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# The Talent Code

Daniel Coyle

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## About the Book

In *The Talent Code*, award-winning journalist Daniel Coyle draws on cutting-edge research to reveal that, far from being some abstract mystical power fixed at birth, ability really can be created and nurtured.

In the process, he considers talent at work in venues as diverse as a music school in Dallas and a tennis academy near Moscow to demonstrate how the wiring of our brains can be transformed by the way we approach particular tasks. He explains what is really going on when apparently unremarkable people suddenly make a major leap forward. He reveals why some teaching methods are so much more effective than others. Above all, he shows how all of us can achieve our full potential if we set about training our brains in the right way.

## About the Author

Daniel Coyle is a two-time National Magazine Award finalist and a contributing editor to *Outside* magazine. He has written for the *New York Times* magazine and *Sports Illustrated*. His previous books include *The Times* bestseller *Lance Armstrong: Tour de Force*, which won Best Biography in the 2006 British Sports Book Awards. He first wrote about the idea of a talent code in a March 2007 article for *Play*. He lives in Alaska.

Also by Daniel Coyle:

*Hardball: A Season in the Projects*

*Waking Samuel*

*Lance Armstrong: Tour de Force*

For Jen

# the TALENT CODE

GREATNESS ISN'T BORN.  
IT'S GROWN.

**DANIEL COYLE**



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Then [David] took his staff in his hand, chose five smooth stones from the stream, put them in the pouch of his shepherd's bag and, with his sling in his hand, approached Goliath.

—1 Samuel 17:40



# Introduction

## THE GIRL WHO DID A MONTH'S WORTH OF PRACTICE IN SIX MINUTES

Every journey begins with questions, and here are three:

How does a penniless Russian tennis club with one indoor court create more top-twenty women players than the entire United States?

How does a humble storefront music school in Dallas, Texas, produce Jessica Simpson, Demi Lovato, and a succession of pop music phenoms?

How does a poor, scantily educated British family in a remote village turn out three world-class writers?

Talent hotbeds are mysterious places, and the most mysterious thing about them is that they bloom without warning. The first baseball players from the tiny island of the Dominican Republic arrived in the major leagues in the 1950s; they now account for one in nine big-league players. The first South Korean woman golfer won a Ladies Professional Golf Association (LPGA) tournament in 1998; now there are forty-five on the LPGA Tour, including eight of the top twenty money winners. In 1991 there was only one Chinese entry in the Van Cliburn piano competition; the most recent competition featured eight, a proportional leap reflected in top symphony orchestras around the world.

Media coverage tends to treat each hotbed as a singular phenomenon, but in truth they are all part of a larger, older pattern. Consider the composers of nineteenth-century Vienna, the writers of Shakespearean England, or the artists of the Italian Renaissance, during which the sleepy

city of Florence, population 70,000, suddenly produced an explosion of genius that has never been seen before or since. In each case, the identical questions echo: Where does this extraordinary talent come from? How does it grow?

The answer could begin with a remarkable piece of video showing a freckle-faced thirteen-year-old girl named Clarissa. Clarissa (not her real name) was part of a study by Australian music psychologists Gary McPherson and James Renwick that tracked her progress at the clarinet for several years. Officially, the video's title is *shorterclarissa3.mov*, but it should have been called *The Girl Who Did a Month's Worth of Practice in Six Minutes*.

On screen, Clarissa does not look particularly talented. She wears a blue hooded sweatshirt, gym shorts, and an expression of sleepy indifference. In fact, until the six minutes captured on the video, Clarissa had been classified as a musical mediocrity. According to McPherson's aptitude tests and the testimony of her teacher, her parents, and herself, Clarissa possessed no musical gifts. She lacked a good ear; her sense of rhythm was average, her motivation subpar. (In the study's written section, she marked "because I'm supposed to" as her strongest reason for practicing.) Nonetheless, Clarissa had become famous in music-science circles. Because on an average morning McPherson's camera captured this average kid doing something distinctly un-average. In five minutes and fifty-four seconds, she accelerated her learning speed by ten times, according to McPherson's calculations. What was more, she didn't even notice.

McPherson sets up the clip for us: It's morning, Clarissa's customary time for practice, a day after her weekly lesson. She is working on a new song entitled "Golden Wedding," a 1941 tune by jazz clarinetist Woody Herman. She's listened to the song a few times. She likes it. Now she's going to try to play it.

