

the **CrossFit** JOURNAL ARTICLES

Principles of Physiologic Conditioning

Tony Leyland

Athletes, coaches, and trainers familiar with CrossFit know that it works. However, I find that some are nonetheless hungry for more explanations of why it works.

The term “physiologic conditioning” refers to a planned program of exercise directed toward improving the functional capacity of a particular bodily system. There are four basic principles of physiologic conditioning that trainers and athletes must take into account:

- overload
- specificity
- reversibility
- individual differences

Although this model has existed in the athletic community for decades, I believe that it helps us understand some of the reasons behind the efficacy of CrossFit programming. And, furthermore, because CrossFit is such an effective example of the principles in action, it functions as a test—and confirmation—of the model’s value.

Overload: Adapting to the amount of training

The one thing that is totally consistent in the research literature is that if you work the body harder than it is used to, it will adapt and improve in that area. You simply have to stress the body to realize any fitness gains. The overload principle is complex isn’t it? It must be, if people actually believe sitting on a recumbent bike spinning their legs in a circle while reading *People*

magazine is going to provide effective overload. I have a sense that we didn’t evolve gathering food or hunting animals while leaning on a backrest. You might as well just think of “recumbent”—or any other word that suggests comfort and ease—as a synonym for “ineffective.”

However, the simple concept of overload, by itself, does not help you to determine the best program. For people accustomed only to sedentary effort, pretty much any exercise, no matter how moderate, is going to overload them and produce results. Mark Rippetoe addressed this point in some detail in his article “Training Advancement and Adaptation” (*CFJ* #53, January 2007), where he discussed the fact that gains will come slowly for good athletes with years of training experience because, simply put, they are already approaching full realization of their genetic potential and it is therefore difficult to “overload” them in an effective and progressive manner. Training programs for intermediate and advanced athletes must take this into account.

Physical training overload can be accomplished by increasing any (or a combination) of the following three parameters: frequency, intensity, or duration. Obviously we can simultaneously increase more than one of these parameters, but we must be careful not to overtrain by indiscriminately increasing all three at once early in the program. Someone starting in CrossFit would probably not train on the 3-days-on, 1-off cycle and would have to scale intensity downwards. As they progress and establish consistency, frequency and duration tend to stabilize (for reasons having to do with both the realities of scheduling and the nature of high-intensity—i.e., non-

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sustainable—exercise), but the intensity will continue to increase.

Coach Glassman has repeatedly seen improvement over a ten-year period with athletes who are dedicated to CrossFit training and proper nutrition. In order to ensure this continued improvement in physiologic capacity during training, the relative degree of overload must keep pace with the adaptive changes that occur both in physiology and performance. Before long, you will not realize any further training effect if you maintain the same frequency, intensity, and duration of work. The observation that athletes reach training plateaus quite quickly and often struggle to attain further fitness gains led to the development of formally periodized training programs in the late 1950s.

Periodization, in the athletic training sense, is an organized approach to training that involves progressive cycling of various aspects of a training program over specific time periods. The concept of periodization comes from Hans Selye's model, known as the General Adaptation Syndrome (GAS),

for describing biological responses to stress. If you ever took Psychology 101 or learned anything about “psychological stress,” you probably came across GAS. What is less common knowledge is that Selye's work on the body's response to positive and negative stressors (exercise, in this case) is applicable to athletic training programs and has in fact been used by the athletic community in the development of periodized programs since the late 1950s. (A recent major contribution to that literature, of course, is Mark Rippetoe and Lon Kilgore's recent book [Practical Programming for Strength Training](#).)

Periodization and the research on its efficacy is most widely used in resistance program design to provide an effective overload and avoid overtraining. Periodization systematically cycles the focus—the frequency, duration, and intensity—of training and incorporates lower-workload or “transition” phases. These “transition” phases are essential rest periods designed to allow tissues to repair and fuel substrates to be restored, etc. If you rest longer than you need to, you will not improve fitness at the rate you could improve, but

inadequate rest can cause injuries. This is the real skill in program design, to be able to get athletes to work hard and improve physical fitness levels at an optimal rate without causing overuse injuries or systemic overtraining (negative stress).

