (in set numbers) held constant, and program smaller jumps in intensity. A very quick example from strength training would be to do a mesocycle of 6 sets of 5 reps on average. Test abilities before and after by simply comparing rep efforts in training, as opposed to performing a formal rep-max test, and see if gains occurred. If so, try 3 sets of 5 next meso, and check whether gains occurred again. Make sure to go up in intensity by the same amount each meso, perhaps 10lbs each micro. If no gains occurred, then MEV is somewhere between 4 and 5 sets of 5, and you have a pretty good estimate of your MEV. You can then either use big jumps in intensity and stay at around 4-5 sets of 5 to go from MEV to MRV, or bump up to somewhere between your MEV and MRV, perhaps 6 sets of 5, and do your normal intensity progression there. Another option is to use a volume progression from 4 sets to let's say an 8 set MRV with very small intensity progressions, for very similar effects. For the best trade off of safety and strength increases, we recommend the middle option: staying around 6 sets of 5 and moving through intermediately sized intensity jumps, to go from your MEV - 6x5 with 3 reps in the tank on the average set - to your MRV - 6x5 with 1 rep in the tank on the average set. Please remember that such a progression with no set increases is not likely best for most *hypertrophy* applications, since volume progressions are likely more important to hypertrophy.

Finding your MEV:

1. Start your mesocycle with moderate set numbers.
2. Don't add sets, increase weight and proximity to failure weekly.
3. Deload after 3-5 microcycles, test your rep performance.
4. If performance went up, repeat steps 1-3 with 2-4 fewer sets.
5. Repeat steps 1-4 until performance is stable after a mesocycle. Your MEV is just above the volume level of this last test.*

* Steps 4 and 5 can be done with months of normal training between them and step 3, as you don't want to delay gains by focusing solely on testing your MEV.

Finding Your MV

First, wait a second: did we skip over how to find MAV? We didn't, because recall that MAV floats in the range between your MEV and MRV, and by finding those two values, you've basically found where to train for best gains, likely rendering a direct MAV estimate needless. However, there are some distinct advantages in MV estimation.

For one thing, the lower your MV, the more fatigue you can drop on deloads, tapers and active rest phases without sacrificing fitness. If you think your MV is higher than it really is, you might not be dropping as much fatigue as you could be during your typical weeklong deloads. This may be hampering your training at every other time point as well, since you end up carrying a higher level of cumulative fatigue at all times, which reduces the effect of nearly every component of the training process. A low MV also means lower training volumes on intentionally low volume phases to resensitize hypertrophic processes, which means those phases can be shorter than you had otherwise planned, and you can get back to growing more quickly. Lastly, finding that your MV is lower than you thought is a great way to get more out of vacations and other periods of time where training at the higher volumes needed to progress may not be possible. With a very low MV, you have that much more time to vacation, move house, or periodically focus on other life priorities in lieu of gainful training. And, of course, once you stop *underestimating* your MV, you can stop regularly losing gains during all of the aforementioned low volume phases!

Finding your MV takes a while longer than finding your MEV and MRV, because the only time you can consistently test it is during an intentionally low volume maintenance phase. On the bright side, it's very easy to tell if you're below MV, because losing ability is quite straightforward to measure. Another factor that shortens the process of finding your MV is that you know for sure it's under your MEV, so it's not much of a descend before you hit it. Since the downside of underestimating your MV is a loss of gains, you don't want to start the estimate low and move up, but rather start the estimate high and move down.

A good strategy for finding your MV is to start your first low volume maintenance phase just under your MEV. If you don't lose any fitness (however you measure it depending on what characteristic it is), you know that volume is at or above your MV. Next time you get a chance to run a maintenance phase in the normal process of training, lower your volume by another increment: in hypertrophy training by something like 2 sets per body part per week. See if you lose any gains after the phase is over. If not, repeat this process, and go down in volume next time. If you do, then the volume between your last test and this one is likely your MV, and it's a good idea to set your MV at a value just above that for the time being, same as your second to last test, so you can be sure you're not losing gains.

This method applies to all sports in its basic logic. For example, if you play soccer every year, and have two seasons with two low volume breaks in between them, try some different volumes during each of these breaks, to test if your basic soccer skills have worn off, or if they remain intact by the start of each new season. If so, see if you can't drop volume a bit more next time, and still keep skills intact. By finding your actual MV and using that time to heal from injuries and refresh your passion for the game, you might be adding years of soccer play at your peak. Contrarily, if you're training too hard even during your breaks from formal seasons, you raise the odds of wearing yourself down sooner rather than later, which can ultimately cut your career short.

With all of these estimation methods, we recommend sticking to the principles of altering volumes, observing subsequent performance, and repeating, without getting too caught up in the minutia of each method. In addition, we recommend being ready to put in the long time intervals needed to find your landmarks, and continuing to collect the data needed to update them. If you don't like writing down your training, or aren't mindful of how your body and performance respond to various volumes, you won't benefit much from finding and using these landmarks anyway!

Finding your MV:

1. Start your low volume mesocycle just under your MEV.
2. Test performance after the low volume mesocycle.
3. If performance was stable or improved, cut volume by 2-4 sets per bodypart per week in the next low-volume phase.
4. Repeat steps 1-3. Note the first low volume mesocycle that sees performance drop during a post-test.
5. Your MV is likely just above the volume of the mesocycle in step 4.

For effective tracking of your training, we encourage the use of a tracking sheet like the Worksheet Templates for Volume Landmark Tracking on pages 112-113.

6 VOLUME LANDMARKS THROUGH THE DIETING PHASES

Anyone who has dieted to lose fat has likely noticed that such dieting affects performance, gain rates, and, perhaps most notably, recovery. The reason you noticed this is that it's true: dieting does meaningfully affect all of these, and its effects also predictably alter your volume landmarks. In this chapter, we'll outline how both hypercaloric and hypocaloric dieting, that is, both gaining and losing weight, affect the volume landmarks, and extract the basic implications of dieting for the training process and program design. Because fat loss and muscle gain are usually the biggest drivers behind dieting, we'll focus most of our discussion on this topic, but also touch on general performance.

MRV Under Different Dieting Conditions

MRV and Hypocaloric Dieting

During hypocaloric dieting, food consumption is insufficient to meet all of the body's needs, which is why the body will burn body fat to fill the void. A deficit resulting from an increase in activity, a decrease in food intake or a combination is a great thing for fat loss, and the whole mechanism by which fat loss works. Where training volume is concerned, however, the hypocaloric condition is not such a great thing, as it has several negative effects thereon. For one thing, body systems are no longer as likely to spare resources towards recovery from training, as more focus is given to contracting resource expenditure and saving more for critical survival systems, due to the perceived state of famine. For another, such resource scarcity also leads to a lower ability to reduce accumulating fatigue. Ability to recover from any given volume *and* to combat fatigue lead to the drop of MRV on a hypocaloric diet. The extent of MRV reduction is in direct proportion to the size of the caloric deficit created by the diet (Figure 14). As such, small deficits will lead to small reductions of MRV, while large deficits will lead to large ones.

MRV and Hypercaloric Dieting

In contrast to hypocaloric dieting, hypercaloric dieting raises the amount of resources that can be allocated toward recovery, it can also raise the MRV (Figure 14). Additionally, the extra energy elicited by the diet can boost work capacity as well. So, for those whose work capacity holds back their MRV, as opposed to their recovery ability, hypercaloric dieting will raise MRV. This is especially magnified if much of the excess nutrient consumption is carbohydrate. However, this increase is not linear, and it drops off as more calories are added over and above the maintenance level. It is by no means clear that hypercaloric conditions provide any added MRV-raising benefit once the surplus exceeds about 20% of the maintenance diet. Thus, if your maintenance level intake is 3000 calories, and you want to max out your MRV, there is likely no benefit to exceeding 3600 calories. In fact, anything much over this value will likely yield no added benefit, but rather only the cost of a linearly escalating amount of added fat gains.

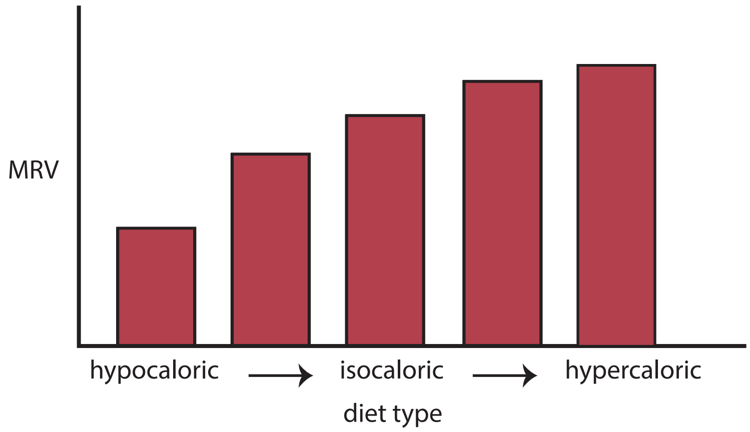


Figure 14. MRV And Dieting: An example of relative changes to MRV resulting from a very hypocaloric (far left) to a very hypercaloric (far right) diet. MRV drops during hypocaloric conditions due to the energy deficit, and increases (to a point) under hypercaloric conditions, due to the energy surplus.

MEV and Hypocaloric Dieting

MEV was previously, roughly described as the state at which anabolic and catabolic processes are just noticeably tilted in favor of the anabolic. On a hypocaloric diet, catabolic processes, or those which burn fat, rise, while, due to decreased food availability and various hormonal and other signaling factors downstream, (like insulin, glycogen storage, etc.), anabolic processes fall to some extent. As such, in order to keep the anabolic processes above the catabolic, we must train with higher volumes to make up the difference. For this fundamental reason, MEV is higher on a hypocaloric diet than it is on an isocaloric diet. The extent to which it is higher is determined directly by the magnitude of the deficit. A small deficit has a small effect on raising the MEV, while a huge deficit can actually push the MEV up and over the MRV, which has some interesting implications for a later discussion (Figure 15).

MEV and Hypercaloric Dieting

Because the MEV is the balance between anabolic and catabolic processes which just barely favors the anabolic, and because the hypercaloric condition increases the anabolic response and decreases the catabolic response to any given volume of training, we can expect MEV to fall on a hypercaloric diet (Figure 15). Put simply, when you are on a hypercaloric diet, you don’t have to train as much in order to see the first glimpses of progress compared to an isocaloric diet.

Figure 15. MEV and Dieting: An example of relative changes to MEV resulting from a very hypocaloric (far left) to a very hypercaloric (far right) diet. MEV becomes larger during hypocaloric conditions, as more training is needed to generate improvement under lower energy conditions. Under hypercaloric conditions, MEV is lowered, and more gains can be had with lower training volumes due to the caloric surplus.

MAV and Hypocaloric Dieting

Because MEV is higher and MRV lower, the total length of the adaptive curve is reduced in terms of volume progression. But, in addition to this, the magnitude at any point of the adaptation curve is also reduced (Figure 16). This is because, while net anabolic signaling is still possible for a non-excessive deficit size (for an athlete that's not yet very advanced, anyway), the processes that actually build muscle from those signals are themselves hamstrung by the deficit. As a result, less muscle is built, less strength accrued, less technique acquired, and so on. In addition, because recovery mechanisms are impaired by the diet to some extent, fatigue accumulates more rapidly between microcycles, which has to be accounted for in program design. Lastly, we have a problem with Functional Overreaching. The process of Functional Overreaching involves closing in on or just overshooting the MRV for a microcycle in order to push the systems outside of their normal ability to recover. A deload follows, allowing affected the systems to not only recover, but to overcompensate, forcing them to expand their abilities more than they would during normal training. But such huge forays into a high fatigue state require the presence of a high degree of recovery ability to bring affected systems back to baseline. Such an ability is reduced during hypocaloric dieting, and, to make matters worse, this ability doesn't increase during the deload, because the dieter's body will prioritize combating the fatigue that has accumulated during their normal training and has been exacerbated by dieting. Due to these limitations of recovery ability, Functional Overreaching is not recommended during dieting phases, especially the more stringent ones. In simple terms: if you don't have the resources to recover from overreaching, why attempt it?

MAV and Hypercaloric Dieting

MRV is higher and the MEV is lower on a hypercaloric diet, and thus the MAV window is bigger (Figure 16). This means that adaptation curves will be longer, and thus the total net amount of adaptation you can expect from a mesocycle will be greater. But it gets better still: because of the greater resources available for making adaptations, each microcycle itself will have a higher magnitude of adaptations. Thus, the area under the curve, aka the net adaptation amount, will be greater still. Lastly, because Functional Overreaching will have the recovery resources to be utilized to its fullest, it extends the MAV curve as much as just above the MRV, so long as the deload follows shortly thereafter.

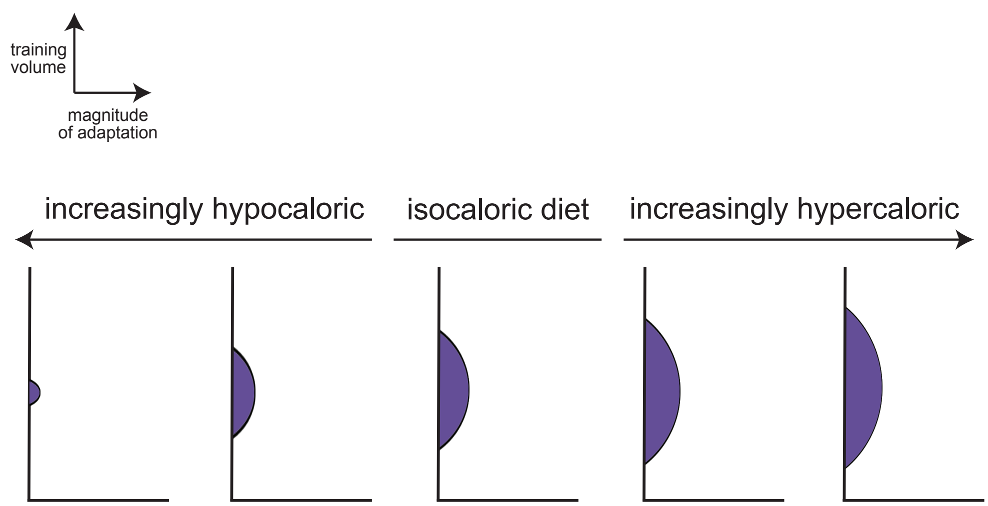


Figure 16. MAV and Dieting: An example of relative changes to MAV and adaptation magnitude resulting from a very hypocaloric (far left) to a very hypercaloric (far right) diet. Although the trend is always the same, degree of effect on MAV and adaptation potential vary with training type. This figure depicts what changes to hypertrophic MAV and adaptation might look like.

MV and Hypocaloric Dieting

Because the balance of anabolic and catabolic processes tilts towards catabolism on a hypocaloric diet, just like MEV, MV also rises during a hypocaloric diet (Figure 17). For advanced athletes and/or very big deficit diets, MV can push up and over MRV, which has implications of its own, as we'll see!

MV and Hypercaloric Dieting

Just as with MEV, the higher anabolic activity of the hypercaloric phase leads to lower maintenance volumes (Figure 17). In other words, if you needed something like 8 sets per week to prevent losses in adaptations during an isocaloric diet, you may only need something like 6 sets per week to maintain them in a hypercaloric state. There are implications for, and cautions against, leveraging this phenomenon, up next.