Clarissa draws a breath and plays two notes. Then she stops. She pulls the clarinet from her lips and stares at the paper. Her eyes narrow. She plays seven notes, the song's opening phrase. She misses the last note and immediately stops, fairly jerking the clarinet from her lips. She squints again at the music and sings the phrase softly. "Dah dah dum *dah*," she says.

She starts over and plays the riff from the beginning, making it a few notes farther into the song this time, missing the last note, backtracking, patching in the fix. The opening is beginning to snap together—the notes have verve and feeling. When she's finished with this phrase, she stops again for six long seconds, seeming to replay it in her mind, fingering the clarinet as she thinks. She leans forward, takes a breath, and starts again.

It sounds pretty bad. It's not music; it's a broken-up, fitful, slow-motion batch of notes riddled with stops and misses. Common sense would lead us to believe that Clarissa is failing. But in this case common sense would be dead wrong.

"This is amazing stuff," McPherson says. "Every time I watch this, I see new things, incredibly subtle, powerful things. This is how a professional musician would practice on Wednesday for a Saturday performance."

On screen Clarissa leans into the sheet music, puzzling out a G-sharp that she's never played before. She looks at her hand, then at the music, then at her hand again. She hums the riff. Clarissa's posture is tilted forward; she looks as though she is walking into a chilly wind; her sweetly freckled face tightens into a squint. She plays the phrase again and again. Each time she adds a layer of spirit, rhythm, swing.

"Look at that!" McPherson says. "She's got a blueprint in her mind she's constantly comparing herself to. She's working in phrases, complete thoughts. She's not ignoring errors, she's hearing them, fixing them. She's fitting small

parts into the whole, drawing the lens in and out all the time, scaffolding herself to a higher level.”

This is not ordinary practice. This is something else: a highly targeted, error-focused process. Something is growing, being built. The song begins to emerge, and with it, a new quality within Clarissa.

The video rolls on. After practicing “Golden Wedding,” Clarissa goes on to work on her next piece, “The Blue Danube.” But this time she plays it in one go, without stopping. Absent of jarring stops, the tune tumbles out in tuneful, recognizable form, albeit with the occasional squeak.

McPherson groans. “She just *plays* it, like she’s on a moving sidewalk,” he says. “It’s completely awful. She’s not thinking, not learning, not building, just wasting time. She goes from worse than normal to brilliant and then back again, and she has no idea she’s doing it.”

After a few moments McPherson can’t take it anymore. He rewinds to watch Clarissa practice “Golden Wedding” again. He wants to watch it for the same reason I do. This is not a picture of talent created by genes; it’s something far more interesting. It is six minutes of an average person entering a magically productive zone, one where more skill is created with each passing second.

“Good God,” McPherson says wistfully. “If somebody could bottle this, it’d be worth millions.”

This book is about a simple idea: Clarissa and the talent hotbeds are doing the same thing. They have tapped into a neurological mechanism in which certain patterns of targeted practice build skill. Without realizing it, they have entered a zone of accelerated learning that, while it can’t quite be bottled, can be accessed by those who know how. In short, they’ve cracked the talent code.

The talent code is built on revolutionary scientific discoveries involving a neural insulator called myelin,

which some neurologists now consider to be the holy grail of acquiring skill. Here's why. Every human skill, whether it's playing baseball or playing Bach, is created by chains of nerve fibers carrying a tiny electrical impulse—basically, a signal traveling through a circuit. Myelin's vital role is to wrap those nerve fibers the same way that rubber insulation wraps a copper wire, making the signal stronger and faster by preventing the electrical impulses from leaking out. When we fire our circuits in the right way—when we practice swinging that bat or playing that note—our myelin responds by wrapping layers of insulation around that neural circuit, each new layer adding a bit more skill and speed. The thicker the myelin gets, the better it insulates, and the faster and more accurate our movements and thoughts become.

Myelin is important for several reasons. It's universal: everyone can grow it, most swiftly during childhood but also throughout life. It's indiscriminate: its growth enables all manner of skills, mental and physical. It's imperceptible: we can't see it or feel it, and we can sense its increase only by its magical-seeming effects. Most of all, however, myelin is important because it provides us with a vivid new model for understanding skill. *Skill is a cellular insulation that wraps neural circuits and that grows in response to certain signals.* The more time and energy you put into the right kind of practice—the longer you stay in the Clarissa zone, firing the right signals through your circuits—the more skill you get, or, to put it a slightly different way, the more myelin you earn. All skill acquisitions, and therefore all talent hotbeds, operate on the same principles of action, no matter how different they may appear to us. As Dr. George Bartzokis, a UCLA neurologist and myelin researcher, put it, "All skills, all language, all music, all movements, are made of living circuits, and all circuits grow according to certain rules."

