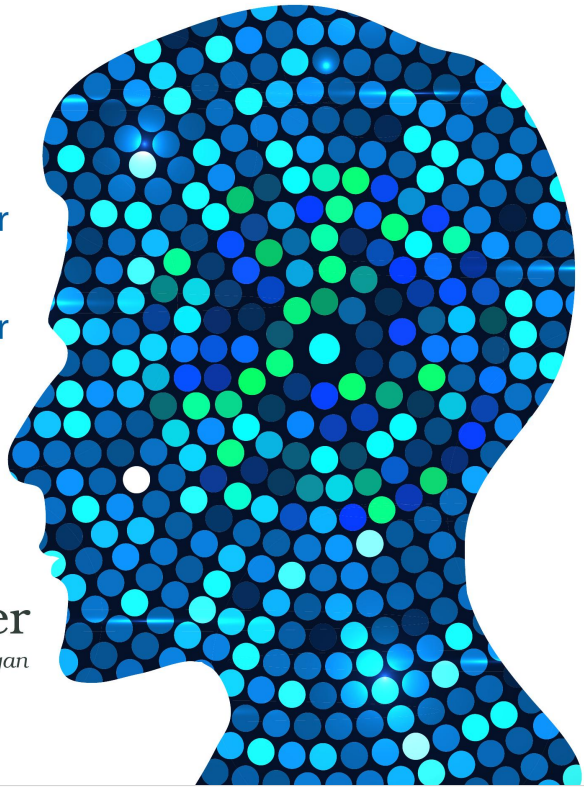
The Pragmatic Programmers

The Healthy Programmer

Second Edition



Refactor Your Fitness

Improve Your Mind

Joe Kutner

edited by Brian P. Hogan

This extract shows the online version of this title, and may contain features (such as hyperlinks and colors) that are not available in the print version.

For more information, or to purchase a paperback or ebook copy, please visit https://www.pragprog.com.

Copyright © The Pragmatic Programmers, LLC.

CHAPTER 2

Bootstrapping Your Health

One of the greatest mathematical puzzles to ever be solved was Fermat's last theorem. More than 300 years ago, Pierre de Fermat conjectured that there were no solutions to the following equation where `n` is greater than 2:

$$x^n + y^n = z^n$$

It was not until 1995 that Andrew Wiles succeeded in proving this conjecture, and the solution did not come easily. Wiles retreated to his attic and secretly struggled with problem after problem for eight years. The secrecy was necessary because of the popularity of the theorem. If word got out that Wiles was working on it, the distractions would never end.

When Wiles released his proof to the public, it re-energized the field of number theory. But the question most people wanted to ask him was not about mathematics. They wanted to know how he was able to remain creative and generate new ideas while working alone for such a long period of time. His answer was surprising.

"I would go for a walk," Wiles told Simon Singh in *Fermat's Enigma: The Epic Quest to Solve the World's Greatest Mathematical Problem [Sin98]*. "When I'm walking I find I can concentrate my mind on one very particular aspect of a problem, focusing on it completely. I'd always have a paper and pen ready, so if I had an idea I could sit down at a bench and start scribbling away."

Walking is a powerful activity. It can stimulate creative thinking and it's the best way to bootstrap your health. In fact, a few brisk strolls might be better for you than a single cardio session at the gym. In this chapter, you'll learn how walking periodically throughout the day can have a dramatic effect on your risk of developing many diseases and even on your mortality. We'll discuss how much to walk, how fast to walk, how often to walk, and even how

• Click HERE to purchase this book now. discuss

to walk. Ultimately, you'll learn why this simple form of exercise is one of the most important things you can do in your life. It certainly was for Andrew Wiles.

Wiles's effort during those eight years was monumental and his genius is unparalleled, but much of his thought process during that time was similar to the way in which programmers find solutions to problems in software. Both tasks require intense concentration and creativity. As it turns out, walking is a great way to promote this kind of brain function. Let's begin by discussing why this happens and how you can leverage it to become a more productive programmer.

Thinking on Your Feet

Go for a walk right now. Put this book down, walk around, and get your blood flowing. After five or ten minutes, come back and pick up where you left off. Your ability to think, remember, and concentrate will be enhanced as blood returns to your brain. In fact, a number of scientific studies have shown that this kind of exercise has a direct impact on your ability to learn new things.[1,2]

One of the most interesting places where you can find evidence of the link between exercise and learning is in school children. In the decade before the COVID-19 pandemic, schools around the world began implementing physical activity programs in an effort to curb childhood obesity, and many of them continue today. While these programs typically have successful health outcomes, a number of them also lead to academic improvements in the students who participate.

