

Use It or Lose It

Movement is sleep's opposite partner, the high side of a wave that fuels our health but whose value we underappreciate. Too little movement, like too little sleep, weakens and diminishes us in all dimensions of our lives. Intense movement, balanced by deep recovery, dramatically increases our capacity, not just physically but also mentally and emotionally.

"How much you move," explains Eric Heiden, an orthopedic surgeon and five-time Olympic speed-skating champion, "affects your strength, your power, your balance, how you look, how you think, how well you withstand the high winds and rain showers of life and how long you will stand. Everyone needs concentrated doses of several kinds of movement to remain fully functional."

Because our behaviors are so interdependent, the failure to exercise eventually prompts a vicious cycle. The more sedentary we become, the more we begin to avoid exercise. When we move less, we burn fewer calories, gain weight, lose strength, endurance and flexibility, and find it increasingly difficult and uncomfortable to move.

When we first met Steve Wanner, a young partner at Ernst & Young, he was working twelve- to fourteen-hour days, felt perpetually exhausted, slept poorly, and made no time to exercise. While there is no evidence that being more fit reduces the need for sleep—elite performers typically get more sleep than average—there is considerable evidence that regular exercise makes it easier to get to sleep and leads to a higher quality of rest.

One of the first changes Wanner instituted was to go to sleep earlier and wake up in time to take an early-morning run before his wife and four children woke up. Running rejuvenated him, not just because it made him feel better physically but also because it made him feel better about himself. When Wanner got to work, he felt more pos-

itive and alert, and when he arrived home, he felt less tired and more able to engage with his family. Success at building a workout ritual eventually emboldened him to launch a number of other positive rituals around the way he organized his day. Whenever he did fall out of his routines during the busiest work periods, he felt the consequences on his mood and his productivity almost immediately.

Simon Ashby, a vice president at Sony Europe, also launched a series of changes in his life by adding an exercise routine. "I was always a halfhearted runner," he told us. "I wanted to ritualize running more effectively. I don't have time to run in the early morning and I'm too tired in the evening, so it had to be at lunchtime. As I worked through this ritual, I realized there was a powerful story I told myself that was getting in my way, which went all the way back to high school. I hated changing in the dark, dirty locker room, and now I found myself imagining a moment when my colleagues would see me walking down the halls in my running kit and start laughing at me. But I decided to give it a go anyway, and instead of laughing at me, people did quite the opposite. My running gave *them* permission to exercise over lunch. After a quick jog over the motorway, I would find myself in beautiful countryside. It was relaxing and inspiring, and I came back feeling great and fully fueled for the afternoon ahead."

MOVE AND THRIVE

What makes exercise uniquely powerful is that it's simultaneously a way to build capacity physically and to reliably renew energy mentally and emotionally. The impact can also be experienced quickly and it is easily measurable.

In a study of 15,000 same-sex twins conducted in Finland, for example, the sibling who exercised regularly had a 55 percent lower risk of early death compared to the twin who did not. Nor was the exercise bar set very high. On average, the physically active twins exercised at moderate intensity—a brisk walking pace an average of six times a month, for thirty minutes at a time. In short, they invested just three hours a month on exercise. In another study, older adults who exercised just once a week were 40 percent less likely to die over the twelve

years of the study than those who did nothing at all. Frequency of exercise can make an even more significant difference. In a third study, men who exercised at least five times a week were one-seventh as likely to get heart disease as those who exercised just once a week. "Regular exercise," a study in *The Journal of the American Medical Association* concluded, "acts like a vaccine on the immune system."

There is also broad and compelling evidence that fitness improves cognitive capacity and emotional well-being, two factors that powerfully influence performance and productivity. In a meta-analysis of some one hundred studies, a team of researchers in London concluded that "exercise improves mental health and well-being, reduces depression and anxiety and enhances cognitive functioning." The study also found that exercising regularly is more effective than doing so occasionally and that high-intensity exercise is better than low-intensity.

In a study aptly named SMILE (Standard Medical Intervention and Long-term Exercise) Duke researchers found that vigorous exercise for thirty to forty-five minutes per session three times a week was at least as effective as antidepressant drugs in reducing symptoms of depression. Scores of studies have shown that exercise also significantly reduces symptoms of anxiety. Regular exercise has also been shown to significantly slow shrinkage of the frontal cortex, where our capacity for conscious, purposeful thinking resides. This helps explain why regular exercisers in middle age have proven to be one-third as likely to get Alzheimer's disease as those who don't exercise at all.