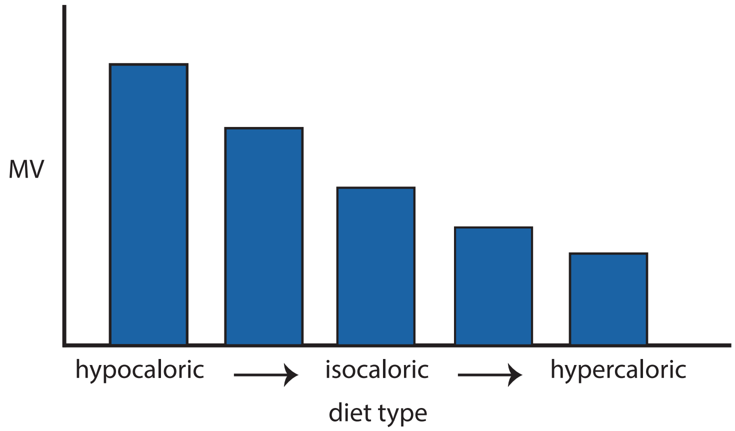


Figure 17. MV and Dieting: An example of relative changes to MV resulting from a very hypocaloric (far left) to a very hypercaloric (far right) diet. MV becomes larger during hypocaloric conditions. Under hypercaloric conditions, MV is lowered, due to the caloric surplus.

Implications for Training on a Hypocaloric Diet

Below is a numbered list of select implications of hypocaloric dieting on changes to the volume landmarks and how such changes can influence overall training program structure. Figure 18 illustrates a summary of the relationships between the volume landmarks and the diet phases throughout this discussion, so please refer to it as needed.

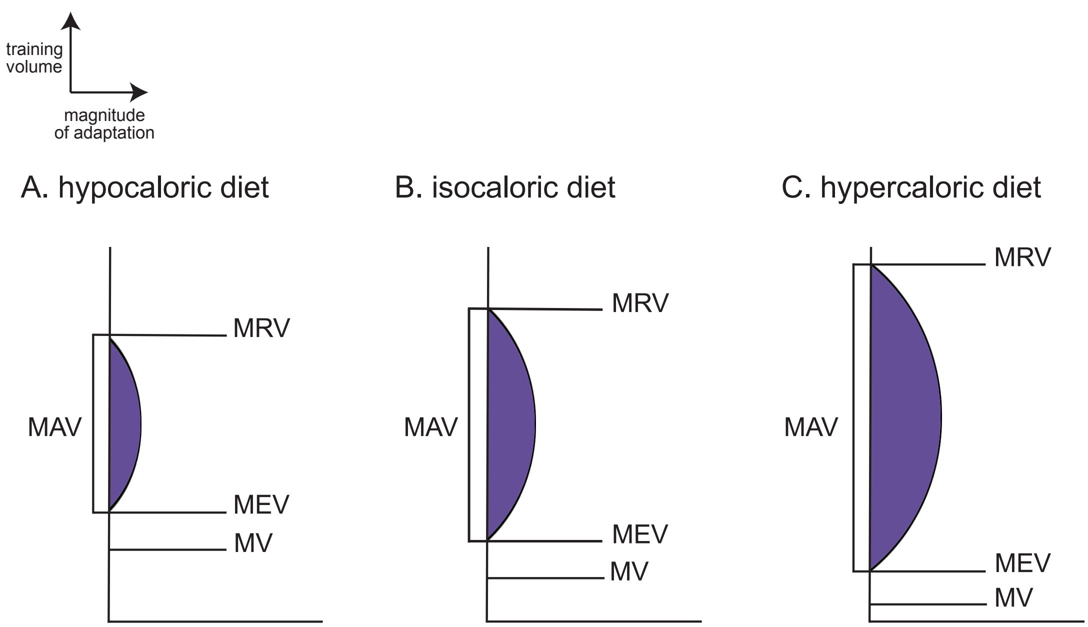


Figure 18. Volume Landmarks During the Diet Phases: A. Under hypocaloric conditions, MRV is lower and MV and MEV are higher, resulting in a restricted window of volume for adaptation compared to isocaloric conditions (B). C. Under hypercaloric conditions, MRV is higher and MV and MEV are lower, resulting in a larger window of volume for adaptation compared to isocaloric conditions (B).

1. Because MEVs are higher during hypocaloric dieting, you would start your accumulation progressions, aka your volumes in microcycle 1, higher than normal, to account for this rise in MEV. The exception to this rule is when a diet is so restrictive or an athlete so advanced, that the interval between MEV and MRV is small enough that normally rising fatigue during an accumulation phase, even with minimal progression, delimits the length of the accumulation phase too much, resulting in a poorer accumulation:deload paradigm. If this is the case, one may start the first micro's volumes even lower, so long as they are still above the MV. Wait, does this mean that some part of - and sometimes the entire - accumulation phase will be under the MEV, and hence offering very few or zero gains? Indeed it does. So, is there a way to fundamentally avoid this? No, not really. And because even the MV rises when hypocaloric, we must be careful to start above and not below it, again, a concern for more advanced athletes, and those running big deficits. For them, the MEV may have already gotten too close to the MRV, or has reached or exceeded it. This means gains have already been factored out of the equation, which makes being above MV a loss prevention measure instead of a gain enhancement one.

2. Since MRVs are lower than otherwise, your progression from MEV, or, in more extreme cases from MV, cannot go up as high as it normally does. So, if, for example, if you normally go from an MEV of 12 sets per body part per week to an MRV of 20 sets per week, on a hypocaloric diet, you might want to start at something like 14 sets per week, and stop at something like 18 sets per week. In addition, because of an insufficient amount of resources to benefit from Functional Overreaching, it might further be a good idea to stop just short or just at the MRV instead of getting to or going above it, as recommended under normal conditions.

3. On a hypocaloric diet, your MAV, or rather, your adaptation curve - the distance between MEV and MRV - is reduced in length. But you want to conserve your typical accumulation:deload paradigm, and not have to spend extra time deloading. Because of these constraints, it is in your interest to make smaller jumps in volume and/or load during your microcycle-to-microcycle progressions. A quick example is, when starting with 14 sets instead of 12 and ending at 18 sets instead of 20, you might want to only add 1 set or so during each microcycle, instead of the 2 sets or so you would add under isocaloric conditions. Alternatively, or in addition, you could progress more slowly on intensities, which could mean that instead of adding 10lbs or so per microcycle to your compound movements, you can only add 5lbs or so. If you're highly advanced, and thus working with an even smaller MEV-MRV window, you might alternate adding sets and weight each micro. So, add a set one micro, then add a weight while holding sets steady the next one, and so one, or even try 2 micros at the same weight and set range, possibly adding a rep here or there or maybe even just maintaining all-around. Since the reduction in novelty on your accumulation phase from micro to micro means that even your MV is going up a bit during that time, it's probably not a good idea to increase *nothing* throughout your meso, so it's best to increase what you can, as slowly as you need to so as to stay over MEV - or MV in more extreme cases - and under MRV.

Figure 19 illustrates that a normal overload progression is inappropriate for hypocaloric dieting, as the lowered MRV and raised MEV (the top and bottom bars in each graphic) create a situation where we exceed both values at the beginning and end of the progression. On the other hand, the expanded MEV-MRV window of the hypercaloric phase means that a standard progression won't take advantage of the whole adaptation curve, by shortcutting above MEV and below MRV.

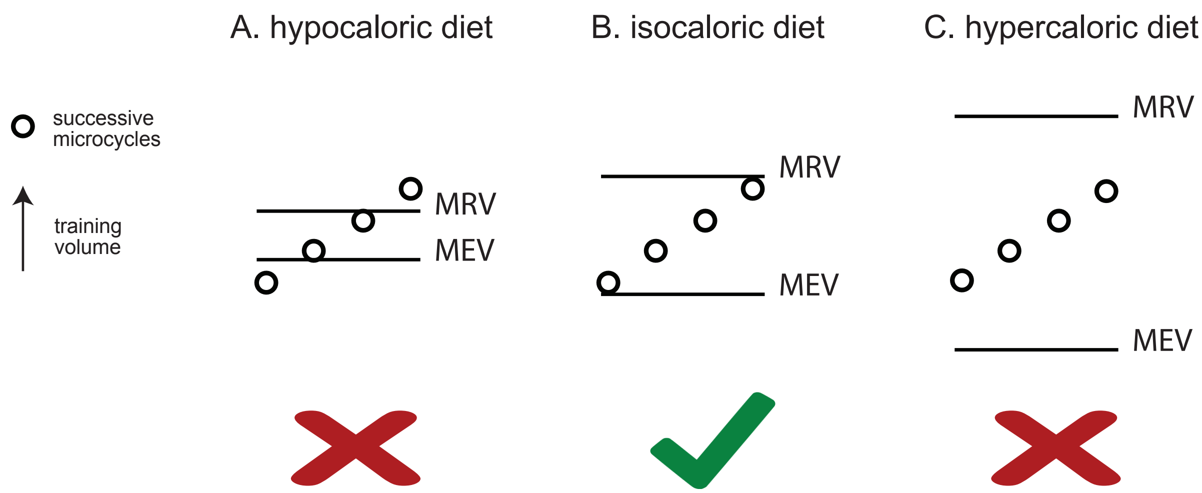


Figure 19. Errors in Overload Progressions During Dieting: A. Illustrates running a normal progression of training on a hypocaloric diet. In this example the first microcycle falls under MEV and the fourth microcycle falls above MRV. B. Illustrates isocaloric conditions where normal progression falls between and spans from MEV and MRV. C. Illustrates that a normal progression of training under hypercaloric conditions will fail to span the full distance between MEV and MRV. The green check mark under the isocaloric condition example indicates that this is the only condition under which a normal progression of training is appropriate. As indicated by the red x's beneath the hypocaloric and hypercaloric condition examples, for best results, volume progression needs to be altered under these altered diet conditions.

In contrast to the mistakes illustrated in Figure 19, Figure 20 shows how to properly adjust overload progressions to the conditions of the diet phase. On the left hand side of the figure, the hypocaloric condition has been adjusted for by a narrowing of the typical overload progression to one that fits into the more constrained MEV-MRV window. In practice, this can be accomplished with a reduction in either the number of working sets added from microcycle to microcycle, jumps in the size of the weight, intensity in exercises, or any combination. When adjusting for the hypercaloric condition, two potential strategies can be used. The first strategy (Figure 20, C), is the increasing of size of each jump between progressions, whether by adding more sets than in an isocaloric condition, more intensity, or both. The alternative adjustment (Figure 20, D), is to keep the progression jumps the same size, but to lengthen the duration of the mesocycle, to make room for a lower starting point and higher ending point. For safety reasons, and the increased likelihood of retention of gains after the training cycle is completed, we recommend the Hyper-D style adjustment in most cases, with a major caveat being time restricted mesocycle limitations, such as those found in a competition training plan, where the start date of training and the date of the competition are not in the programmer's control.

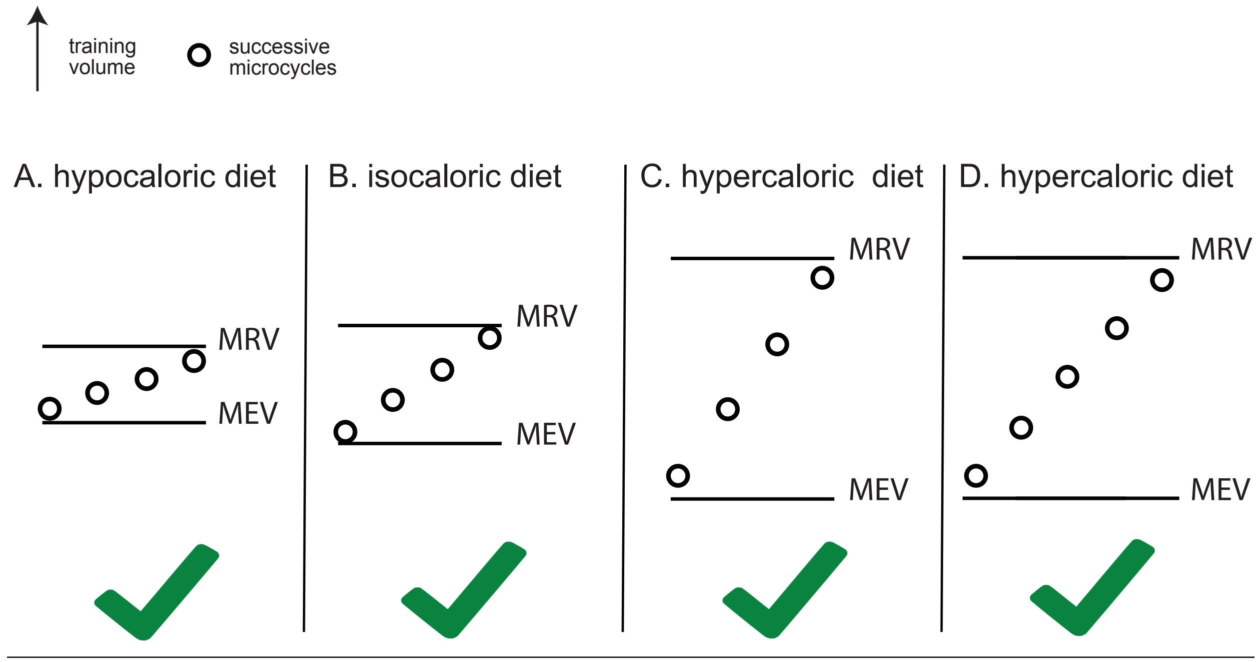


Figure 20. Appropriate Overload Progressions During Dieting: A.-D. Illustrate appropriate training progressions under hypocaloric (A), isocaloric (B), and hypercaloric (C,D) dieting conditions. C. and D. illustrate two different options for adjusting training progression under hypercaloric conditions. C. Illustrates the option of making larger jumps in training volume across microcycles compared to normal isocaloric conditions to adjust for hypercaloric conditions. D. Illustrates the option of adding more microcycles to the progression, rather than making larger volume jumps microcycle to microcycle. Note that the added microcycle will extend the length of the mesocycle rather than altering the length or frequency of microcycles.

4. The need to specialize in individual body parts and/or aspects of your game comes from the constraint that, for a sufficiently developed athlete, total body MRV will not be high enough to allow for all component body parts or game elements to simultaneously be trained from MEV to MRV. In other words, the sum of individual MRVs is higher than the total body MRV in more advanced athletes. For instance, if you tried to train your chest and legs “all out”, you might have to go a bit easier on your back and arms, so that your total volume isn’t so high that you get overtrained. In technique sports, a BJJ player, for example, that’s very good might have to do so much wrestling to improve her wrestling game, so much judo to improve her judo game, and so much rolling to improve her ground game, that she can’t go “all out” trying to improve all of these aspects at the same time without exceeding her total sport MRV. Given this, to make progress, athletes advanced enough to have a component sum MRV higher than their total body MRV keep some of their body parts/abilities between MEV and MRV, and hence progress on them, and keep the rest just around MEV, to keep them gaining slightly, or even keep the rest at MV to sustain them, thereby creating recovery room for the priority parts/abilities.

It’s a great way to organize training, but the problem with trying to do this on a deficit is that, if you take some parts/abilities from MEV to MRV, you might sap so much of your now much smaller recovery ability, that you can’t fit all of the other parts/abilities into the total recovery ability - or total body MRV - even if all of the other focus areas are at MV! Ergo, for advanced athletes especially, prioritizing some parts/abilities during hypocaloric dieting means having to dip below the MVs of others to compensate, resulting in a loss of ability on the latter, which means taking a step back to take one forward. In addition, specialization with the intent to progress assumes the availability of resources to fuel that progress. But, since such resources are low on hypocaloric diets, and net adaptation itself is a questionable process, we might be specializing - and putting other muscles/abilities at risk, below their MVs - for not much of anything. Lastly, advanced athletes often make their best gains through Functional Overreaching, as normal processes are no longer disruptive enough to incentivize their physiology to adapt further. Because FO is not a likely possibility on a hypocaloric diet, it's likely not a good idea to specialize and try to shoot for FO, while neglecting other body parts/abilities under MV. Thus, especially for the advanced, rather than specialize on advancing certain body parts or abilities at the expense of the others, hypocaloric diets should likely be times of all around training, designed to conserve gains, or, at most, make minimal ones.