In the coming pages we'll see those rules in action by visiting the world's best soccer players, bank robbers, violinists, fighter pilots, artists, and skateboarders. We'll explore some surprising talent hotbeds that are succeeding for reasons that even their inhabitants cannot guess. We'll meet an assortment of scientists, coaches, teachers, and talent researchers who are discovering new tools for acquiring skill. Above all, we'll explore specific ways in which these tools can make a difference in maximizing the potential in our own lives and the lives of those around us.

The idea that all skills grow by the same cellular mechanism seems strange and surprising because the skills are so dazzlingly varied. But then again, all of this planet's variety is built from shared, adaptive mechanisms; evolution could have it no other way. Redwoods differ from roses but both grow through photosynthesis. Elephants differ from amoebas but both use the same cellular mechanism to convert food into energy. Tennis players, singers, and painters don't seem to have much in common but they all get better by gradually improving timing and speed and accuracy, by honing neural circuitry, by obeying the rules of the talent code—in short, by growing more myelin.

This book is divided into three parts—deep practice, ignition, and master coaching—which correspond to the three basic elements of the talent code. Each element is useful on its own, but their convergence is the key to creating skill. Remove one, and the process slows. Combine them, even for six minutes, and things begin to change.

1

# Deep Practice

# Chapter 1

## The Sweet Spot

*You will become clever through your mistakes.*  
—German proverb

### CHICKEN-WIRE HARVARDS

In December 2006 I began visiting tiny places that produce Everest-size amounts of talent.<sup>fn1</sup> My journey began at a ramshackle tennis court in Moscow, and over the next fourteen months it took me to a soccer field in São Paulo, Brazil, a vocal studio in Dallas, Texas, an inner-city school in San Jose, California, a run-down music academy in New York's Adirondacks, a baseball-mad island in the Caribbean, and a handful of other places so small, humble, and titanically accomplished that a friend dubbed them "the chicken-wire Harvards."

Undertaking the journey presented me with a few challenges, the first of which was to explain it to my wife and four young kids in as logical (read: un-harebrained) a way as possible. So I decided to frame it as a Great Expedition, sort of like those undertaken by nineteenth-century naturalists. I made straight-faced comparisons between my trip and Charles Darwin's voyage aboard the *Beagle*; I sagely expounded how small, isolated places magnify larger patterns and forces, sort of like petri dishes. These explanations seemed to work—at least for a moment.

"Daddy's going on a treasure hunt," I overheard my ten-year-old daughter Katie patiently explain to her younger



sisters. “You know, like at a birthday party.”

A treasure hunt, a birthday—actually that wasn’t too far off. The nine hotbeds I visited shared almost nothing except the happy unlikeliness of their existence. Each was a statistical impossibility, a mouse that had not only roared but that had somehow come to rule the forest. But how?

The first clue arrived in the form of an unexpected pattern. When I started visiting talent hotbeds, I expected to be dazzled. I expected to witness world-class speed, power, and grace. Those expectations were met and exceeded—about half the time. For that half of the time, being in a talent hotbed felt like standing amid a herd of running deer: everything moved faster and more fluently than in everyday life. (You haven’t had your ego truly tested until an eight-year-old takes pity on you on the tennis court.)

But that was only half of the time. During the other half I witnessed something very different: moments of slow, fitful struggle, rather like what I’d seen on the Clarissa video. It was as if the herd of deer suddenly encountered a hillside coated with ice. They slammed to a halt; they stopped, looked, and thought carefully before taking each step. Making progress became a matter of small failures, a rhythmic pattern of botches, as well as something else: a shared facial expression. Their taut, intense squint caused them to take on (I know this sounds weird) an unaccountable resemblance to Clint Eastwood.

Meet Brunio. He’s eleven years old, working on a new soccer move on a concrete playground in São Paulo, Brazil. He moves slowly, feeling the ball roll beneath the sole of his cheap sneaker. He is trying to learn the *elastico*, a ball-handling maneuver in which he nudges the ball with the outside of his foot, then quickly swings his foot around the ball to flick it the opposite direction with his instep. Done properly, the move gives the viewer the impression that the player has the ball on a rubber band. The first time we

watch Brunio try the move, he fails, then stops and thinks. He does it again more slowly and fails again—the ball squirts away. He stops and thinks again. He does it even more slowly, breaking the move down to its component parts—*this*, *this*, and *that*. His face is taut; his eyes are so focused, they look like they're somewhere else. Then something clicks: he starts nailing the move.