Increasingly, the research suggests that we are best served by training both our cardiovascular capacity and our strength. In both cases, we get a high return from a relatively low investment of time. While nearly all of us require seven to eight hours of sleep a night to function optimally, we can thrive on only a fraction as much exercise. Agencies ranging from the American College of Sports Medicine to the American Heart Association suggest at least three and up to six days a week of moderate-intensity physical activity for twenty to forty-five minutes a day. Even that amount of time, most researchers now agree, can be split between two or three sessions over the course of a day, so long as each one is at least ten minutes long.

Modest as this seems, for the richness of rewards it provides, a remarkable percentage of us remain sedentary. In the two most recent government reports, a paltry 15 percent of U.S. citizens regularly engaged in vigorous activity for twenty minutes a day at least three times a week. Twenty-five percent of Americans are almost completely sedentary, while 60 percent are only sporadically active. The more educated and more affluent people are, the more they exercise, but not as dramatically as you might suspect. Fifteen percent of those with a high school degree are physically active, for example, but even among adults with an advanced degree, the number rises to only 25 percent. Overall, the World Health Organization has found that between 60 and 85 percent of adults worldwide, including both developing and developed nations, are inactive. Two million deaths every year can be attributed to a sedentary lifestyle.

THE HEART WAVE

Although nearly every system in our body operates rhythmically when it's healthy, most are part of our autonomic nervous system and we have little or no control over them. Digestion, body temperature, and hormone levels all oscillate on their own clocks, mostly outside our awareness unless something goes wrong. Our heart rate is one of the few rhythms we can intentionally influence.

The greater our cardiovascular capacity, the more efficiently we can move oxygen throughout our bodies. The best way to build cardiovascular capacity is to regularly make waves—exerting ourselves for periods of time to drive up our heart rates and then recovering back to a resting rate. In the process we increase our heart rate *range*. The greater our range, the more flexibly we can respond to varying kinds of physiological and emotional demands. As we get older, our maximum heart rate decreases and so, therefore, does our range.

That isn't good news. A study published in *The New England Journal of Medicine* found that heart rate range strongly predicts mortality. Men whose resting heart rate was high (75 or above) or whose heart rate remained unusually low during exercise (lower than 89 beats), were four times as likely to die as men with normal heart rate ranges.

The good news is that exercise expands our heart rate range and can also significantly slow its decline over time.

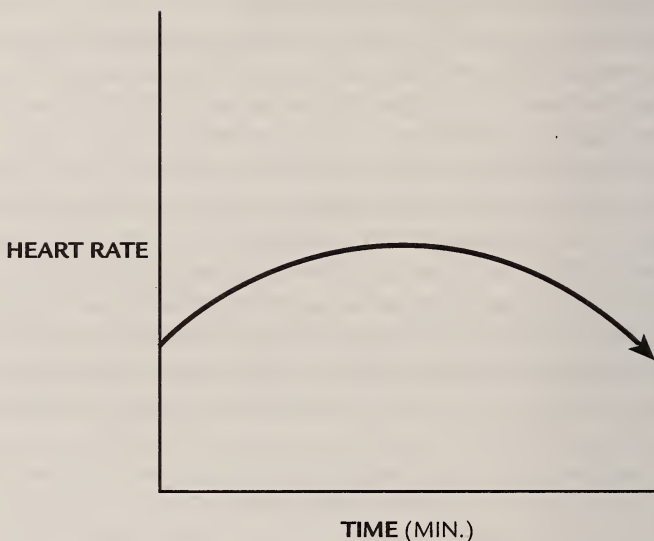
If moving flexibly between lower and higher heart rates contributes to our overall health and effectiveness, what does the ideal wave look like? In the absence of regular exercise, the heart's ability to pump efficiently drops approximately 30 percent between ages thirty and seventy—nearly 1 percent a year—and faster after that. Through steady-state aerobic exercise, we train endurance, which is a reflection of the ability to consume oxygen more efficiently. Typically, that requires raising our heart rate into a certain range and holding it there for twenty, thirty, or even forty-five minutes. Marathon runners can do so for two or three hours at a time. They become virtual exhaling machines, washing out large amounts of carbon dioxide with each breath.