5. Because advanced trainees already have higher MEVs (as we'll explore in greater depth in the next chapter), their MEV-MRV margin is already narrowed. During hypocaloric dieting, and very restrictive dieting even intermediates dieters will often see their MEVs elevate to or above their MRVs during the diet. What this means is that, for intermediates doing very restrictive dieting, and for advanced trainees doing much of any kind of hypocaloric dieting, expecting gains in ability to occur during that time is unrealistic. This is a point that is useful to make because individuals who have dieted as beginners and intermediates will, to some extent, get used to and expect a certain level of gain even during a diet, albeit at a lower level. At some point when the MEV-MRV gap closes, the only rational expectation should be the prevention of losses. In short, gains on a diet become less and less likely with training experience. As such, other focuses, like structure of training and work on specific areas when not dieting, represent a much better use of a dieter's time and mental resources. Note that pretty much the same inputs of intelligent training and proper recovery are also mandated by the diet, gains notwithstanding. Of course, realistic expectations and the drive to do the right things to help in the process never hurt to have.

6. In athletes that are still more advanced or on diets that are still stricter, MV rises so high and MRV falls so low that MV can push right up against MRV. This of course also means that the MEV-MRV relationship has already reversed, putting that MEV *above* MRV. If you interpreted that to mean: "Gains are pretty much in no way possible because the volumes needed to make them exceed the volumes that can be recovered from", you get a gold star for being correct! Now, the big focus of managing training volume on a diet is to ensure it stays in that short sliver between MV and MRV. There may be some room to make increases in volume here: none that lead to gains, but only to staying above the MV as it rises during the mesocycle. These increases, however, will typically be very small. In fact, advanced dieters going for elite levels of leanness - think competitive bodybuilders in their prime, for example - will sometimes have MVs that are above their MRVs! That's right, they actually lose gains, or, in their case, muscle, during the diet, especially towards the end thereof, so their number one mission is to decelerate that loss as much as possible, while still applying the needed hypocaloric conditions to get as lean as possible. This is one reason why, in their early off seasons, you'll hear top national level or pro competitors say things like: "I've almost gotten back all of my pre-diet strength." Notice that, unless you are getting into bodybuilding shape or are a very experienced 10+ years athlete, or both, you should *not* regularly expect to see your MRV dip below your MV. It happens, but is by far not the norm. So, if you are in fact losing noticeable muscle and/or strength on a diet, and you're not on the extreme end of experience or body fat, you likely need to reexamine your approach. And, fundamentally, that reexamination is going to lead you to the same place as it does everyone else, no matter their volume landmark relationships: do your best in trying to

stimulate anabolic and anticatabolic processes, through a combination of intelligent training and the application of the recovery modalities.

7. The volume landmarks can help us answer an important question that arises during diet planning: “How hard can I push the pace of the diet?” In other words, how large of a deficit can you use while staving off needless losses in ability, for which you’ll have to make up later. This question is especially pertinent to those folks who have to perform at the very end of a diet. For example, if a recreational dieter goes a bit too fast, and loses too much muscle, he or she can just get that muscle back over the next couple of weeks, and no harm done. In fact, because muscle that has been gained over long periods of time is especially elastic in its return, this isn’t a huge deal at all. But what about a wrestler or a grappler? She needs *as much of her muscle as possible* at the actual tournament for which she’s dieting! A powerlifter or weightlifter needs their muscle for that very event, and none of the judges at a bodybuilding show care how much muscle you regained in the weeks after the show if you looked too small on the show date! So, especially for these scenarios, the question of “How hard can I push my diet?” is answered with: “What does it take to keep your MV from pushing over your MRV during the diet?” In other words, in any of the mesocycles you run during the diet, your MV must start far enough away from your MRV, so that the fatigue accumulated with maintenance training can be low enough to avoid pushing you over your MRV. This means you must be able to run at least a minimal progression in volume and intensity through your dieting phase. If you’re unable to achieve this, then probably “you’re pushing the diet too far.” How can you know what values to use for such calculations? There’s no way to be sure, but careful monitoring of the volumes and intensities you used alongside other diets you’ve done before can be a great guide. For instance if you could tell that even your first week of trying to lose 2lbs per week made your training so challenging that you weren’t sure if you were going to be able to match it next week, you might be going too fast, and risking exceeding your MRV! On the flip side, if your training was easy the first week, but you feel weaker the following, instead of stronger or comparably strong, you are likely under your MV, and must either add more volume, or reduce the aggressive pace of the deficit. In any case, if you have to be “on” after your diet is over without time or calories to reclaim lost abilities, it’s almost always a good idea to give yourself a bit more time than you think you’ll need, and reduce the deficit to a bit below what you think you can pull off, giving yourself some safety net.

8. While application of the recovery modalities is important when gaining weight or maintaining it, you might still get pretty good gains even if you don’t do the best job with the modalities during these times. This is particularly true if your shortcoming is more with consistency than average application. For example, if you tend to sleep a bit less on a Tuesday night, but sleep a bit more on a Wednesday night, you’ll probably not notice the downside in your training or in your results on a hypercaloric or isocaloric diet. Such is not the story with a hypocaloric diet. Especially for the intermediate and advanced trainees, there may be a very fine line to walk between the MV and MRV during the diet, and the consistent and proper application of the recovery modalities is a very powerful force pushing your MV down and propping your MRV up. Insofar as you make a great effort to get consistent sleep, relaxation, nutrition, and supplementation, you will enhance your muscle loss prevention or any other fitness characteristic. But if you fail to do due diligence to the recovery modalities on a strict diet, you may very well be guaranteeing ability loss during its course. Lastly, the nature of your strategies for applying the modalities themselves must align with physiology. For example, carbohydrate intake is established as hugely important to maintaining performance and aiding in recovery, where fat intake past minimal levels is less essential. So, if you’re cutting carbs too early in a diet at the expense of fat cuts that would not endanger minimal fat levels, this suboptimal decision during a diet might be costing you adaptations.

Implications for Training on a Hypercaloric Diet

1. Because recovery abilities will be enhanced on a hypercaloric diet, some of the volumes that occur towards the end of mesocycles will be the highest of all the phases. In fact, we can be even more assertive, and say that because a hypercaloric diet is almost always used to put on muscle mass, because our MRVs are going to be elevated, and because our ability to recover and benefit from Functional Overreaching is going to be increased, it's a downright misappropriation of resources *not* to train harder during a hypercaloric dieting phase than any other phase, especially towards the end of a mesocycle. Ok, but why "towards the end of a mesocycle" and not "on average?"

2. The reason we don't say "train super hard during the whole mesocycle in a hypercaloric phase" is that we'd be forgetting the other big effect of this phase on the volume landmarks; its reduction of the MEV. Not only can you productively survive harder training on extra calories, you can also grow from lower than normal volumes, thanks to the lowered MEV of a hypercaloric phase. So wait, does this mean that we have to train less or more on a hypercaloric diet? Actually, both! Because our MEVs are down, we can start with less volume than we usually do. But, because our MRVs are up, we can end with more volume than we usually do. And since our ability to benefit from Functional Overreaching is enhanced, we can meet or even slightly exceed MRV at the tail end of an accumulation phase. This gives us a longer adaptation curve, and thereby elongates the path on which MAV walks from MEV to MRV, yielding more gains along the way. Added bonus: gain rates at any point along that curve are also higher than usual due to the added calories, so we can make all the more use of the longer accumulation phase! For instance, if you normally start with 12 sets per body part, and end with 20 before deloading, when hypercaloric, you can start with something like 10 sets, and end with 22 before deloading, perhaps extending your mesocycle from a 5:1 accumulation:deload paradigm to a 7:1 during this dieting phase.

3. While the hypercaloric condition does come with a lowered MV, applying this understanding can have its pitfalls. One of the potential misapplications of this knowledge is the utilization of hypercaloric dieting during a sensitization phase in bodybuilding training, such as during a mesocycle of intentionally low volumes designed to potentiate later gains, or during a deload or active recovery phase. Yes, the good news is that a hypercaloric dieting phase during such training phases will result in MVs that are even lower than they usually are, enhancing the capability to maintain abilities with less work. *However*, the downside is that, because they are maintenance volumes, by definition, minimal workload is being done, and no muscle is being built. What do we get if we combine excess calories with a condition of no muscle growth, and minimal workload? You guessed it: fat gains! While fat gains over the week of a deload are not a big deal in and of themselves due to sheer low total fat amounts, it's still extra tissue, which will necessitate longer hypocaloric dieting later, wherein gain rates will be reduced or paused completely. And, even if deloads are too short to worry about getting fat during, active rest phases and certainly low volume resensitization phases are prime candidates for fat gain on hypercaloric diets.

So, if the lower MVs we get from hypercaloric diets are not usable during deload, active rest phases, or low volume phases, when can we use this benefit? Well, a great situation for just this purpose is the emphasis/de-emphasis training structure, particularly with regard to power, strength, and hypertrophy based sports. For intermediate and advanced bodybuilders, for example, combined, sum total MRVs of all of the body parts can exceed the MRV of the body as a whole. Especially for advanced athletes, one recourse is to put some body parts - say half, though this can vary greatly depending on the situation - on the normal MAV trajectory, from MEV to MRV, while keeping the others at their individual MVs. This lets us grow at least some body parts while maintaining others, and to then later swap, and start growing the currently maintained parts, thereby taking a “one step forward, one step paused” approach to long term gains. If we are using a hypercaloric diet, then we can contract the MVs of the deemphasized body parts even further than we otherwise could, thus making room for training more body parts on emphasis than we could train in an isocaloric condition. In other words, because we don’t have to risk muscle loss as much, we can train the deemphasized body parts less, leaving more room to push the emphasized ones further. Assuming all already have room for their MRVs, we could even move a body part from de-emphasis to emphasis, and thus progress faster overall!

In Figure 21, let’s presume that each color scheme symbolizes a part of the body. Blue is the pushing complex (chest, shoulders, triceps), red is the pulling complex (back, shoulders, biceps), and green are the legs. While beginners can train all three major parts of the body to their local MRVs and still not overshoot their systemic MRVs, this is more complicated for intermediate and especially advanced lifters. Intermediates might have to train one of the body parts, in this case, the pushing complex, only at MV levels, while the other two are trained to their fullest extents. Or, all three can be trained, but two of them must be scaled back to only around their MEVs and no higher, to fit into systemic fatigue constraints. Advanced lifters may not enjoy that option, and might have to rotate one body part to MV at all times. This would enable their systemic MRV to accommodate the higher training volume needs of their individual body parts.

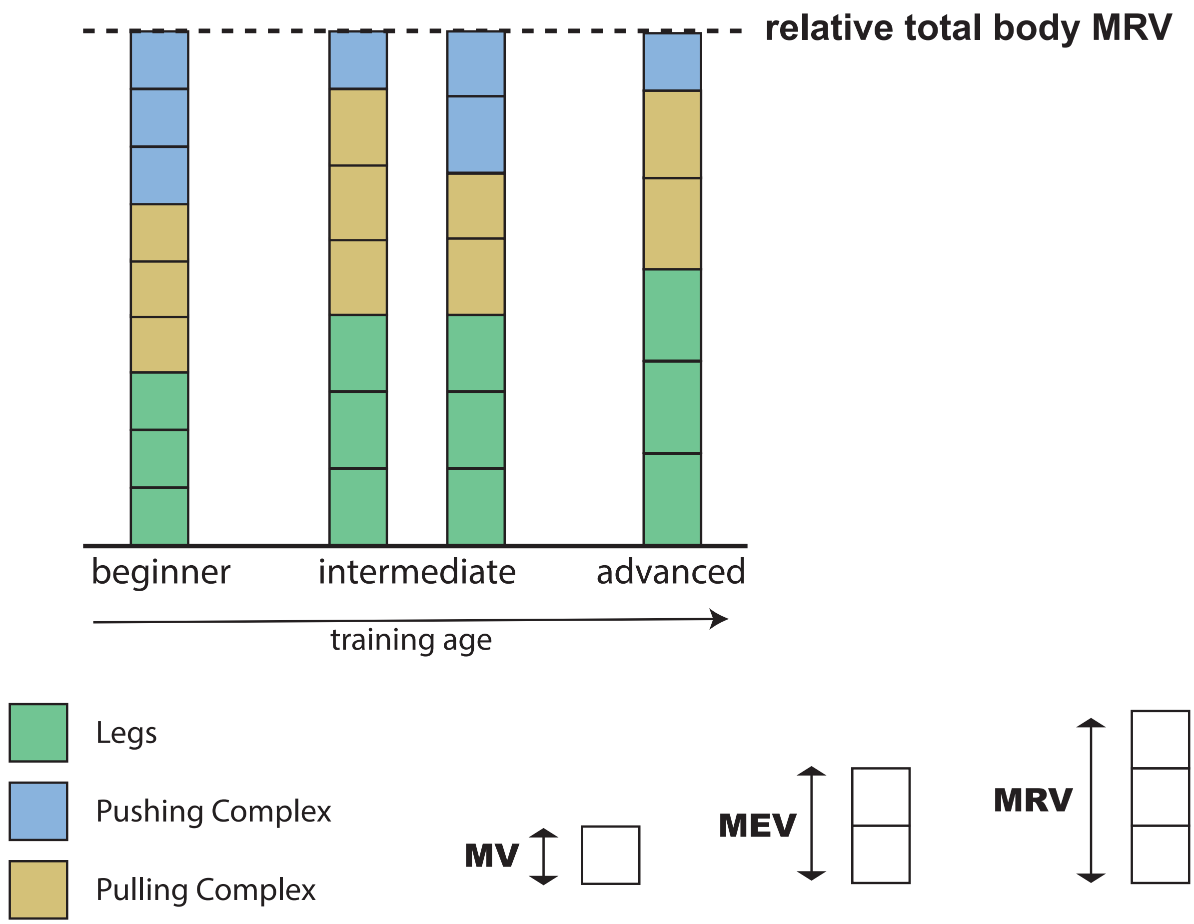


Figure 21. Fitting Body Part MRV into Whole Body MRV Across Training Age: This diagram illustrates MV, MEV, and MRV for body parts (single, double, and triple boxes, respectively) with respect to total body MRV. As a beginner (column one) individuals might be able to train legs (green); chest, anterior shoulders, triceps (pushing complex, blue); back, posterior shoulders, biceps (pulling complex, gold) all to their individual MRVs, without surpassing total body MRV. Intermediate level individuals, however, might have to train only one or two body parts to MRV, keeping training of the other parts at MEV or MV: two possible examples of this emphasis and de-emphasis are shown. The advanced athlete in this example can train only one body part to MRV in order to have room to train all parts at at least maintenance volume. (Total body MRV is shown as relative changes in MRV with training age are not represented here for simplicity).

7 VOLUME LANDMARKS OVER THE TRAINING CAREER

In our explorations of each of the volume landmarks, we've seen how they differ between individuals and situations, and, after the last chapter, how they differ between the dieting phases. In this chapter, we dive into a deeper discussion of how the volume landmarks change for individuals as they progress in their training careers.

Before we dig into the specifics of each landmark, let's first address the definitions of the different classes of athletic experience. When we refer to these terms in the remainder of the chapter, please assume that we are using them to mean roughly the following:

Novice: Fewer than 6 months of dedicated training
Beginner: Between 6 months and 3 years of dedicated training
Intermediate: Between 4 and 7 years of dedicated training
Advanced: 8 to 14 years of dedicated training
Highly Advanced: 15 years+ of dedicated training
Masters: More than 8 years of dedicated training AND over the age of 40

These definitions are only meant as averages to guide your thinking, and are not exact values set in stone. They also differ from the definitions of various authoritative sport science bodies such as the NSCA. They are not meant to be offered as better alternatives, but rather, as tools for reasoning about volume concepts over training career lengths. Thus the question of "If I've been training for 7.5 years, does that make me an intermediate or an advanced athlete?" is not one that can be definitively answered. All of the volume landmarks change on a spectrum, and training ages should also be seen as a spectrum as well, instead of as discrete categories with precise cutoffs. Additionally, while these categories work well for strength, hypertrophy, and endurance-based athletes, their timelines for speed, power, and high technique sports and abilities can be significantly different, so please note this before extrapolating.