In the United Kingdom, a program called *The Daily Mile* enourages school children to walk or run for fifteen minutes every day. Over the last ten years, fourteen-thousand primary schools have adopted the program and as many as three million students have participated worldwide. That's given researchers a lot of data to analyze, and what they've found is revealing. In addition to improving health factors such as body mass index (BMI), studies have shown that the program has positive academic and learning outcomes. Students participating in the *The Daily Mile* typically experience short-term cognitive

1. *Joggin' the Noggin: Towards a Physiological Understanding of Exercise-Induced Cognitive Benefits [SDJ18]*
2. *Response of brain-derived neurotrophic factor to combining cognitive and physical exercise [MHYI18]*

improvements when tested within 20-minutes of exercising,[3] and improve math, reading, and writing skills after 12-months in the program.[4]

Schools around the world have started similar programs that show equally positive results.[5] In Kansas, Chile, and Korea, studies have found a postive correlation between physical activity and test scores.[6,7,8,9] All of this research factors in socioeconomic status when aggregating their results, which makes the numbers less biased. Other studies have found that adding physical activity to video games can improve cognitive function in the children who play them.[10] Results like these, along with the findings of many other studies, have revealed the profound link between physical fitness and academic achievement.[11]

That's all well and good for school children, but what does it mean to programmers? To begin with, programmers are perpetual students. In a field like technology, where change is constant, learning new concepts is a part of the job. A programmer's ability to absorb new technology is essential to staying relevant. Unfortunately, this often leads to a sedentary lifestyle as we hack on code late into the night or read the latest tech books. In some cases, it leads to consumption of too much caffeine.

As demonstrated by kids from Seoul to Santiago, one of the best ways to enhance your ability to learn is to get some exercise. There's also a wealth of laboratory evidence showing that our brains work better when our bodies are active. In particular, they become better at remembering new concepts, ideas, and patterns.

Here's a quick example. Try to memorize the following string of letters:

3. *A citizen science study of short physical activity breaks at school: improvements in cognition and wellbeing with self-paced activity [BCBG20]*
4. *Effectiveness and cost-effectiveness of The Daily Mile on childhood weight outcomes and wellbeing: a cluster randomised controlled trial [BPAM20]*
5. *Spark: The Revolutionary New Science of Exercise and the Brain [Rat08]*
6. *Physical activity and academic achievement across the curriculum: Results from a 3-year cluster-randomized trial [DHGH17]*
7. *A before-school physical activity intervention to improve cognitive parameters in children: The Active-Start study [GHFG20]*
8. *Effects of School-Based Physical Activity Programs on Health-Related Physical Fitness of Korean Adolescents: A Preliminary Study [LSYK21]*
9. *The relationship between physical fitness and academic achievement among adolescent in South Korea [Han18]*
10. *A Literature Review on the Effects of Exergames on Executive Function in Youth [EFTF23]*
11. *Exercise makes better mind: a data mining study on effect of physical activity on academic achievement of college students [DHCL23]*

I N T S M L I F H

Okay, you've got it. But how will you remember it tomorrow? The basic memory mechanism in your brain works by recruiting nerve cells, called neurons, which build new pathways that transmit electrochemical signals. To oversimplify things, the strength of these pathways determines how well you remember something. Over time, these pathways weaken and eventually fade away—especially if you don't make them strong in the first place. However, studies have shown that the walk you took a few minutes ago helped to strengthen the connections you made when memorizing those letters.

In one experiment, which was published in the journal *Medicine and Science in Sports and Exercise*, participants were asked to memorize some letters just like you did a moment ago. They were then asked to either sit quietly or run. The participants who ran were quicker and more accurate when they were tested than subjects who sat.[12] The benefits go beyond memorizing strings of letters, though. Similar studies have tested participants ability to recall a set of images,[13] recognize patterns, or remember other people's faces.[14]

The link between memory and exercise can most likely be explained by a class of protein called brain-derived neurotrophic factor (BDNF). This protein is responsible for strengthening the connections between neurons. As it turns out, exercise increases the production of BDNF. Shortly after the link between BDNF and memory was discovered (and a Nobel Prize was awarded), a researcher at the University of California, Irvine, devised an experiment to show that more BDNF is produced in the brains of mice that run on an exercise wheel than those that sit around.[15]

When you went for a walk earlier, you were encouraging your brain to produce BDNF. Now that you've returned to reading, those proteins are being put to work as your brain creates new neurons and synapses. The result is that you have a better chance of remembering things you learn shortly after exercising. This applies to programming as well as reading.

Try it out the next time you're working on something new. Go for a walk before you start researching the distributed-data-clustering software you've been wondering about. Or maybe stroll around the block after you've exhaustively debugged some tough legacy code. When it comes time to refactor it, you'll probably be quicker at remembering how it works.

12. *The Effect of Acute Aerobic and Resistance Exercise on Working Memory [PHFT09]*
13. *Acute Moderate Exercise Improves Mnemonic Discrimination in Young Adults [SHBO17]*
14. *Acute Exercise Effects Predict Training Change in Cognition and Connectivity [VWNC20]*
15. *Exercise: a behavioral intervention to enhance brain health and plasticity [CB02]*

> **Tip 1** Studies show that doing exercise before or after learning something new can help you remember it.

Can you still remember that string of letters? You probably can.

Unfortunately, most programmers' lifestyles tend to favor the activity levels of the sedentary mice in the study from UC Irvine, which means their brains are lacking BDNF and may not be reaching their learning potential. Programmers who make regular trips to the gym aren't doing much better if they sit idle for the remaining ten to fifteen hours each day. In either case, taking a few daily walking breaks can make a big difference. It can boost your brain power, but it's also the best way to stay healthy.

• Click HERE to purchase this book now. discuss