Aerobic exercise is good not only for the heart and lungs but also for the brain. Give a lab mouse the opportunity to run as freely as it likes, and researchers have found that its brainpower improves. Push the mouse to run even harder than it would choose to run by itself, and its cognitive power increases even more. The same seems to be true for human beings. Taiwanese researchers have found that cardiovascular exercise actually prompts us to produce new brain cells. In one study at the University of Illinois, a group of students was asked to memorize a string of letters and then pick them out from a list flashed at them. Next, they were asked to do one of three things for thirty minutes: sit quietly, run on a treadmill, or lift weights—in all cases followed by a thirty-minute “cool down.” Then they were retested. The aerobic exercisers did best. In another study, the same proved true for brisk walkers compared to stretchers on before-and-after tests of cognition. While researchers aren't certain of the explanation they believe it may be that aerobic exercise increases blood flow to the brain.

INTERVAL TRAINING

Aerobic exercise creates a “long” wave by pushing our heart rate considerably above the range we maintain when we're sedentary—which most of us are the vast majority of the time. Creating a wave is vastly

Steady State Aerobic Training



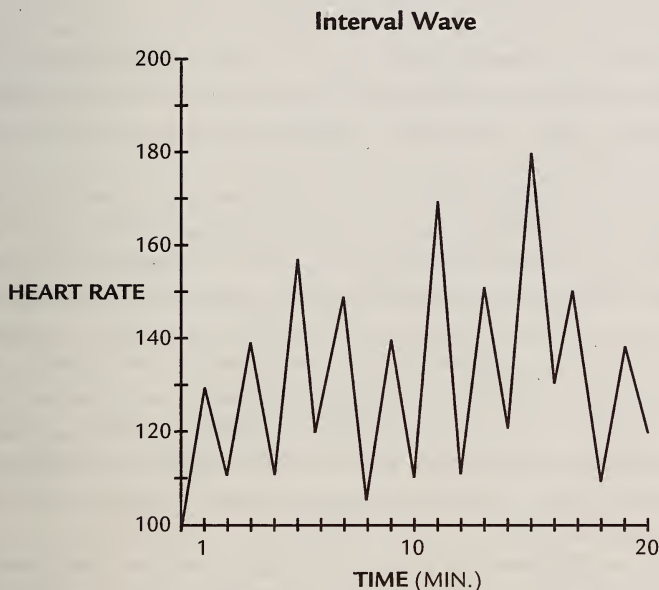
preferable to not moving and prompts a broad range of benefits. The aerobic wave is depicted in the diagram above.

In most aerobic activity, we move from one form of linear energy expenditure to another. The limit of steady-state aerobic exercise is that the body adapts relatively quickly to any level of continuous challenge. The consequence is that we cease building further cardiovascular capacity once we've reached a certain level of fitness.

Interval training operates on the premise that the value we derive from exercise has less to do with the time we invest in it than with the intensity of energy we expend for short periods of time, followed by full recovery. This training process is sometimes referred to as periodization, or the managing of work/rest ratios. It's the same principle that applies to increasing effectiveness in other disciplines, the way Ericsson's violinists did, by practicing at high intensity and focus for seventy-five to ninety minutes at a time and then taking a rest.

Interval training is *anaerobic*, meaning that it doesn't rely on oxygen but instead on lactic acid drawn from the muscles. Rather than continuous expenditure of energy, an "interval" typically lasts be-

tween thirty seconds and two minutes, during which you push considerably past your comfort zone. The wave is more spiky and looks like the diagram below.



The notion of maximizing physical performance by alternating periods of intense activity with rest dates back to ancient Greece, when an author named Flavius Philostratus wrote about it in *Gymnasticus*, essentially a training manual for Greek Olympic athletes. Russian sports scientists began systematically applying the precepts to their Olympic athletes in the 1960s, with extraordinary success, and today interval training is common among athletes all over the world.

During the interval, lactic acid builds up, pushing you toward oxygen debt and ultimately forcing you to stop and rest. Each time you can motivate yourself to push a little longer or harder, you're effectively setting the body's limit higher. That's because during recovery, we all experience a phenomenon known as "supercompensation." In response to the higher demand the body has just experienced, it adapts—in this case by building more capillaries. Over time the heart

becomes able to tolerate higher levels of lactic acid and therefore can pump more blood and oxygen to the rest of the body.