With that, let's discuss how the volume landmarks change over the training career. After that, we'll discuss some of the more interesting and important implications these changes have for the training process over the career span.

1. MRV Over the Career Span

Novices usually have very poor work capacity, insofar as they have not actively trained prior. While their recovery abilities may not be exceedingly poor in the objective sense, training is so novel to them, that it is highly disruptive per unit of volume. Put simply, they are so unused to training that the tiniest bit beats them up. If you administer intermediate level training volumes to novices, they get profound and counterproductive levels of soreness and ability impairment.

As novice turns into beginner, and beginner into intermediate, into advanced, MRVs continue to rise. This rise is of course hastened by athletes who are more invested in utilizing recovery modalities, and in training more intelligently, avoiding practices like going to failure on every working set, for instance.

At the Highly Advanced level, intensities used can become so great that MRVs actually decline. To be clear, this is not an aging or cumulative stress effect, it's a byproduct of the sheer intensities now being used, as they are now in large part required for overload. For example, an advanced lifter might have a weekly MRV of 20 sets for his quads. If he does 20 sets of squats, at 10 reps per set, with 315lbs, he's going to boast a weekly sum total of 63,000lbs of volume. If a highly advanced lifter uses 405lbs for the same set and rep scheme, he will be putting out 81,000lbs weekly volume, which is an absolutely radical and uncommon increase in ability. So, let's say that only a jump to 70,000lbs per week or so is realistic, and total volume can't go up much beyond that. What kinds of sets and reps are we looking at if he's now squatting 500lbs? 14 sets of 10 at 500lbs. First of all, note that the proxy volume, as measured by working sets, has decreased a *ton*. Second, how many athletes can actually recover from 14 sets of 10 at 500lbs on a weekly basis? We're not so sure there *are* athletes that can recover from this amount of work. Very high intensities do contribute to further adaptations, but, at the extreme ends, that means volumes must come down at times to compensate for the added fatigue.

In masters athletes, the aging process reduces both work capacity and recovery ability, so we can expect MRVs to slowly decline with time. Now, there are many athletes in their 40s and 50s that experience increases in their MRVs, but the vast majority of them are individuals who entered their sport later in life, and are still beginners or intermediates in their training age, even though they are older in biological age. Older athletes who have been training a long time almost always see declines in MRV values. And they can still make gains, but they can make the best gains by adapting to their falling MRVs, not by trying to train like they used to when they were younger and exceeding them. Figure 22 illustrates how MRV will likely change over the course of the athlete's career.

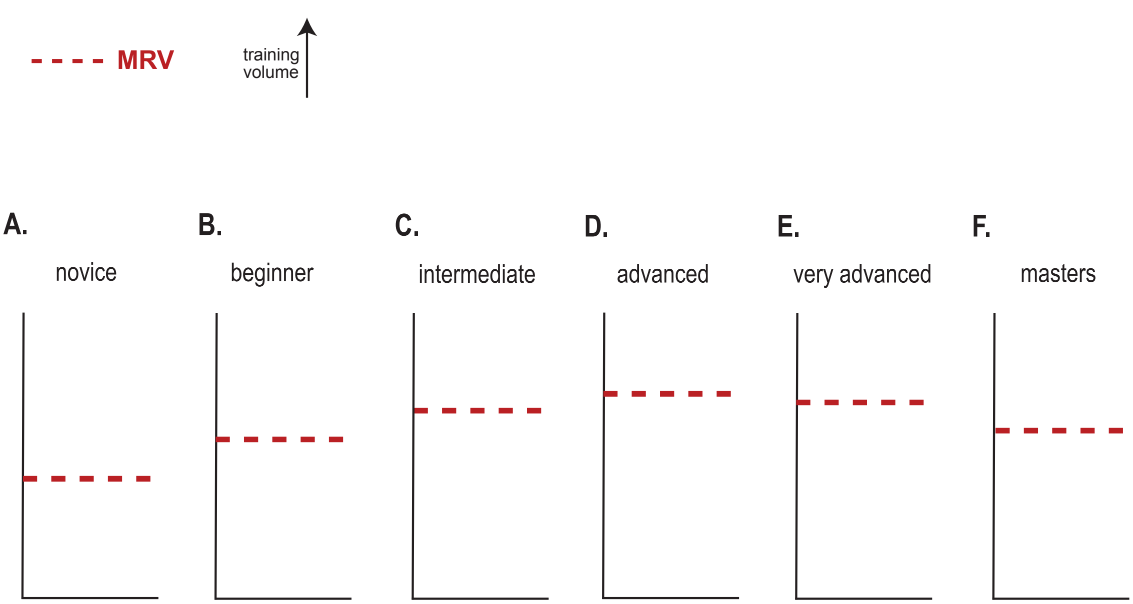


Figure 22. MRV Over the Career Span: Training volume is plotted on the y-axis and dashed red line indicates volume of training required to reach MRV. Across training age from novice to advanced (A.-D.), MRV climbs. From very advanced to masters however MRV begins to drop.

2. MEV Over the Career Span

The MEV for a typical Novice lifter or runner is 1. One working set per week for a lifter, and one mile a week for the runner. Yep, just about *anything* leads to gains for the novice athlete. This concept is so well known, that bragging about rates of gain in the first 6 months of training is considered a kind of faux pas in gym culture.

As novices become beginners and beginners become intermediates and advanced, MEVs continue to rise, as more and more stimulus is needed to keep systems adapting. Thanks for nothing, Overload Principle! At the “highly advanced” level, the MEV might get very close to the now stalling MRV, which has many interesting implications for advanced training, as we will explore in a later section. For masters athletes, MEVs might rise above MRVs, which means that net gains are no longer possible, and maintenance or conservation of ability to the highest degree possible becomes the recourse (Figure 23).

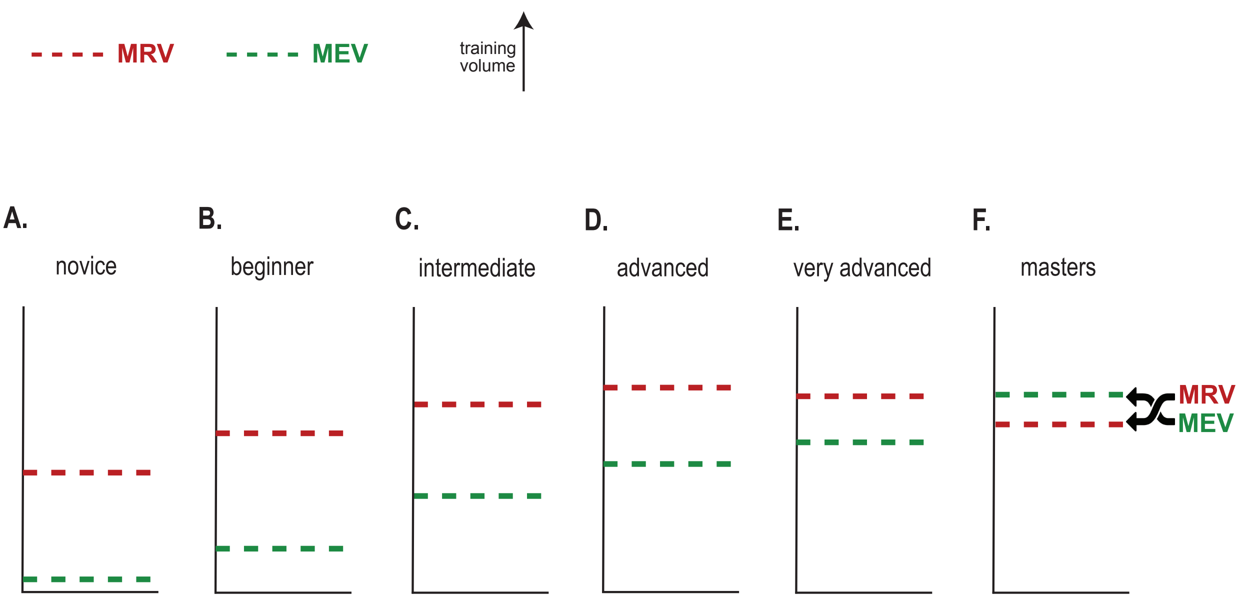


Figure 23. MEV Over the Career Span: Training volume is plotted on the y-axis. A dashed red line indicates volume of training required to reach MRV, while a dashed green line indicates volume of training required to reach MEV. Across training age from novice to advanced (A.-D.), MEV climbs along with MRV. From very advanced to masters, however, MRV begins to drop as MEV continues to climb, reducing the gap for productive training between the two. In masters level athletes, MEV can actually land above MRV.

3. MAV Over the Career Span

The MAVs of novices are initially very low. As a result, hypertrophy gains in the first several weeks of a training program are sometimes insignificant, likely because even the 8 sets a week of resistance training mostly exceeded the MAV curves of the participants in many academic studies. Luckily, neural abilities in novices rise so fast that improvements in ability are nonetheless made, eventually leading to growth and its acceleration. Another interesting phenomenon that arises from this observation is that, for years, one-set-to-failure protocols performed just as well in short term studies as multiset protocols. This is because, while one-set to failure protocols probably under dosed and were on the low end of the MAV curve, multiset protocols were overdosed and on the high end, both averaging the same gains. Only when these studies were carried out over a longer 8+ week period did MAVs rise enough for the multiset groups to show a clear superiority.

When considering MAV change, from beginners to the highly advanced, we must consider 2 factors: the length of the adaptation or MEV-MRV curve, and the magnitude of gains to be expected at any part of that curve, as represented by the height of the curve, which represents the amount of gain expected per microcycle (Figure 24). These two factors are multiplied to give us the area under the adaptation curve, and thus the total amount of adaptation gain possible per mesocycle.

As beginners evolve into the highly advanced, the rate of gain or height of the curve for any given accumulation microcycle declines. In addition, with rising MEVs and MRVs, up until the “advanced” level, there isn’t much of a change in curve length, so “intermediate gains” can still be quite impressive in total amount, or area under curve. But, for advanced and especially highly advanced athletes, MRV climbs slowly, and can reverse, while MEV climbs continue unabated, leading to a reduction in the length of their MAV curves, as well as reductions in their heights. This of course means that, for the advanced and especially the highly advanced, the rate of gain in any one mesocycle will be *much* lower as compared with that of a beginner’s or an intermediate’s.

Masters athletes may find themselves in a situation where their MEVs exceed their MRVs, and thus the whole theoretical MAV curve is out of reach. Unfortunately, no net gains are possible in such a scenario, short of revolutionary, futuristic changes to training or to the recovery modalities.

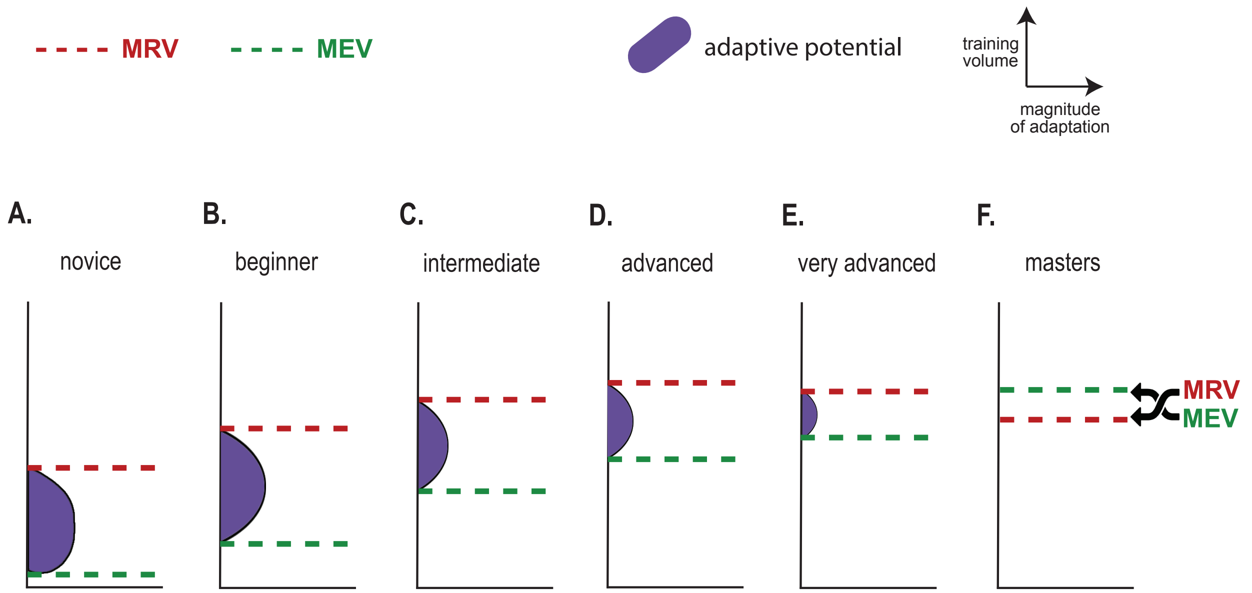


Figure 24. MAV Over the Career Span: Training volume is plotted on the y-axis. A dashed red line indicates volume of training required to reach MRV, while a dashed green line indicates volume of training required to reach MEV. The space between MRV and MEV is the MAV, and the area under the shaded, purple curve indicates adaptation potential within that training volume. Across training age from novice to advanced (A.-D.), MEV climbs along with MRV, but adaptation magnitude is reduced. From very advanced to masters, MRV begins to drop as MEV continues to climb, reducing the gap for productive training between the two. At masters level in very advanced athletes, MEV can actually land above MRV, eliminating the potential for further progress.

4. MV Over the Career Span

There is an interesting observation on the capability of maintaining gains in abilities that has been made not only in the sport and exercises sciences, but also in the studies of almost *any* purposeful and difficult long term skill acquisition process. From hypertrophy to typing, from strength training to piano, and from volleyball to skateboarding, the longer someone has been training, the relatively less they need to do to maintain their skills within a very close margin to their best efforts. In this context, “relatively” refers to how much they need to work to further improve their skills. In other words, while MEV continues to increase steadily over the training years, MV rises quickly through the novice and beginner years, but just as quickly loses steam, and rises much more slowly during intermediate, advanced, and highly advanced stages (Figure 25). We turn to the pianist for an illustrative example of this. If someone learns how to play piano for 2 years, and then begins missing practices and only plays a couple times a week, will she still improve? Almost certainly not. In fact, she will probably get worse. It may take years of twenty five hour practice weeks to reach a high level in the “advanced” category, and just as many to exceed this level. But how many hours a week does it take for someone who is already advanced to just stay at his or her current level? Any answer above 5 hours would be sheer overkill. So, while the ratio of MV to MEV is 1:2 or so for a beginner, it might be more than 1:5

for an advanced player. We could have picked any number of other skills for this example, including the ability to ride a bike: once you know how, the amount of riding required to maintain skill is much smaller than the amount required to notably enhance proficiency. This phenomenon is echoed by the common expression “like riding a bike”, meaning of course that most skills tend to intuitively come back to us with minimal effort after a period of underuse.

In strength sports and hypertrophy research, this effect is well documented. If a novice lifter quits for months he’ll have to train for months to regain previous ability status, whereas if an advanced lifter quits for months, he’s back to being close to where he left off within weeks of resuming his training. Moreover, advanced lifters can maintain their abilities on just a couple of hard working sets per week, while, for beginners, anything much short of MEV is a slow backslide. The concept of high MV:MEV ratios for highly advanced athletes is well exploited in many formal sport training settings. For example, Eastern European lifters commonly take whole months off of hard training after a World Championship event, and even longer after an Olympics. This practice baffles many Western lifters, but is in fact highly effective. The lifters that do it don’t lose nearly as much ability as would be expected for a beginner who quits for as long, and they regain it incredibly quickly.