Russian physiologist Leo Matveyev and Czech sport scientist and Olympic coach Tudor Bompa are regarded as the fathers of modern periodization. Bompa's training phases last between four and eight weeks, after which the number of reps and sets and the selection of exercises are altered. CrossFit does similar, though its “period” is much shorter—it varies exercise, energy systems, loads, and volume day to day. And although this level of “periodization” has yet to be well studied, we do know it works well.

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So, while CrossFit is not a periodized program in the traditional sense, I believe that it contains many similar elements. CrossFit challenges the body to adapt to constantly varied movements, intensities, and durations. This is why the literature on periodized programs shows periodized programs to be

better than fixed ones; they challenge the body's adaptive powers better. CrossFit takes this challenge even further by constantly varying the form of overload as well.

CrossFit's [“World-Class Fitness in 100 Words”](#) gives the following prescription for variety:

“...mix these elements [CrossFit exercises] in as many combinations and patterns as creativity will allow. Routine is the enemy.”

“Routine is the enemy” is essentially a restatement of the overload principle. Routine is to be avoided for three main reasons. First, as discussed above, research has consistently shown that athletes quickly reach plateaus in training. The second reason to avoid routine is to make you work on your weaknesses. You can easily avoid your weaknesses when sticking to routines. How many people come to CrossFit after doing lots of single-mode aerobic work and some high-rep low-weight resistance training and then say “Hey, I thought I was fit...but I just found out I wasn't.” Well their aerobic conditioning (in their favorite modality) and muscular endurance may have been good, but those are only two out of

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ten components of fitness! You can't hide from your weaknesses when following CrossFit programming.

The third reason routine is the enemy is that sticking to a routine is boring (for most of us anyway). I am not a psychologist, but it is important not to forget the motivational aspect of CrossFit. Variety maintains interest (and therefore effort) better than remaining on a fixed program. Although traditional periodized programs keep things changing and interesting, the variety is on a much smaller scale. I come from a competitive sports background, and I am accustomed to varied stimuli, constant change, and an element of unpredictability.

The incredible variety of CrossFit programming is sometimes described as "random." But is it really random? No. With a truly random program you could theoretically get three CrossFit Totals in a row, or three 10K runs in a row. But research and coaching experience shows variety in a program is crucial, and mixing the program up so much that it almost looks random may be the best way to train and to challenge your adaptive ability.

Specificity: Adapting to the type of training

Specific exercise elicits specific adaptations. Elite specialists can be spectacular in their one event. For example, running 26 miles all at sub-five-minute-mile pace is mind-boggling, but you will never see an athlete who can run a 2.5-hour marathon and can also deadlift 700 pounds. So specialization does come at a cost. Give that elite marathon runner a 95-pound thruster workout and things could get ugly. If you truly want to be impressed you will find CrossFit athletes with 500-pound deadlifts, 3-minute Frans, sub 40-minute 10K runs, 4.5-second 40-yard sprints, and greater-than-bodyweight clean and jerks. Now that is impressive across the entire spectrum of human performance.

There is a real price to pay for being a specialist at every level, and especially at the elite level of most sports. In

his book *Lance Armstrong's War*, Daniel Coyle explains that Tour de France cyclists don't like to walk. He even states that they will get out of breath walking up stairs! Their white blood cell counts tend to be 30 percent below average and their bodies become vulnerable to colds and disease. They push elevator buttons with their elbows to help avoid germs. And they are skinny—very skinny. Here is a quote from Coyle's book.

"Tour riders are skinny, far skinnier in person than they look on television or in photos. Their upper arms are so slender that you could almost wrap your thumb and index finger around them. The wife of one American rider says she can tell the Tour [Tour de France] is drawing near when she can start to see her husband's internal organs—his liver, his kidneys—beneath his skin."

This is an incredible indictment of specialization. Sure these athletes have amazing cardiorespiratory fitness (VO_2 max) on a bike, but make them run and they burn out way faster than you would imagine. Don't even think about having them do 150 wall ball shots. Obviously the systemic components of their VO_2 max (lungs, heart, and major arteries) are going to be important for running distance. So they are able to train and adapt more quickly than sedentary people to other modes of long-distance cardiovascular work (Lance

Armstrong ran a marathon in just under three hours after some training). But the fact remains that specialization is for insects... whether you like that fact or not. (See my article in [CFJ #52](#) if you want to review VO_2 max and why it is mode-specific).