The effects of interval training can be extraordinary. In one study, subjects were asked to sprint for thirty seconds on a stationary bicycle and then pedal lightly for four minutes, in a series of intervals. After a total of just fifteen minutes of intense cycles—thirty intervals performed over two weeks—three-quarters of the subjects doubled the amount of time they could ride at a moderate level of intensity before exhaustion. More extraordinary still, the subjects had all been active and reasonably fit before the experiment.

Far more than steady-state aerobic exercise, interval training works both sides of the wave, extending our range at the top but also increasing the speed of our recovery back to a resting state. Fitness is simply a reflection of the speed of recovery. The fitter we are, the faster we recover. When we move too little—i.e., “undertrain”—we weaken, atrophy, and struggle to recover even from modest exertion. That doesn’t mean we should challenge ourselves at the highest level every day. Push too hard, too frequently, and the result will eventually be breakdown and burnout, or what athletes call “overtraining.” For that reason, interval training typically makes sense no more than twice a week.

In an experiment known as the Dallas Bed Rest and Training Study, researchers at Southwestern Medical School in Dallas recruited six college students to literally spend their summer in bed. The goal was to test the effect on their overall health, most notably their cardiovascular and pulmonary function. After just three weeks in bed, the subjects experienced a deterioration in cardiovascular fitness that was equivalent to twenty years of aging. It’s hard to imagine more vivid proof of the adage “Use it or lose it.”

Thirty years later, five of the six subjects were retested. Only two had continued to exercise with any regularity, and all had gained weight and body fat. Even so, the declines from thirty years of actually aging were less than those they had suffered during the original three weeks of bed rest. Immediately after being tested, the five men were put on an aerobic exercise program, which included regular walking, jogging, and cycling. In just six months, the declines they had suffered over the previous thirty years were completely reversed—extraordinary evidence that cardiovascular training has huge bene-

fits, even late in life. We lose fitness very rapidly when we're sedentary, but we can also gain it back if we're willing to make the effort.

RESISTANCE TRAINING

In recent years, the research has made it increasingly clear that strength training—or resistance training, as it's sometimes called—is at least as important as training for endurance. Just as we lose approximately 1 percent of our cardiovascular capacity per year from the age of thirty on in the absence of training, so we lose an average of one-half pound of lean muscle mass every year. When it comes to strength, we've underestimated the costs to our everyday capacity, perhaps because for so long we tended to associate weight lifting with vanity and outsize bodybuilders. For example, the Dallas Bed Rest and Training Study, which was first conducted in 1966, focused exclusively on loss in cardiovascular capacity and didn't even look at loss of muscular strength.

Strength is arguably more fundamental than endurance, simply because we require strength to move at all. Building greater strength increases everything from metabolism to coordination to flexibility to bone density to balance. The average ninety-year-old who doesn't weight train must contract his thigh muscles at maximum capacity just to get out of a car or stand up from a sitting position. The leading cause of death from injuries among people aged sixty-five or older in the United States is falls. A vast number of them are influenced by muscle weakness, declining coordination, and poor balance. Nearly one of every three people over age sixty-five suffers a fall annually. One-third of all women and one-sixth of all men suffer a hip fracture by the age of seventy. Between 18 and 33 percent of these patients die within a year of the fall, many from complications such as infection, blood clots, and pneumonia. As the baby boomer population continues to age, the number of falls, fractures, and deaths will likely increase dramatically.

But strength also serves us in our everyday lives. Because muscle burns calories so much more efficiently than fat, resistance training is an effective way to stay lean, even without losing weight, and also to fuel more sustainable high energy. We have one overall energy reser-

voir, and the more energy we expend physically just to accomplish everyday activities, the more fatigued we become, and the less energy we have available for everything else we do.

Surprisingly little investment is required to prevent loss of strength, even very late in life. In one of a series of studies of the elderly, Tufts University researcher Miriam Nelson and her colleagues put a hundred residents of a nursing home on a ten-week resistance training program. The residents worked out three days a week for forty-five minutes a session, with plenty of rest between sets. The youngest subject in the study was seventy-two, the oldest was ninety-eight, and subjects had a mean age of eighty-seven. Nearly all of them required walkers, canes, or wheelchairs to get around. Over ten weeks, they more than doubled their strength on average and improved their "gait velocity" by 12 percent and their stair-climbing power by nearly 30 percent. The lesson is clear: it's not too late to gain significant strength until it's literally too late.