For masters athletes, the balance of signaling starts to increasingly favor catabolism over anabolism, and MVs rise to meet, and eventually exceed, MRVs, leading to a decline in ability. While proper training and recovery modality application can decelerate this decline, its occurrence is unfortunately inevitable.

In the next section we’ll discuss some important and interesting implications of these career-long changes in the volume landmarks.

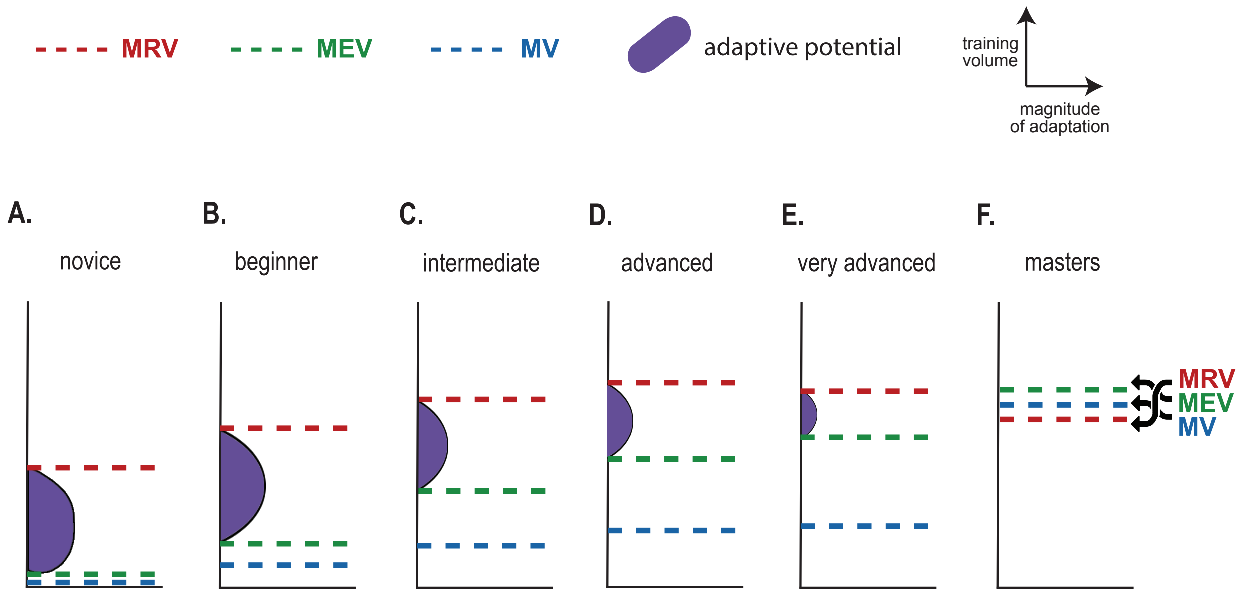


Figure 25. MV Over Career Span: Training volume is plotted on the y-axis. A dashed red line indicates volume of training required to reach MRV, while a dashed green line indicates volume of training required to reach MEV. The space between MRV and MEV is the MAV, and the area under the shaded, purple curve indicates adaptation potential within that training volume. MV is indicated by a dashed blue line and also climbs with training age. Across training age from novice to beginner, MV (A.-B.), MV climbs along with MEV and MRV. But from Intermediate to Very Advanced (C.-E.), MV climbs very slowly, leading to a notable MV-MEV gab development that has many implications for the training process. From very advanced to masters MRV begins to drop, as MV begins to climb faster. At the masters level in very advanced athletes, MV can land above MRV, making even maintenance of gains impossible at any training volume.

5. Implications of Career Shifts in Volume Landmarks

As individuals go from novice to highly advanced, we see their MRVs and MEVs rise during most of that time. While MEVs continue to rise, MRVs eventually flatline, and might even decline a bit due to higher intensities of effort. While MVs grow at first, their growth becomes much slower than that of the MEV-MRV window, creating a bigger and bigger gap between MV and MEV over the course of the intermediate and advanced years. Eventually, MEVs and MVs continue to rise while MRVs fall into the masters years, and adaptations decelerate, stop, and then reverse. Let’s explore some of the implications of these changes in this section.

Implication 1: MEV-Biasing of MAV for Novices and Beginners & Impossibility of MAV Biasing for Intermediate+

Novices and Beginners have something big going for them, which is of note to this topic: they make amazing gains even without pushing the boundaries much. On the downside is that their technique development isn't yet complete, and their motivation levels might not be as high as those of more advanced athletes. Due to their incomplete technical development, their technique will tend to break down at high volumes and fatigue states, or close to MRV. As a result, they may be inadvertently learning bad, broken technique, *and* therefore risking injury. In fact, because technique is *very* hard to change once established in the novice and beginner stages, it is a very good idea to learn it right the first time, and a very bad one to initially learn it wrong. Learning improper technique has both short term and career-long implications, particularly because it's *very* difficult to change especially later in an athlete's career.

So if we insist on pushing novices and beginners into the psychologically difficult and technically challenging area of training close to MRV, we'll definitely see better short term gains. But the risk of injury, poor technique acquisition, and psychological burnout are distinctly higher when regularly pushing novices and beginners to their MRVs. The upside is faster progression, but is progression really a problem for novices and beginners? We don't think so! Sure, if advanced athletes wanted to avoid near-MRV training to get better, they would be missing out on a lot. But novices and beginners can make absolutely great gains even if they only cycle their training from MEV to perhaps two thirds of the way to their MRVs, and then restart. This sort of training still makes for very good gains, and has *much* lower injury, poor technique acquisition and burnout risk.

We cannot say that such restraint in overload progression for novices and beginners is *always* a good idea, but we'd like for you to consider it the default for most types of athletes, before they reach their intermediate stages.

Once an athlete is an intermediate, is there a way to bias training to one side of the MAV curve, either closer to or further from MRV? No, not really. As more experience is gained, because of rising MEVs and falling MRV heights, adaptation curve length and thus room to make progressions in overload in any given meso becomes a more and more prized possession. What this means is that, while novices and beginners may benefit from biasing their training to MEV and avoiding getting too close to MRV with any regularity over the long term, intermediates and above will benefit most by utilizing the entirety of the adaptation curve, and running almost all of their mesocycles from MEV to MRV.

Implication 2: The Growing MV-MEV Gap and What It Implies

For a novice, the MV and MEV are essentially almost the same value (Figure 26). If it takes a minimum of 4 sets a week to get you bigger as a novice, 3 sets a week might just make you smaller. But as novices become beginners and beginners become intermediates, their MEVs leave their MVs behind. Sounds strange. So, if our MV is 8 sets per week, and our MEV is 12 sets per week, what the hell does the adaptation curve look like between those two points? To be very technical, anything just over the MV can be considered adaptive. But, for intermediates and beyond, the slope of that adaptation curve is *tiny*. So tiny, that training between the two points for months and months may reveal practically no detectable improvements whatsoever.

As such, the extra gains you get in our example of going from 8 sets to 11 sets of training per week are barely detectable. But, as you pass 12 and approach 20 sets, our hypothetical MRV, gain rates again become much higher. Super mysterious, right? How the hell does that even work? Isn't muscle growth just the balance of catabolic and anabolic activity, where any tipping of the scales in any direction is a smooth curve? Well, yes and no.

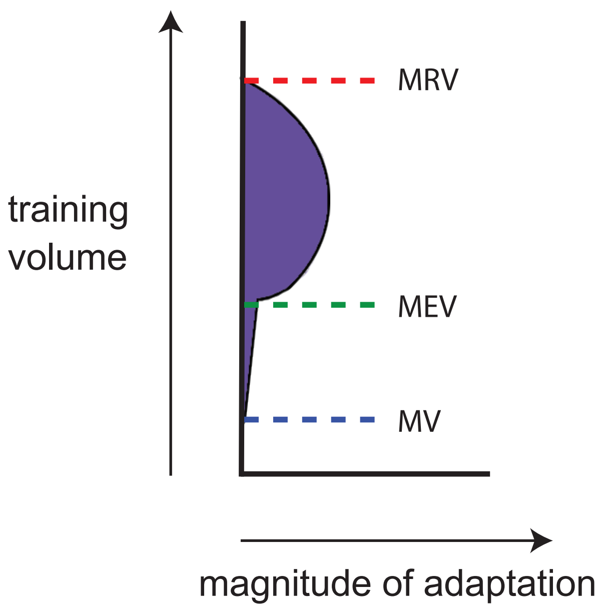


Figure 26. The MV-MEV Gap: In more experienced lifters, low MVs (dashed blue line) mean very minimal training is needed to retain gains, but larger MEVs (dashed green line) imply the necessity for very hard training to get any *new* gains (shaded, purple area). The growing gap between the two is not a productive volume at which to train. Training between MV and MEV not only fatigues more, it results in little to no new gains.

True, muscle growth is largely the balance of catabolic and anabolic activities. But muscle growth, like other forms of adaptive improvement, isn't like putting sand into a pile, where, if you add more sand than you remove, the pile gets bigger. For a better analogy, let's reuse our prior one of the construction of a building. If you think of new muscle as the accessible floors of a newly constructed building, a frame is not enough. You need a ceiling, windows, a floor, pipes, and a staircase or elevator to actually lead to that floor. Now you can imagine construction rates between MV and MEV as those just fast enough to build the floor, but not fast enough to build the floor and the ceiling at the same time, while also repairing cracks in the floor during ceiling construction. It's kind of like adding workers: if it takes at least 4 workers to hold up a beam and a fifth to install it, having any fewer than 5 workers on a job - while it can allow for cleaning the site, fixing the floors, and building a lot of structures - nevertheless means that there won't be enough workers to install that beam, so the next floor won't really ever get built. Analogous systems seem to be at play in the human body, where the amount of training needed to upkeep them is rather small, but some serious hurdles need to be scaled in order to make real, notable, long term gains to the already advanced system, like the building of complex structures such as entire sarcomeres, or sending a sufficiently strong signal to immigrate satellite cells.

In other words, the body becomes very efficient at keeping its gains, but very resistant to making new ones. In fact, resistant enough, that a truly superlative stimulus must be produced to catalyze gains, and all of those stimuli lie above the MEV.

The reality of the developing MV-MEV gap can be observed in nearly every sport and ability. A surprisingly small amount of training can keep the most advanced athletes close to their very best, but, due to their higher MEVs, only very high levels of effort can actually improve those bests. This relationship provides plenty of implications and training recommendations.

The first implication we can derive from this specific relationship is that, when advanced athletes take deloads, active rests, low volume training periods, or tapers, they can and *should* be using volumes that are *much, much* lower than the ones they typically use in normal MAV training. For instance, a bodybuilder who regularly trains with between 14 and 18 sets per body part per week to grow, might only train with 8 sets per week during deloads or volume resensitization phases. What's the downside of training with, let's say, 13 sets of a low volume phase? Simply that volume sensitivity takes longer to accumulate with higher volumes, and fatigue takes longer to fall. High level athletes accumulate massive levels of fatigue, and need all the help they can get dropping it, and anything impeding that drop had better have some serious upsides. But what are the upsides of doing 13 sets versus 8 sets? None, really! You still get maintenance just the same, whether you're at 8 sets per week or 13 sets per week, and essentially no added gains by going on the higher end. If an athlete is bad about going down to their MV instead of hanging around just under MEV during low volume phases, he is likely to pay an especially high price in the long term, through more wear-and-tear injuries, the precursors to which would have healed, had training during low phases actually been down at MV and not needlessly higher.

The second and highly related implication is that, when advanced athletes are actually trying to make gains, it's going to require serious levels of effort. Ho-hum or "middle of the road" training will not be a common feature of high level progressions. On the other hand, low volume or fatigue reduction training will be relatively easy for higher level athletes, much easier than most would guess, based on how hard their hardest training is. The illusion that you have to train just as hard to keep your gains as you do to make new ones is just that: an illusion. And this rift between maintenance and progression training means that advanced athletes have to especially avoid the "no man's land" of training between MV and MEV. From a motivational perspective, beginners and intermediates may very well have productive workouts even if they don't feel like giving it a super overloading effort that day. For them, if training is even a bit higher than MV, it's probably also higher than MEV, and will help them make at least *some* gains. But, for the advanced and beyond, it's either "gas" time or "break" time, with not much in between. When writing programs for advanced athletes, keeping this in mind can help you avoid that middle path, which, while just fine for novices, beginners, and some intermediates, will not be productive for the advanced and highly advanced.

As athletes progress in their application of consistent training, and evolve from advanced to highly advanced, their windows for what's effective, MEV-MRV, close even more, which brings us to our next discussion!

Implication 3: The Narrowing of the MAV Window in Advanced+ and What This Implies

As athletes evolve from advanced to highly advanced, a special kind of challenge to the training process emerges. While MEVs continue to go up throughout this time, MRVs often slow their ascent, flatline, and can even drop somewhat, outside of the effects of the aging process, simply to make room for the growing absolute intensities of training and their increasing burdens on recovery systems. The result is the closing of the gap between MEV and MRV, which makes progression difficult, fatigue accumulation consistently problematic, and means most of training is near MRV. Some strategies can be used to continue to create adaptations in such conditions.

One strategy to create adaptations with narrow MAV windows is to lower the training frequency per each training week or microcycle. By lowering frequency, but keeping the same volume, each session becomes much more overloading. In other words, the session's volume is more likely to be higher than "intra-session" MEV. Yes, even sessions have MEVs, but they are of very little concern in most cases, so long as the total volumes sum up to MEV or above for the microcycle as a whole. As athletes get more advanced, however, they likely need bigger "pulses" of training to jar their physiology out of complacency. On the one hand, this is effective, but on the other, it's highly fatiguing. If we continue down this road, pretty soon, we only have recovery room for maybe one or two big sessions a week. What this can lead to is a reduction in overloading sessions, but also an increase in recovery sessions per microcycle. Whereas a beginner might overload the same systems 4x during a microcycle, a highly advanced athlete might only have room for *one* big overloading session - any less, and he wouldn't adapt much - and a smaller recovery session. Remember that advanced athletes keep gains very well, and don't need high volumes to do so, but they take on a ton of fatigue, and need all the help they can get in dropping it. Working with these realities, a sound approach for advanced athletes is to split their training microcycle into halves, with one being hard, *or exceeding* what would be the MRV of the micro if both halves were the same, and the other very easy, or at MV. This allows them to push their adaptations forward without accumulating too much fatigue to continue progression. Moreover, because each every other half micro is an excession of MRV, this is technically a paired down application of Functional Overreaching and recovery, on a consistent micro-micro basis. The astute reader will notice that this is a form of training undulation. In fact, such undulation paired with lower overloading frequencies is likely a bigger benefit for the highly advanced than it is for less experienced athletes.

Another strategy for the highly advanced is to perhaps relegate intra-MAV progressions to those of only per-set intensity, instead of set numbers. Yes, an intermediate might be able to go from 12 sets to 20 sets over an accumulation phase, and see growth at every point in between. But a highly advanced athlete may have MEV of 18 and MRV of 20. What the hell kind of progression is he supposed to do?! Well, instead of progressing in sets and intensity or weight on the bar, a highly advanced athlete can just progress on intensity, adding 5-10lbs to the bar each microcycle, but not adding any sets, or maybe just adding a set once every 2-3 microcycles or only in the last micro, to ensure FO. That way, he still achieves progression, but only as much as he can fit, which is much less than he used to as a less experienced athlete.

A third strategy for continued gains as a highly advanced athlete is the greater use of emphasis/de-emphasis structure in mesocycle training design. Particularly for the highly advanced, total body MRV is vastly exceeded by summated per-body part MRVs. While novices, beginners, and intermediates might be able to fit all of their body parts, or even other sport priorities, into their full MEV-MRV progressions within their total body MRVs, intermediates might start to have to dip some body parts or sport foci to at or below their MEVs, in order to allow for training of prioritized parts all the way up to their MRVs. Advanced athletes might have to split their schedules in half, prioritizing only half the body or set of sport demands for one or several mesocycles, while keeping the rest only at MV, and flipping that around when needed. Highly advanced athletes might need to go further still, to basically keeping *most* factors or body parts at MV, and selecting just a few to take from MEV to MRV, so as to be able to fit the whole system into its overall MRV. Does this really slow down the rate of gains? It does. But it sure beats trying to cram everything in, chronically overtraining, and hence getting all of the exhaustion but *none* of the gains to show for it.