Meet Jennie. She's twenty-four years old, and she's in a cramped Dallas vocal studio working on the chorus of a pop song called "Running Out of Time." She is trying to hit the big finish, in which she turns the word *time* into a waterfall of notes. She tries it, screws up, stops, and thinks, then sings it again at a much slower speed. Each time she misses a note, she stops and returns to the beginning, or to the spot where she missed. Jennie sings and stops, sings and stops. Then all of a sudden, she gets it. The pieces snap into place. The sixth time through, Jennie sings the measure perfectly.

When we see people practice effectively, we usually describe it with words like *willpower* or *concentration* or *focus*. But those words don't quite fit, because they don't capture the ice-climbing particularity of the event. The people inside the talent hotbeds are engaged in an activity that seems, on the face of it, strange and surprising. They are seeking out the slippery hills. Like Clarissa, they are purposely operating at the edges of their ability, so they will screw up. And somehow screwing up is making them better. How?

Trying to describe the collective talent of Brazilian soccer players is like trying to describe the law of gravity. You can measure it—the five World Cup victories, the nine hundred or so young talents signed each year by professional European clubs. Or you can name it—the procession of transcendent stars like Pelé, Zico, Socrates, Romário, Ronaldo, Juninho, Robinho, Ronaldinho, Kaká, and others

who have deservedly worn the crown of “world’s best player.” But in the end you can’t capture the power of Brazilian talent in numbers and names. It has to be felt. Every day soccer fans around the world witness the quintessential scene: a group of enemy players surround a Brazilian, leaving him no options, no space, no hope. Then there’s a dancelike blur of motion—a feint, a flick, a burst of speed—and suddenly the Brazilian player is in the clear, moving away from his now-tangled opponents with the casual aplomb of a person stepping off a crowded bus. Each day, Brazil accomplishes something extremely difficult and unlikely: in a game at which the entire world is feverishly competing, it continues to produce an unusually high percentage of the most skilled players.

The conventional way to explain this kind of concentrated talent is to attribute it to a combination of genes and environment, a.k.a. nature and nurture. In this way of thinking, Brazil is great because it possesses a unique confluence of factors: a friendly climate, a deep passion for soccer, and a genetically diverse population of 190 million, 40 percent of whom are desperately poor and long to escape through “the beautiful game.” Add up all the factors and—voilà!—you have the ideal factory for soccer greatness.

But there’s a slight problem with this explanation: Brazil wasn’t always a great producer of soccer players. In the 1940s and 1950s, with its trifecta of climate, passion, and poverty already firmly in place, the ideal factory produced unspectacular results, never winning a World Cup, failing to defeat then-world-power Hungary in four tries, showing few of the dazzling improvisational skills for which it would later become known. It wasn’t until 1958 that the Brazil the world now recognizes truly arrived, in the form of a brilliant team featuring seventeen-year-old Pelé, at the World Cup in Sweden.<sup>[fn2](#)</sup> If sometime during the next

decade Brazil should shockingly lose its lofty place in the sport (as Hungary so shockingly did), then the Brazil-is-unique argument leaves us with no conceivable response except to shrug and celebrate the new champion, which undoubtedly will also possess a set of characteristics all its own.

So how does Brazil produce so many great players?

The surprising answer is that Brazil produces great players because since the 1950s Brazilian players have trained in a particular way, with a particular tool that improves ball-handling skill faster than anywhere else in the world. Like a nation of Clarissas, they have found a way to increase their learning velocity—and like her, they are barely aware of it. I call this kind of training deep practice, and as we'll see, it applies to more than soccer.

The best way to understand the concept of deep practice is to do it. Take a few seconds to look at the following lists; spend the same amount of time on each one.

A	B
ocean / breeze	bread / b_tter
leaf / tree	music / l_rics
sweet / sour	sh_e / sock
movie / actress	phone / bo_k
gasoline / engine	chi_s / salsa
high school / college	pen_il / paper
turkey / stuffing	river / b_at
fruit / vegetable	be_r / wine

computer / chip

television / rad\_o

chair / couch

l\_nch / dinner

Now turn the page. Without looking, try to remember as many of the word pairs as you can. From which column do you recall more words?