Building strength is by its nature an interval exercise, meaning it's characterized by successive waves of energy expenditure and energy renewal. Even though lifting weights is so strenuous that it can't be done for longer than a couple of minutes without rest, almost no deaths have been attributed to it. By contrast, there have been a good number attributed to steady-state aerobic exercise—perhaps most famously that of running guru Jim Fixx at the age of fifty-two, directly following his daily run.

Strength training is an especially vivid example of how stress—and the attendant discomfort—is essential to our growth. As the Dallas Bed Rest and Training Study makes clear, if we fail to challenge our bodies regularly, they quickly atrophy. At the same time, when the stress we subject ourselves to is linear and continuous, damage is the inevitable outcome. The obstacle to increasing our capacity across all dimensions of our lives is not the stress caused by high demand but rather the absence of intermittent recovery. It's during renewal—not exertion—that growth occurs.

Above all, resistance training provides a vivid example of the value of intensity over volume. Arthur Jones was the inventor of Nautilus weight equipment and also a proponent of something he called "high-intensity training." The best way to build strength, he began arguing in the 1960s, is through workouts that are brief, intense, and relatively widely spaced. Jones suggested performing just one set of eight

to twelve repetitions for any given muscle group, and only one time a week, or at most twice. Each set of repetitions, he argued, should be done to the point of failure, meaning total fatigue of the muscle. In practical terms, that meant training sessions as short as thirty minutes. “SuperSlow” refers to an even shorter and more intense version of the original Jones protocol, in which practitioners lift and lower a weight to strengthen a specific muscle group at a very slow speed—ten seconds up and ten seconds down. An entire workout requires twenty minutes or less and can produce remarkable gains.

Although there is still some disagreement about the ideal number of sets to perform for each muscle group, the preponderance of scientific evidence suggests that a single set for each muscle produces results at least as good as multiple sets and with less chance of injury. There is virtually unanimous agreement that after intensely training a given muscle group, at least two days of rest (and up to seven) are required to ensure maximum repair and growth.

Among the small percentage of clients who were doing strength training regularly when we began working with them, almost none trained their muscles to complete exhaustion. That’s hardly surprising, even though most of them were aware that doing so is considered the best and most efficient way to build strength. It’s difficult and counterintuitive to push ourselves to the very limits of our capacity. Doing so is not just physically uncomfortable but also tends to prompt primitive survival fears.

In defining the ideal way to train, our point is not that we should all be lifting the greatest possible weight to the point of complete muscle failure, or running intervals at the highest possible heart rate. Rather, it’s to illustrate three principles that we believe are fundamental to sustainable high performance. The first is that we cannot expect growth or improvement in any dimension of our lives without intentionally and regularly challenging our current capacity. The second is that intense effort for short periods, followed by intentional rest and recovery, is more efficient, more satisfying, and ultimately more productive than moderate, continuous effort for longer periods of time. The third principle is that Aesop had it wrong in his classic fable about the tortoise and the hare. It isn’t the tortoise, slow and steady, that wins the race. Rather, it’s the hare, who balances intense bursts of energy with intermittent periods of recovery.

CHAPTER SEVEN ACTION STEPS

- Take a few moments to create an exercise log. (To download a template, go to www.theenergyproject.com/exerciselog.) Write down exactly what exercise you got during the past seven days, including walking, and how long you engaged in it. Experts say we need twenty to forty-five minutes of exercise three to six days a week, including two weight training sessions. How well are you doing?
- If you're struggling to find the time or the motivation to start an exercise routine, buy a pedometer and record the number of steps you take every day. Shoot for 10,000. Look for ways to increase your number of steps by taking the stairs, parking your car farther away from your office, taking a walk as a recovery break during the day, or even holding walking meetings with colleagues.
- At least once a week, do an interval workout. Buy a heart rate monitor to better gauge your efforts and push past your comfort zone for an interval of thirty seconds to a minute. Then take thirty seconds to a minute to allow your heart to recover to a comfortable resting rate. (For more information, go to www.theenergyproject.com/intervaltraining.)