Next, more advanced athletes can introduce more frequent exercise variation into their programs. Beginning a novel movement pattern can lower MEV, which can give us more overload opportunities. Of course, for anyone up to intermediate level, very frequent variation can be problematic, as it violates the specificity sub-principle of Directed Adaptation, and hinders overload progression with overly frequent shifts in exercise selection. But, for advanced athletes, progressions are so short that this isn't much of a trade off, and the lower temporary MEVs of new movements may offer net benefits. By altering the most taxed muscle fibers, such frequent variation might also reduce the rate of cumulative fatigue. One exercise can be done for perhaps as few as 2 microcycles in a row, another can be chosen after, and so forth. This sort of progression is likely most effective for physique athletes, who are interested in general hypertrophy. Power and strength athletes that desire the directed adaptations of their specific events are likely best served by staying away from frequent exercise variation.

Last but not least on our list of advanced strategies is a high degree of emphasis on the recovery modalities. Even advanced athletes can make gains by doing "ok" with applying the recovery modalities. But for the highly advanced, there may be little choice. Some missed sleep, extra stress, and missed meals can be the difference between a three week overload window, or 3 microcycles between MEV and MRV, and a one week overload window. How much better can you get when you have to deload every other week? Not much. Such razor thin margins between MEV and MRV don't leave much wiggle room, and athletes should be focused on applying the recovery modalities consistently so that they can keep those margins as far apart as possible and continue to progress, otherwise known as getting their MEVs to fall a bit and their MRVs to rise a bit. In simple terms, if the highly advanced are not progressing, "not training hard enough" is rarely the culprit, but consistent application of the recovery modalities usually is. If MRV and MEV *both* continued to rise through this stage, then it would be an even bet that the problem is either not enough recovery application or hard enough training. But since MRVs slow down and eventually stop escalating, "not doing enough training" is no longer as likely a source of problems for adaptations, while "not enough recovery modality application" likely is.

Please note that such strategies as described here are in effect "last resorts" for generating gains in the highly advanced. They are *by no means optimal* for any other stage of athletic development, and, particularly for novices and beginners, they're anything but! The fact that this differential training prescription is customized for developmental status is one of the many reasons why individualized programming is superior to generalized programming. It's also a damn good reason why newer athletes should seek to understand the principles behind the methods of the highly advanced, instead of simply copycatting these seasoned pros.

Implication 4: The Volume Conundrums of the Masters Athlete

When individuals pick up new sports or new forms of training in their later years, for example, after age 40, they can make great gains for a long time, but none of the phenomena discussed here about masters athletes will apply to them. The group of people to whom these phenomena apply will be those who have already been training hard for at least 8 years preceding their 40th birthday. Because of the summative effects of training experience and aging, those who enter their 40s as “advanced” will have volume landmarks that more closely resemble those of “highly advanced” individuals under age 40. After perhaps 5-10 additional years, many of the following volume landmark shifts will become likely for this demographic:

A. MRV Descending Below Historical MAV

At some point, masters athletes will see their falling MRVs descend below what used to be the average of their MAV curves. This, of course, means that their former best gain rates will cease being possible, but net gains can continue to be within reach.

B. MRV and MEV Cross Paths

At some later point, rising MEVs and falling MRVs will cross paths. This marks the end of positive adaptation curves, and means that only a retention of already gained ability (MV) is possible henceforth.

C. MRV and MV Cross Paths

Finally, due to impeded recovery abilities, falling MRVs will descend below MVs. MVs will simultaneously be rising, due to lowered anabolic activity and increased catabolic activity, both at baseline and in response to training. At this point, losses in net ability are the result.

Seems pretty grim, and to some extent it is… We will all age, and will not stay our best athletic selves forever. *But*, if one is interested in retaining as much ability as possible, intelligently constructed training *and* diligent application of the recovery modalities can very much slow the decline. Slowing the decline of strength and endurance in older age may mean the difference between spending your later years in a nursing home, and living them out completely independently. Not a small matter for most in all walks of sport and life.

8 SELECT IMPLICATIONS FOR ORGANIZATION OF SPORT TRAINING

Well done: you made it to the last chapter! We hope you liked the read, and that it's really gotten you to think about the training process, specifically about how much volume to train with and when. In this final chapter, we'll be taking the lessons learned from the volume landmarks, and parlaying them into further suggestions for beneficial training practices. What follows are a select few insights into how an understanding of the volume landmarks can be leveraged, which we thought were both important enough to explain, and insufficiently covered in the other chapters of this book.

1. The Benefits of Athlete Monitoring

How do you know if you're above your MRV? How can you tell if your MEV has outgrown your expectations? Is your MV actually higher than you hoped? You can answer all of these important questions about your volume landmarks if, and only if, you *monitor* your responses to the training process. For starters, you need to keep track of each of your sessions, and the volumes/intensities achieved therein. Next, make careful and logical manipulations to your training accordingly. Lastly, note responses to training, which can be as varied as the number of goals scored in small sided soccer practice, body fat gains over 6 months, or improvements in strength from micro to micro. Only by carefully tracking and diligently manipulating your training can you fine-tune your approach, and hence get the most out of it. If you're coaching a whole team of athletes, not only should your monitoring be attuned to the team's average responses, but you should also keep track of at least some individuals athletes' variables as well, so that you can tailor prescriptions to individual needs.The tracking templates we have provided may come in handy here (see pages 112-113).

2. Advantages of Individualized Prescriptions

Why concern ourselves with tracking the progress of individuals that comprise a team, as opposed to simply tracking the team's progress as a whole? For one thing, there is a great deal of individual variations in *all* training variables, not the least of which are the training volume landmarks. Even athletes on the same team can have wildly different values. For example, is 5 x 10 in the squat a decent leg workout to do twice a week for hypertrophy? Well, for some individuals that might be right around their MV, but, for others, it might be pushing their MRV! Whenever possible, landmarks should be individually applied, which means the "right amount" of training is a concept that is *only* individually relevant. Given this, a word of caution that template programs, especially the free, online variety, are often going to be quite suboptimal, as they carry a high risk of instructing athletes to be under MEV or above MRV for weeks at a time. For most people, best gains in size and strength are probably somewhere between 5/3/1 and German Volume training, and only a minority will see their *best* results from such extremely low or high volume programs. And, while such prepackaged programs can be a fine start for beginner athletes who are new to the complex landscape of training options, eventually, each athlete will have to play a role in customizing her own training, be that via the direction of a coach, the feedback of training partners, or just a self-made program.

3. Autoregulation and the Volume Landmarks

Your volume landmarks are rarely stable. While they don't usually shift radically, they can float up and down within the context of regular training. And, because they can change, our training plans often have to change with them to continue on the best paths to adaptation. For example, if it was supposed to be the final microcycle of your accumulation phase, and you feel pretty damn recovered, it means you're probably not hitting MRV yet and that you probably ought to run at least another overload microcycle after this one. You might be cutting it close, so make sure you are on the money with your recovery modalities during this time, but otherwise, overload away! For too many reasons to list, your MRV might just be a bit higher, either just this time, or maybe reflecting an overall upward trend. So, why fight it? Keep training! On the other hand, if you're feeling super beat up, and you still have 2 microcycles planned, maybe deloading early is a better idea, so that you don't spend too much time over your MRV.

Or, if you've done multiple mesos, starting with what used to be your MEV, and you've been chronically understimulated in the first microcycle of each one of these recent mesocycles, maybe your MEV has gone up! It might be time to start with a little more, so that you're not spending the first week or two of each training mesocycle in the "no man's land" between MV and MEV.

In general, track your recovery and the degree of disruption you're getting from your training. Outside of formal reevaluations of long term changes in your volume landmarks, be amenable to extending or shortening your accumulation phases, so that you can utilize the whole adaptation curve, and get all of your MAV without any less or any more training than would lead to your best long term gains.

4. Specialization Phases for Advanced Athletes

We've already thoroughly discussed the phenomenon of a "gap" between the MVs and MEVs of highly advanced athletes. Now, we'd like to touch on a very interesting implication that stems from the development of that gap. Especially for athletes whose sport skills have multiple components, there is a chance that training can naturally align itself in such a way that training for *all* desired abilities falls into that gap! Let's take a very pertinent example of MMA training. To be the best, most high level MMA athlete you can, you need to improve each of the following skills:

- BJJ (ground game)
- Wrestling/Judo (takedowns, escapes)
- Striking (Thai boxing especially)
- Full MMA game (practiced live)

So, if you want to get better at MMA, you really kind of have to train for four skills, training for three of which is largely mutually exclusive to the other training types. To train BJJ properly, you can't be getting hit all the time. To train wrestling/judo properly, you can't spend most of your time on your back, or on your opponents, for that matter, as both put you on the ground, preventing you from getting enough takedown reps. Wrestling/judo training needs to be a series of takedowns, takedown defense, and escapes, that restart when both opponents are grounded. Striking is best trained when the opponents aren't allowed to take each other down to the ground, because this forces the training of more actual strikes, versus just a couple in the event that the fight goes to the ground. Lastly, training "MMA" really means sparring with full contact, all styles allowed, but, for the advanced, is mostly about fine tuning their tactics and strategies. That is, MMA training is usually too much like their normal game to let them open up and really learn a whole lot of new additions to that game. And, even if they could open up and experiment, that's not what MMA training is for: it's for taking all of the subcomponent training - BJJ, wrestling/judo, striking - and putting it into practice as an integrated whole, channeled through the tactics and strategies that best suit the individual fighter.

Ok, so, let's say we have to train all of those qualities separately. That's four qualities. Now, let's pretend we're MMA training *full time,* or forty hours a week, which means 10 hours for each style. Now, that's going to get most people damn good. The problem is that the MV for each ability might be about 5 hours per week, while the MEV might be 12 hours per week, and the MRV 15 hours per week. That means that if we split our time between all abilities evenly all of the time, we risk being in that "no man's land" between MV and MEV, where the gains, if they come at all, are staggeringly slow, especially for the advanced.

So, how can the volume landmarks guide us towards a solution to this problem? Well we can pick just two of these four skills at a time, and train them from their MEVs to their MRVs, which would amount to between twenty four and thirty hours of work a week (Figure 27). So, we have just enough room to squeeze in the remaining two skills that we're *not* prioritizing at present, right at their MVs of five hours week each. This way, we get to progress on two skills, while holding two others steady. One or two mesocycles later, we can switch the focus, and take the two skills we've been prioritizing, between MEV and MRV volumes, and put them on MV, while bringing the former MV skills up to MEV-MRV. Over the course of the whole process, we end up with a net gain in *all* abilities, as opposed to the approach where we trained them evenly and simultaneously, and got pretty much nowhere.

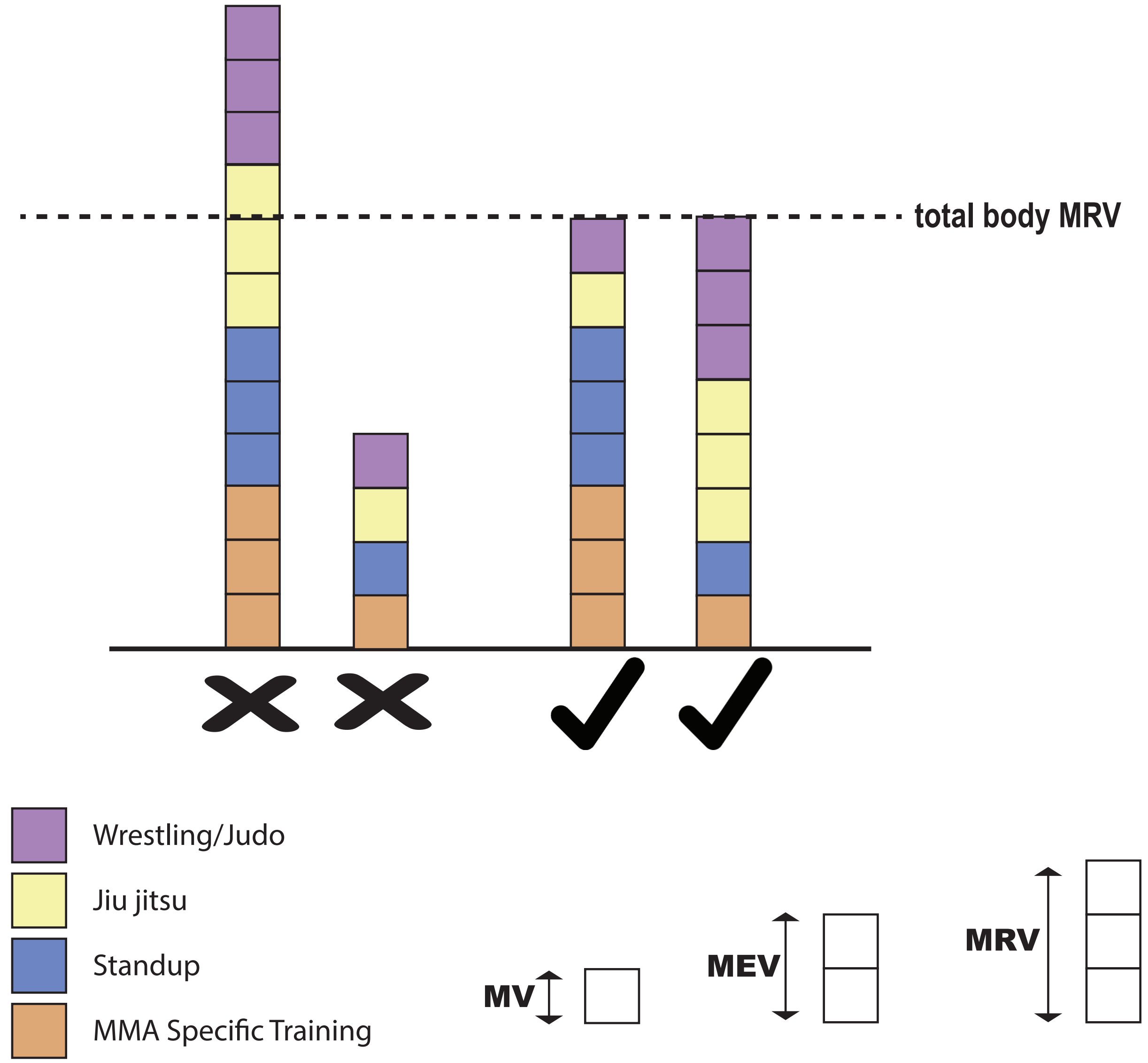


Figure 27. Fitting in High Level MMA Athlete Training: A competitive MMA fighter needs to train wrestling and judo (purple), jiu jitsu (yellow), standup (blue), and integrate all of these into MMA specific training (orange). As we have learned, training at MV (single block) will retain abilities, but will not lead to any new gains. Training at MEV will result in minimal gains (double block), and training up to MRV will result in the most potential gains. In the example in the first column, if an MMA fighter tries to train all of his or her skills to MRV at the same time, full body MRV will be exceeded, leading to a lack of progress on any skill and may in fact make the fighter worse. In the second column, by training all skills only to MV, the athlete avoids exceeding MRV and overtraining, but also cannot make progress. The final two columns show examples of more productive training practices, where some skills are trained to MRV for maximum potential progress, while others are maintained by training at MV. These two examples of training volume distribution can be run sequentially, in order to maximally progress on all skills over time.