The specificity principle also explains why some athletes adapt quite quickly to CrossFit programming. A good rugby player, for example, would have good upper- and lower-body endurance, strength,

and power and good speed to get around the field. And the interval nature of the high-intensity sprint work in the sport would have ensured a decent VO_2 max. Rugby players also have to coordinate their movements into specific skilled movement patterns. So, because of the

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variety of skills and fitness components required in the sport, a good rugby player starting CrossFit will likely make faster progress than most other athletes.

Focusing just on CrossFit training will provide the most balanced improvement in all components of fitness, but you have to do what you love if you want to maintain your skill and capacity at that. (And, remember, CrossFit's recipe for world-class fitness includes the following prescription: "Regularly learn and play new sports.") Just be careful of specializing and be aware of its costs. Personally I have to be playing some sport, but CrossFit allows me to work on components of fitness not stressed by my sport in a really fun and effective way.

Reversibility: Adapting to a reduction in training

The reversibility principle is also known as the "use-it-or-lose-it" principle. Once you reach a desirable level of physical fitness, a regular program of activity must be maintained to prevent deconditioning or a loss in functional capacity. I find, however, that mere maintenance isn't much of a CrossFit concept! CrossFit athletes are always looking to improve their performance. The use-it-or-lose-it principle is pretty obvious, so why do many people "fall off the bandwagon" after starting an exercise program? The underlying answer to that probably involves one or more of the following reasons:

- They worked out at such low intensity (like reading a magazine while they move their legs in a circle) that they just didn't see enough improvement to warrant continuing.
- They had some fitness gains but they reached a plateau fairly quickly and they stopped seeing improvement.
- They injured themselves by overdoing it and became demoralized. (A visit by Pukie at every workout will have this effect as well.)
- They got bored with their program.

Sure everyone can say, "I got too busy" or "I couldn't find the time" (this is the most common reason people give for not exercising). But if they were realizing great fitness gains and having a lot of fun doing it, they'd stay. So I am sticking with that list above as the root cause of the problem.

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One size does not fit all.

From that list, though, CrossFitters probably only need to worry about the possibility of overdoing it. I am just saying what we all already know: that workouts have to be appropriately scaled. This is very different from the mindset that exercise should be "comfortable" or that the key elements of the program should be compromised. As newer CrossFitters progress, they have to keep pushing

the boundaries, as required by the overload principle. Intensity is required, but it is also individually variable.

Individual differences: Limits on adaptability

We cannot expect all individuals to train at the same work rate and to respond to a given training dosage in precisely the same manner. Most people realize that there are limits to the adaptation they can achieve. Look at the records boards on any CrossFit gym. You'll likely find some names that recur frequently, but the top performer is probably not the same across the board, on all the benchmarks.

Some athletes quickly adapt to aerobic training and can achieve a very high level of aerobic performance. However, for these athletes strength training is often harder and strength gains and ultimate strength limits are far less impressive. And vice versa for anaerobic monsters, who tend to abhor anything that involves the aerobic pathway. In addition to genetic predisposition, an athlete's age and sex are also relevant factors. As a 51-year-old, I can't achieve the strength gains I could back when I was 25.

The bottom line of the individual differences principle is that training benefits are optimized when programs are planned to meet the individual needs and capacities of the participants. One size does not fit all. Group

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workouts are a lot of fun and a great way to train a number of athletes at once. But be self-critical. If you need additional flexibility work (like me), do it. If you need to improve your lifting, or your gymnastics skill, or your running performance, do some extra practice or training in that area outside the WOD. Be creative and design some personal workouts that target your specific weaknesses.

If you are unsure about personalizing aspects of your training outside of the WOD, look at what you excel at. Do you do better at strength workouts like maximum deadlifts, presses, etc? Are you a maximal burst power athlete with good Olympic lifts and 20-yard sprints? Or are you better at more sustained high-power outputs, with low times on “Grace” or “Fran,” or at cardiovascular endurance tasks such as 5K runs? Maybe you excel on bodyweight stamina workouts such as “Barbara” or “Angie.” Where do you have to scale things the most? The answers to these questions will direct you toward the other things you need to pay attention to. The good news is that you can improve on those weaknesses. Although there are genetic, anthropometric, age, and sex limits on how, and how much, you will adapt, tackling your weaknesses head-on and making sure that your training adheres to the four basic principles of physiologic conditioning will put you well on your way to elite fitness.



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