If you're like most people, it won't even be close: you will remember more of the words in column B, the ones that contained fragments. Studies show you'll remember three times as many. It's as if, in those few seconds, your memory skills suddenly sharpened. If this had been a test, your column B score would have been 300 percent higher.

Your IQ did not increase while you looked at column B. You didn't feel different. You weren't touched by genius (sorry). But when you encountered the words with blank spaces, something both imperceptible and profound happened. You stopped. You stumbled ever so briefly, then figured it out. You experienced a microsecond of struggle, and that microsecond made all the difference. You didn't practice harder when you looked at column B. You practiced deeper.

Another example: let's say you're at a party and you're struggling to remember someone's name. If someone else gives you that name, the odds of your forgetting it again are high. But if you manage to retrieve the name on your own—to fire the signal yourself, as opposed to passively receiving the information—you'll engrave it into your memory. Not because that name is somehow more important, or because your memory improved, but simply because you practiced deeper.

Or let's say you're on an airplane, and for the umpteenth time in your life you watch the cabin steward give that clear, concise one-minute demonstration of how to put on a life vest. ("Slip the vest over your head," the instructions

say, “and fasten the two black straps to the front of the vest. Inflate the vest by pulling down on the red tabs.”) An hour into the flight, the plane lurches, and the captain’s urgent voice comes on the intercom telling passengers to put on their life vests. How quickly could you do it? How do those black straps wrap around? What do the red tabs do again?

Here’s an alternate scenario: same airplane flight, but this time instead of observing yet another life jacket demonstration, you try on the life vest. You pull the yellow plastic over your head, and you fiddle with the tabs and the straps. An hour later the plane lurches, and the captain’s voice comes over the intercom. How much faster would you be?

Deep practice is built on a paradox: struggling in certain targeted ways—operating at the edges of your ability, where you make mistakes—makes you smarter. Or to put it a slightly different way, experiences where you’re forced to slow down, make errors, and correct them—as you would if you were walking up an ice-covered hill, slipping and stumbling as you go—end up making you swift and graceful without your realizing it.

“We think of effortless performance as desirable, but it’s really a terrible way to learn,” said Robert Bjork, the man who developed the above examples. Bjork, the chair of psychology at UCLA, has spent most of his life delving into questions of memory and learning. He’s a cheerful polymath, equally adept at discussing curves of memory decay or how NBA star Shaquille O’Neal, who is notoriously terrible at shooting free throws, should practice them from odd distances—14 feet and 16 feet, instead of the standard 15 feet. (Bjork’s diagnosis: “Shaq needs to develop the ability to modulate his motor programs. Until then he’ll keep being awful.”)

“Things that appear to be obstacles turn out to be desirable in the long haul,” Bjork said. “One real encounter,

even for a few seconds, is far more useful than several hundred observations.” Bjork cites an experiment by psychologist Henry Roediger at Washington University of St. Louis, where students were divided into two groups to study a natural history text. Group A studied the paper for four sessions. Group B studied only once but was tested three times. A week later both groups were tested, and Group B scored 50 percent higher than Group A. They’d studied one-fourth as much yet learned far more. (Catherine Fritz, one of Bjork’s students, said she applied these ideas to her schoolwork, and raised her GPA by a full point while studying half as much.)

The reason, Bjork explained, resides in the way our brains are built. “We tend to think of our memory as a tape recorder, but that’s wrong,” he said. “It’s a living structure, a scaffold of nearly infinite size. The more we generate impulses, encountering and overcoming difficulties, the more scaffolding we build. The more scaffolding we build, the faster we learn.”

When you’re practicing deeply, the world’s usual rules are suspended. You use time more efficiently. Your small efforts produce big, lasting results. You have positioned yourself at a place of leverage where you can capture failure and turn it into skill. The trick is to choose a goal just beyond your present abilities; to target the struggle. Thrashing blindly doesn’t help. Reaching does.

“It’s all about finding the sweet spot,” Bjork said. “There’s an optimal gap between what you know and what you’re trying to do. When you find that sweet spot, learning takes off.”<sup>fn3</sup>

Deep practice is a strange concept for two reasons. The first reason is that it cuts against our intuition about talent. Our intuition tells us that practice relates to talent in the same way that a whetstone relates to a knife: it’s vital but useless without a solid blade of so-called natural ability.