Application of Volume Landmarks to Sport Periodization

By now you might be thinking: "Man, a lot of this kinda sounds like stuff I know, but never could put into words". Don't worry, you're not alone. In fact, sport scientists and coaches have been using these ideas as the basis of many modern periodization practices for a long time, just perhaps less explicitly. As previously explained, our personal training and coaching experiences leading up to the writing of this book evidenced the need to systematically explain how volume manipulations are done for sport, which in turn necessitated the volume landmarks nomenclature. Now that we can explain it in a meaningful way, we can really dissect our approach to sport periodization in a fun and practical manner.

One of the themes you may have noted throughout is that training for fitness, skills, and/or tactics all have unique volume requirements, which may or may not resemble the landmarks for other types of athletic skills. But what kind of MRVs and MEVs should we be looking at if we are training for speed, hypertrophy, and live scrimmaging in Rugby all at the same time? This presents problems not only in terms of potentially conflicting volume landmark outcomes, but also in terms of that pesky blender effect. How can I train within my MAV for hypertrophy without exceeding my MRV for speed? The short answer is: you probably can't for a number of reasons (one of which is that the physical fatigue generated by Rugby practice would lower MRVs for all of the fitness characteristics).

This idea that you probably shouldn't train for everything at once has in part led to our wonderful training principle of Phase Potentiation, which you can read more about in our book, Scientific Principles of Strength Training. What Phase Potentiation allows us to do is something we like to call emphasis/de-emphasis, which we've already recommended in prior sections of this book. As the name implies, this is a process that allows us to choose those characteristics on which we want to work really hard, while temporarily putting others on the backburner. This method is illustrated by basic examples, like when to strategically use exercise variations in your program, to more substantial examples, like focusing on arm hypertrophy rather than total body hypertrophy, to grand examples, like dedicating two mesocycles of training to power and speed development, while strength and work capacity are simply maintained.

This idea of emphasis/de-emphasis when applied to our volume landmarks allows us to periodize our sport training in the most effective ways. Questions of should I be doing this, or how much of that is needed can now be answered in terms of the volume landmarks. With them, we can strategically quantify how much volume of any given training type should be performed at any given time, and how to manipulate it throughout a sporting season. There are many instances in sport training where MVs are so easy to achieve, that other types of training actually already cover their volume requirements, rendering a specific focus on that trait unnecessary, and mostly or completely removable. Now we're getting somewhere!

Let's take a look at some examples of this:

Powerlifting

Powerlifting may be the most straightforward example we can provide. Its major component is resistance training, with a fudge factor based on individual needs. To make this discussion a little spicier, we can break down that resistance training work into two subgroups:

1. Powerlifting Specific Training, which includes any work directly related to the powerlifts and their prime movers.
2. Accessory Work, which includes any indirect work to keep joints healthy and support the powerlifts: think arms, shoulders, back work, pre-hab and the like.

The phasic structure for powerlifting generally includes a hypertrophy phase, a strength phase, and a peaking phase for competition. These can occur in varying lengths and unequal distributions, but generally in this sequence. During the hypertrophy phase, the powerlifter will be seeking to gain as much muscle as they can, to directly improve the powerlifts -- a no-brainer there. The majority of this will come from powerlifting-specific training, and a smaller but notable portion will come from accessory work. Thus, the lifter will seek to span their MAV for hypertrophy, starting at MEV and finishing at MRV throughout these mesocycles, using a combination of both powerlifting-specific training and accessory work.

As the lifter transitions into their strength phase, a reassessment of MRV must be made. We know MRV for strength is lower than that for hypertrophy, due to increased intensity that necessitates a reduction in total training volume to accommodate it. We also know that the increase in intensity will likely also lower the MEV, by virtue of both its novelty and increased disruptiveness. At the same time, the scope of training is narrowing to increase specificity, at which point the lifter is primarily moving to competition-specific training, sans a whole lot of extra supporting work. Accessory work will be reduced to MV or slightly above, to free up as much room for powerlifting-specific training as possible. It's here we reach a thought-provoking fork in the road, at which many lifters continue doing higher rep hypertrophy training, for fear of losing muscle. What we have found, however, is that overloading strength training can aptly preserve the relevant muscle mass for powerlifting. Given this finding, we can now say that the MV for muscle size is supplied through strength training alone, which means that hypertrophy can be deemphasized in favor of strength. Consequently, most of the MAV for strength is now carried by powerlifting-specific strength training (and a minimal amount of accessory work based on individual needs).

As the lifter moves into the peaking phase, he faces another reassessment of MRV, as maximal strength expression will be much higher in intensity than general strength training, again necessitating a reduction in total training volume. For intermediate to advanced or just very strong athletes, the MEV for maximal strength may become very small, as the near-maximal efforts and high absolute loads will produce huge amounts of fatigue. At this point, the lifter generally transitions to performing almost exclusively powerlifting-specific maximal strength training. Using the MAV for maximal strength that is within the athlete's abilities at least for a short amount of time (one to two peaking mesocycles) achieves MV for accessory related strength and size through powerlifting training alone. This, in turn, frees up precious volume, which can either be used for more powerlifting-specific training *or* for recovery enhancement. Maximal strength training can also preserve both general strength and muscle size for up to several months in length, so MVs for both of those can be achieved through the MAV for maximal strength training alone. We're getting goose bumps just thinking about the elegance of it!

Now, one unique scenario we should address within the peaking phase is the use of tapering into the competition. Here, the goal is to maximally alleviate fatigue, so strength can be maximally expressed. In order to do that, the training volume needs to be progressively reduced all the way down to MV, which, for maximal strength, will be very small. So, the start of a peaking phase and the weeks that follow may be at MEV for maximal strength, but, depending on the individual athlete, somewhere around one to three weeks out from competition, volume will be systematically lowered to MV in prep thereof.

For sports like powerlifting, we can see the applications of these ideas in a pretty straightforward way. But what about sports that have more components than just various forms of resistance training to juggle? Let's take a look at an intermediately complex example:

Team and Field Sports

Team and field sports span a wide variety of activities and physical demands. Although each sport should be assessed individually, team and field sports generally have a high degree of overlap in our discussion of volume landmarks, as they generally follow similar progressions. So, for this discussion, we can see how volume landmarks for sports like rugby, basketball, soccer, American football, handball, and many others can be manipulated throughout a sporting season.

Most team and field sports training can be broken down into the following components:

- Strength Training
- Conditioning
- Sport Techniques
- Sport Tactics
- Speed, Agility, Change of Direction (SAC)

Allowing for some wiggle room for individualization, these will be the main categories of training that will comprise any given total MRV of most team and field sports. The progression for these sports will generally follow a similar one as seen in powerlifting, but with some different goals. Usually, they will start with a general preparatory period, wherein basic work capacity in both the muscles and cardiovascular system, muscle hypertrophy, body compositional changes, and basic sport skills will be enhanced. Once competitions start to approach, a transition to a specific preparatory period will occur. During this phase, maximal strength, power, SAC, sport-specific conditioning and team tactics will be enhanced. Finally, during the competition phase, the athletes will be mastering SAC and team tactics, while actively competing in sport, all the while maintaining previously attained fitness and skills. Sounds scary, but it's actually not too bad: let's dive in!

The first thing you'll notice, is that our MRV consideration is much different than in our powerlifting example. As underscored, the major training component in powerlifting was resistance training, so defining MRVs was as simple as finding it for hypertrophy, strength, or peaking. In our team and field sports example, we have a bit of a hybrid, which makes it a little harder to define. We know the MRV for any given phase will include elements of strength, conditioning, sport skills and tactics, and SAC training. Exactly how much of any one of these your team or athlete needs must first be determined by *a formal needs analysis*. They do not need to be equally distributed, and will very likely be different amongst athletes, even those on the same team and during the same sport season. That being said, we can at least explore some general trends.

In the general preparatory phase, a substantial amount of effort will be invested into developing the athlete's work capacity. This will almost certainly mean that the athlete will start with MEVs for both strength work (such as hypertrophy and work capacity) and conditioning. Right off the bat, if we are allocating training and recovery resources to hypertrophy training and *anything else*, we can expect the athlete would not hypertrophy as much as if she were working through MAV for hypertrophy *only*. We also need to enhance our sports skills at this time, so MEV for sport skills must be included as well. Team tactics will not be emphasized until later, once the athlete has begun to demonstrate some degree of mastery over her sports skills. At this time, only a rudimentary amount of training resources, or MV, will be allocated toward tactics. This could be as little as watching a film or chalk talk, developing a game plan and studying opponents. Lastly, training for SAC at this stage will be largely premature, and thus a waste of training resources. In the general, prep phase SAC will be trained at MV, which can often be achieved through normal strength, conditioning, and sport practice, as the athlete trains many of the underlying characteristics of SAC in these training foci. In some cases, some basic technique reinforcement for SAC may be needed to achieve MV, as some movements require more technique than others. Such small amounts of SAC training are often performed as components of the warm up for either weight room or field/court work.

So, in our general prep phase, we will be starting with MEVs for strength, conditioning, and sport skills, meanwhile, tactics and SAC will be down to MV. Once again, we're back to the dilemma we've been outlining in this book: we can't simply just add MEVs for everything if want to make progress on something. In this case, the MRV for the general prep will essentially be how much strength, conditioning, and skill training the athlete can do. Interestingly enough, the general prep is where we typically see the highest total training volumes throughout the training plan. Here, the progression of each component through to MRV will be dependent on the individual's needs and how the training is distributed.

Now, there will be some variability, even within the general prep phase. An athlete may emphasize or deemphasize any of these components from mesocycle to mesocycle. For example, in meso one, an emphasis on cardio may have been needed, because the athlete was in such poor shape that she could barely get around the field. By meso two, cardio was deemphasized, and strength training was increased. These changes will have an effect on the gen prep MRV, as well as the MAV needed to progress through it.

Just like in our powerlifting example, as the athlete transitions to the specific prep phase, there is a substantial reassessment of both MRV and MEV. In this phase, maximal strength, power, SAC, sport specific conditioning, and tactics become the emphasis, which leads to a large net increase in training intensity. As training intensity rises, both MRV and MEV generally decrease, dictating that the total training volume must simultaneously come down. We also know that maximal strength, power, and SAC training and practice of sport techniques are all very sensitive to the effects of fatigue, which further compels a reduction in total training volumes during this phase.

For the strength training portion, we know that maximal strength and power training are substantial enough stimuli to maintain size and strength, so MVs for traits trained in the previous phase are covered. Strength training volume will still be at MEV, but, as previously mentioned, it will generally be smaller than that of the general prep MEV. Typically, conditioning will shift from more continuous or easy/moderate intensity methods to higher intensity interval style conditioning, which will also cover the MVs for the cardiovascular work capacity developed in the previous phase. In essence, a switch is made from emphasizing sport skill development to applying those skills in game scenarios. This means that, through tactics training, we start moving up to MEV for tactics, and down to MV for skills. Additionally, in some cases, the use of small sided games in tactics training can actually provide MEV for conditioning as well, reducing the need for specific conditioning training. As we now know, this frees up more precious volume, for either other training or recovery. Lastly, SAC training moves into MEV, and specific work in these areas is introduced, though much of the MEV for SAC can be achieved through tactics training alone.

Still with us? Awesome -- let's review that last concept: the specific prep phase sees a total training volume reduction across the board. We have MEVs for the strength, tactics, SAC, and conditioning portions, but, because the intensity of training was increased, the actual volume of each of those components is relatively small, in both MEV and MRV. Skill work moves to MV, which is largely covered by tactics. This may sound like a lot, except that the switch from skills to tactics actually helps cover skills, conditioning, and SAC. As such, we're really looking at a "Buy 1, Get 3 Free!" deal in terms of resource management. The MRV for the specific prep phase will have a large tactics component, a medium strength component, and a relatively small conditioning and SAC component.

The final transition is the competitive or "in-season" phase. Here because the athletes are actively competing, we are emphasizing tactics and SAC, and essentially maintaining all of the other components and preventing deconditioning, to ensure the athletes' maximum preparedness for competition. Aside from tapers, deloads, and active rests, this will be the lowest total training volume phase throughout the training plan. Strength training will move to MV, and muscle size and strength can be maintained as long as the intensity of weight room work remains high. Specific conditioning work and often sport skill work as well will be removed, and MV will be achieved through tactics alone. Tactics and SAC training will both also move to MV, to help bring down systemic fatigue, and, because tactics inherently include elements of SAC, the SAC MV can be achieved solely through tactics.

In other words, in the competitive phase, the athlete is actively training at MV for strength and tactics, but is also able to achieve MV for skills, conditioning, and SAC in the process. The intensity of activities is generally at its highest, and, correspondingly, the training volume is at its lowest. The MRV for the competitive phase is mostly made up of tactics and a bit of weight training, with some wiggle room for individual needs.

Clearly, the more components our training program has, the more difficult it will be to find our golden zone of MAV for each component. As our training goals change throughout the year, this can cause some pretty substantial changes in our training structure. But have you noticed a trend so far? Seems like making your athletes stronger and more skillful at their sport is always a priority. Hmmm... weird!

With that, let's get down to business and inspect this *really* complicated example:

Combat Sport / Fitness Sport

Combat and fitness sports are generally the most difficult to understand in regards to volume landmarks manipulation. Due to the multitude of components, it's difficult to really lock down MRVs, MEVs, and MVs for each one. To the dismay of sport scientists and coaches, preparation for these sports is too often characterized by audacious and blatant use of the blender effect, otherwise known as doing a whole bunch of everything at random. But, though it may seem daunting, comprehension of our earlier team sports example means you're well prepared for this next one.

Let's quickly revisit our MMA example. We've already established that there is *a lot* going on there, but let's really flesh it out. The components of MMA generally include:

- Strength
- Conditioning
- Flexibility
- Wrestling/Judo skills
- Wrestling/Judo tactics for MMA
- BJJ skills
- BJJ tactics for MMA
- Muay Thai skills
- Muay Thai tactics for MMA
- MMA specific skills
- MMA tactics

Where to even begin!? Don't worry, the good news here is that our approach will follow a very similar structure to that of the team sports example above. For MMA, we will have those same general and specific preparatory phases, with similar goals, but, instead of an in-season phase, we will have a fight camp phase, very similar to the peaking phase from the powerlifting example.

Our general prep phase will feature the same general outcomes, as previously described in our team sports example. Here again, we will see the highest total training volumes for the whole competitive cycle. This general prep phase volume allotment, or total training MRV, will consist of MEVs for strength, conditioning, flexibility, core, and all skill categories. We can see here a *major* limitation to our MRV, as we need to somehow achieve overloading training from a number of different sources. Without a doubt, recovery and lifestyle factors must be on point in order to effectively cram in that much training. All tactics will remain at MV at this time, which can be achieved through drilling, light sparring, video, and chalk talk.

The outcomes of the specific prep phase will likewise largely overlap with our team sports example, with one difference being no direct SAC work, as running in MMA is limited enough not to warrant its own attention. Rather, this movement speed enhancement will become an inherent part of the development of skills and tactics. This means that our athlete will be pursuing maximal strength and power through strength training and anaerobic endurance in conditioning, and we will see a marked switch from skill acquisition to development of those skills into MMA-specific tactics that comprise the sport. The switch to tactics also produces an interesting effect, in that, tactics can contribute to provide the MEV for conditioning, cover the MVs for flexibility and core training, *and* cover the MVs for all relevant sport skills.

So, just as before, our MRV and MEV for the specific prep phase are both reduced, as a result of the increase in training intensity. And this makes sense, as sparring with another human is usually harder than punching a bag. Likewise, sparring can keep your skills sharp and actually improve conditioning. No surprise, then, that a big chunk of the MRV for the specific prep phase will be filled by tactics like full contact sparring, drilling, plus video and chalk talk, a moderate chunk with strength training, and smaller parts conditioning and individualized skill refinement.

Things get even more exciting in the fight camp phase! The fight camp can be variable in length, depending on coaching availability, fight scheduling, and personal preferences, but the outcome goals are generally the same, regardless of the timeline. Here, our fighter is seeking maximal strength and power from their strength training, power endurance from their conditioning, and an individualized game plan specific to their upcoming fight. It should hence come as no surprise that tactics will consume the majority of training resources during this phase. But, as the amount of MMA sparring increases, so too does the wear and tear. As a result, the total training volume for the fight camp phase is reduced in both MEV and MRV. It's noteworthy here that the tactics, like sparring, in this phase will be specific MMA tactics for the upcoming fight. What's interesting is that this type of sparring can provide the MEV for the conditioning component, ie power endurance, as well as the MVs for all relevant sport skills and tactics previously trained. Essentially, what is needed are MEVs for strength/power training and MMA tactics, which cover the MEV for conditioning as well as MVs for all skills, tactics, and flexibility. It's worth mentioning, however, that there's only so much sparring one can actually do. Sparring does help cover a number of different bases, but the total training volume and MRV must consequently come down.

As mentioned in the powerlifting example, typically, the fight camp also includes a tapering period prior to competition. Roughly 1-2 weeks out from competition, the fighter will progressively begin reducing strength training and tactics to MV, in order to alleviate fatigue and maximize preparedness. How many times have you heard about fighters pulling out of fights due to injury, or complaining about camp related injuries after the fight was over? Some of that is just a normal and an inherent part of the process, and it happens, but you have to wonder how much of that is really from mismanagement of training resources.

So what about something like fitness sport? Can we apply these same ideas? Unfortunately, the answer is not so simple as yes or no. Of all the sports and activities we can discuss, fitness sport probably has the greatest degree of inter-individual variation in athlete needs analysis. This simply means that, even though a group of fitness sport athletes may all have the same goal, their programs could actually be highly different, though with some common themes. Thus a one-size-fits-all approach will not work.

In some contexts, this has led to the unfortunate misunderstanding that periodization does not work for fitness sport. Although we can see why people may think that, and, if we limited our scope of periodization of fitness sport to the one used for other sports, like shotput throwing or bobsledding, they would be correct. Fortunately, such limitations on the application of periodization do not actually exist. The two underlying principles of periodization are that:

1. It's virtually impossible to effectively train for everything at the same time.
2. It's perfectly ok to emphasize some things at certain times, while deemphasizing others.

Periodizing for fitness sport should operate on these same principles, but the volume landmarks of its various components require a drastically different approach from one athlete to the next.

That being the case, how can we apply the volume landmarks to fitness sport? First, we must tackle the idea of training everything at the same time. Doing so implies hitting MEVs for *every fitness characteristic, every fitness skill, and every competition-style tactical application*. As we're well aware, doing so isn't feasible, and renders measurable progress in any one of these areas equally unattainable. Attempting this would result in athletes quickly exceeding their MRVs for specific fitness skills and characteristics, and, consequently, their total system MRVs as well. In absence of direct research in this area, we speculate that even trying to specifically train at MVs for all the aforementioned components may be enough to potentially exceed total system MRV. Just think about how many possible events there are. Even one repetition or 5 seconds of exertion at *all* of them would be multiples the training volume anyone could handle. Something, though not everything, will have to give.

Even if the athlete was actually able to specifically train at MVs for everything, we run into another problem. In this hypothetical scenario, we are only doing maintenance in lieu of making any progress! By our previously established definitions, we need some MEVs to be progressing. This means that some fitness components, skills, and tactics may only be kept at MV or even below, while those chosen for training at MEV must be strategic, affording the strategically-minded athlete an important advantage. Therefore the analysis of needs is a critical step in the development of both volume landmarks and general programming for fitness sport. More so than possibly any other sport, the volume landmarks for fitness sport must be representative of the athlete's true strengths and weaknesses.

First, let's establish that the individual needs analysis trumps any traditional progressions and phase potentiated models. Now we can explore if there are any common grounds or more general trends in volume landmark progressions over time. One sport we can actually model in preparing for fitness sport is the sport of Strongman. Strongman event training is far too brutal to overload consistently throughout the year, and thus a large chunk of their programs revolve around gaining size and strength, while maintaining or refining the technical aspects of the Strongman events. As competition draws near, there is a marked change where the emphasis on size and strength is reduced, and overloading the Strongman events increases. This pattern continues as they move into their final prep stages, and Strongman event training becomes the focus, while strength training moves into maintenance values.

Fitness sport will follow a similar, albeit not identical, pattern, of emphasis and de-emphasis throughout the training program. In general preparatory phases, MEVs for fitness characteristics and fitness skills will be trained, whereas tactics - think WODs, METCONs, and so on - will generally be trained closer to MVs. While this can certainly vary depending on individual needs, the common thread is training in the areas of fitness that need to be elevated the most, prioritizing the skills that need to be learned or improved upon, and using tactics to maintain event-specific conditioning and possibly MVs for other skills and characteristics. As competitions and qualifiers draw near, there will be a change in emphasis/de-emphasis, from building baseline fitness and skills earlier on, to withholding from applying those in competition-style fashion. For example, the athlete would now spend more time training skills specific to fitness sport, including ring muscle ups, weightlifting movements, wall balls and such, and doing competition-style practices like WODs and METCONS, and specific events like Fran, Murph, and so on. So, the skill and tactical components and specific fitness characteristics that need it would be trained through MAVs, while others just at MVs, or even just maintained through tactics. Other, less essential work, may be deemphasized down to MVs or maintained through tactics. Keep in mind that as the tactical component goes up, so too does the intensity, resulting in accumulation of fatigue. No surprise here that total system MRV starts to go down as competition-specific training goes up. And this makes sense, as there are only so many METCONS or Murphs one can do before breaking down.

Lastly, at some point, there will be an unusual transition, where instead of doing a true peaking/tapering phase for a single competition, the fitness sport athlete may find themselves in an 'in-season' type phase, where there are numerous qualifiers and regional competitions at which they need to perform well, all scheduled possibly mere weeks apart. Here, tactics will comprise the majority of training, and would be trained through MAV, while most other components will move down to MVs for specific training, or possibly just be maintained through tactics. Again, because there are so many components, and events can vary so much, relying solely on tactics for MVs could potentially backfire, in the event that some of those components never actually get trained or practiced. It's a high risk, high reward strategy, where the athlete is trying to do as much tactics training as possible, by way of reducing volume and fatigue from other sources. MAVs for tactics will largely be performed throughout this time, and may possibly be reduced to MVs for the purposes of a strategic taper into an important competition. Athletes and coaches should however be wary of the "risk" portion of this strategy, as there's nowhere to go but down after hitting a peak, so reducing tactics down to MVs would be advantageous in the short term, but potentially disadvantageous in the longer term especially if done too often.

As confirmed, fitness sport is going to be the most variable and most challenging in terms of managing volume landmarks. The model presented here is by no means 100% correct for every athlete, but is rather more of a generalized progression based on sound theory. More individualization is needed here than in possibly any other area of sport, resulting in what we fondly think of as sort of a jigsaw puzzle of volume landmarks. But through the constant balance of emphasis/de-emphasis and judicious improvements in some areas at the cost of temporarily pausing progress in others, we can transform mere practitioners into superb fitness beings.

Summary and Implications

By now, you can see that our volume landmarks discussion has some major implications for all of sport training, and is not just theoretical mumbo-jumbo. Let's review some critical takeaways before we call it a day.

Time, effort and recovery ability are finite resources. The idea of equivalent exchange is at play here, in that, in order to gain one thing, something else must be taken away. This is as true in anime (for those that caught the Fullmetal Alchemist reference) as in sport training. Too often, our instinct is to add more and more training, which, though it has its potential merits, also has some non-trivial detractions. The MRV landmark allows us to establish a practical and quantifiable upper limit to training volumes. Through its use, we can not only prevent unwanted overreaching, but also ensure that enough resources are being allocated to the recovery-adaptive processes. The MRV landmark also facilitates a training priority system, wherein we can emphasize the areas that matter the most in our program, and reduce or exclude those that matter the least. Additionally, the MRV landmark shows us how the upper limits of training can change under different conditions.

Equally important to knowing how much is too much, a lower boundary of dose is needed, to tell us how much is not enough to make progress, or, more accurately, how much is minimally needed to do so. The MEV landmark helps make a clearer distinction between favoring overload or fatigue management, in that we can now determine if our practices are too conservative, and hence failing to yield measurable progress. MEV also tells us how much training is needed under different conditions, and how to modify training accordingly. With our upper and lower bounds established, and our two-part definition of overload in hand, we've figured out our training sweetspot: the MAV.

MAV ensures that we start productively, but not overly aggressively. Starting right at the MRV would lead to burnout, overreaching, and too-frequent deloading between mesocycles. Starting and holding at the MEV would yield positive results, but would violate the progressive component of overload, leading to subpar gains in the long term, and impeding our adaptive potential.

The MV, though probably the least sexy volume landmark in our discussion, nevertheless also serves a critical role, in both its ability to guide our phase potentiate over time, and to guide the process by which we resensitize the body to training stimulus and promote long term gains. In fact, knowing how to manage MVs both directly and indirectly is how we can stack and summate gains in fitness over time. If we can reduce resources in one or more areas and not decondition, we can allocate additional resources to other areas, and make gains there. If we can identify training modalities that can hit MVs for multiple characteristics, like tactics training for example, we can greatly reduce resources to nonessential modalities, and thus spend more time training the ones we need most. The MV is also the critical component of many fatigue management strategies, like deloads, tapers, and active rests. The MV allows for a huge reduction in training fatigue but without the risk of adaptation decay.

Determining the MVs, MEVs, MAVs, and MRVs for a sport allows us to take our existing annual plans and now individualize them for any given phase, under any given condition, for any given athlete. It reveals levels of customization that we simply couldn't achieve before, in absence of proper terms and definitions. The volume landmarks are the link between the Specificity, Overload, Fatigue Management, Variation, and Phase Potentiation principles that allow us to effectively periodize sport training over time, making it that much more effective, and our performances that much more exceptional.

Following the Sources and Further Reading section at the conclusion of this text, we have also included some worksheet template examples for determining your MRV, MEV, and MV. We hope you find these useful.

Closing Thoughts

We sincerely hope you enjoyed our book. The volume landmarks may seem like common sense or something that trainees and trainers either knowingly or unknowingly may already do, but are also concepts many of us have taken for granted. In the sport and exercise sciences, we don't always have research and concrete findings on these topics. We would like to think that folks generally use the best logic and resources available to make sound choices, but this can be difficult in our information-saturated day and age. For instance, the research on dose-response relationships is out there and available, but, for many, it's too mathy or intangible to bother with. Making intelligent training easier to conceptualize and practice is what drove us to outline the concepts that comprise this book. Our goal herein was to develop an evidence-based and practical way of conveying these ideas to sport scientists, coaches, and athletes alike.

When we first sought out to formalize these ideas into evidence-based intellectual concepts, we really didn't realize how deep the MRV rabbit hole went. Being passionate in the pursuit of all things performance enhancement, we saw bad things happening to good athletes and coaches, and wanted to grasp the reasons and solutions at play. What we stumbled upon was not just how to get the most jacked, or have the best abs, though that's part of it. But what this book really addresses is the underlying mechanisms of how to individually periodize for sport. When we finally had this epiphany, and realized the scope of the discussion, we could hardly stop talking about it. It is our hope that you expand and improve upon these ideas, through scientific inquiry or hands-on practice, or, ideally both.

Now, are you ready to train?

- Mike Israetel and James Hoffmann

Did you enjoy this book? Want to keep the discussion going? Join RP+ to interact with the authors in our weekly interactive webinar! Membership includes access to:

- Exclusive weekly videos and blog posts
- Courses designed by PhDs and experts in the field
- Amazing recipes
- Our huge forum with dedicated staff to help answer your questions

And much more!

For more information on RP+ check out Renaissance Periodization Plus!

Sources and Further Reading

Foundational Texts

Principles and Practice of Resistance Training

Tapering and Peaking for Optimal Performance

Periodization: Theory and Methodology of Training

Science and Development of Muscle Hypertrophy

Science and Practice of Strength Training

Overload

Scientific Principles of Strength Training

Fundamentals of Resistance Training: Progression and Exercise Prescription

Dose-Response Relationships

Quantitative Analysis of Single vs Multiple Set Programs in Resistance Training

Dose-Response Relationship Between Weekly Resistance Training Volume and Increases in Muscle Mass: A Systematic Review and Meta-Analysis

The Dose-Response Relationships Between Resistance Training Volume and Muscle Hypertrophy: Are There Really Still Any Doubts?

A Meta-Analysis to Determine the Dose Response for Strength Development

Applications of the Dose-Response for Muscular Strength Development: A Review of Meta-Analytic Efficacy and Reliability for Designing Training Prescription

The Effect of Weekly Set Volume on Strength Gain: A Meta-Analysis

Maximizing Strength Development in Athletes: A Meta-Analysis to Determine the Dose-Response Relationship

Single Vs Multiple Sets of Resistance Exercise for Muscle Hypertrophy: A Meta-Analysis

The Role of Resistance Exercise Intensity on Muscle Fibre Adaptations

Is There a Minimum Intensity Threshold for Resistance Training Induced Hypertrophic Adaptations?

Muscular Adaptations in Low Vs High Load Resistance Training: A Meta-Analysis

Fatigue and Fatigue Management

Exercise and Fatigue

Overtraining Syndrome in the Athlete: Current Clinical Practice

Unraveling the Neurophysiology of Muscle Fatigue

Muscle Fatigue: What, Why and How it Influences Muscle Function

Resistance Exercise Overtraining and Overreaching. Neuroendocrine Responses

Mechanisms of Muscle Fatigue in Intense Exercise

Monitoring Training Load to Understand Fatigue in Athletes

Interactive Processes Link the Multiple Symptoms of Fatigue in Sport Competition

Physiological and Psychological Fatigue in Extreme Conditions: Overtraining and Elite Athletes

Fatigue Management in the Preparation of Olympic Athletes

Fatigue During High-Intensity Intermittent Exercise: Application to Bodybuilding

Volume Landmarks and Periodization

- Block Periodization Vs Traditional Training Theory: A Review

New Horizons for the Methodology and Physiology of Training Periodization

Periodization Paradigms in the 21st Century: Evidence-led or Tradition-Driven?

Adaptive Decay and Deconditioning

Muscular Characteristics of Detraining in Humans

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

The Development, Retention, and Decay Rates of Strength and Power in Elite Rugby Union, Rugby League and American Football: A Systematic Review

Individualization and Individual Response

Individual Differences in Response to Regular Physical Activity

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

Genetic Influences in Sport and Physical Performance

Understanding the Individual Responsiveness to Resistance Training Program Periodization

Volume Landmarks and Nutrition

The Renaissance Diet

Renaissance Woman

Athlete Name: ______________________________
Sport or Activity: ______________________________
Training Age: ______________________________

Example of Volume Landmarks Tracking in Bodybuilding:

RP	Sets per week			Adjusted for Hypercaloric			Adjusted for Hypocaloric		
	MV	MEV	MRV	MV	MEV	MRV	MV	MEV	MRV
Vertical Pushing									
Horizontal Pushing									
Vertical Pulling									
Horizontal Pulling									
Deltoids									
Biceps									
Triceps									
Quads									
Hams									
Glutes									
Calves									
Trunk									

Example of Volume Landmarks Tracking in Powerlifting or Strength Training:

RP	Sets per week			Adjusted for Hypercaloric			Adjusted for Hypocaloric		
	MV	MEV	MRV	MV	MEV	MRV	MV	MEV	MRV
Bench									
Bench Assistance									
Squat									
Squat Assistance									
Deadlift									
Deadlift Assistance									
Accessory Work									

Athlete Name: ______________________________

Sport or Activity: ______________________________

Training Age: ______________________________

Example of Volume Landmarks Tracking in Sport Training:

	Sets / Efforts per week			Adjusted for Hypercaloric			Adjusted for Hypocaloric		
	MV	MEV	MRV	MV	MEV	MRV	MV	MEV	MRV
Weightlifting Movements									
Sprinting									
Plyometrics									
Upper Strength									
Lower Strength									
Technique (minutes)									
Sport Practice (minutes)									