## Daniel Goleman: *Peak Performance: Why Records Fall*

Daniel Goleman was born in 1946 in Stockton, California, and was educated at Amherst College and Harvard University. After working for several years as a professor of psychology, he began his career as an editor for *Psychology Today*. He has contributed more than fifty articles to psychology journals and has written a dozen books, including *The Meditative Mind* (1988); *The Creative Spirit* (1992); *Mind Body Medicine: How to Use Your Mind for Better Health* (1993); *Emotional Intelligence* (1995); *Working with Emotional Intelligence* (1998); *Social Intelligence* (2006); and *Ecological Intelligence* (2009). Goleman published a new management training series called "Leadership: A Master Class in 2012." In "Peak Performance: Why Records Fall," reprinted from a 1994 *New York Times* article, Goleman analyzes how dedication to practice contributes to peak performances.

THE OLD JOKE—How do you get to Carnegie Hall? Practice, practice, practice—is getting a scientific spin. Researchers are finding an unexpected potency from deliberate practice in world-class competitions of all kinds, including chess matches, musical recitals, and sporting events. 1

Studies of chess masters, virtuoso musicians and star athletes show that the relentless training routines of those at the top allow them to break through ordinary limits in memory and physiology, and so perform at levels that had been thought impossible. 2

World records have been falling inexorably over the last century. For example, the marathon gold medalist's time in 3





the 1896 Olympics Games was, by 1990, only about as good as the qualifying time for the Boston Marathon.

"Over the last century Olympics have become more and more competitive, and so athletes steadily have had to put in more total lifetime hours of practice," said Dr. Michael Mahoney, a psychologist at the University of North Texas in Denton, who helps train the United States Olympic weightlifting team. "These days you have to live your sport." 4

*Through their hours of practice, elite performers of all kinds master shortcuts that give them an edge.*

That total dedication is in contrast to the relatively leisurely attitude taken at the turn of the century, when even world-class athletes would train arduously for only a few months before their competition. 5

"As competition got greater, training extended to a whole season," said Dr. Anders Ericsson, a psychologist at Florida State University in Tallahassee who wrote an article on the role of deliberate practice for star performance recently in the journal *American Psychologist*. "Then it extended through the year, and then for several years. Now the elite performers start their training in childhood. There is a historical trend toward younger starting ages, which makes possible a greater and greater total number of hours of practice time." 6

To be sure, there are other factors at work: coaching methods have become more sophisticated, equipment has improved and the pool of people competing has grown. But new studies are beginning to reveal the sheer power of training itself. 7

Perhaps the most surprising data show that extensive practice can break through barriers in mental capacities, particularly short-term memory. In short-term memory, information 8

is stored for the few seconds that it is used and then fades, as in hearing a phone number which one forgets as soon as it is dialed.

The standard view, repeated in almost every psychology 9
textbook, is that the ordinary limit on short-term memory is for seven or so bits of information—the length of a phone number. More than that typically cannot be retained in short-term memory with reliability unless the separate units are "chunked," as when the numbers in a telephone prefix are remembered as a single unit.

But, in a stunning demonstration of the power of sheer 10
practice to break barriers in the mind's ability to handle information, Dr. Ericsson and associates at Carnegie-Mellon University have taught college students to listen to a list of as many as 102 random digits and then recite it correctly. After 50 hours of practice with differing sets of random digits, four students were able to remember up to 20 digits after a single hearing. One student, a business major not especially talented in mathematics, was able to remember 102 digits. The feat took him more than 400 hours of practice.

The ability to increase memory in a particular domain is at the 11
heart of a wide range high-level performance, said Dr. Herbert Simon, professor of computer science and psychology at Carnegie-Mellon University and a Nobel laureate. Dr. Ericsson was part of a team studying expertise led by Dr. Simon.

"Every expert has acquired something like this mem- 12
ory ability" in his or her area of expertise, said Dr. Simon. "Memory is like an index; experts have approximately 50,000 chunks of familiar units of information they recognize. For a physician, many of those chunks are symptoms."

A similar memory training effect, Dr. Simon said, seems 13
to occur with many chess masters. The key skill chess players rehearse in practicing is, of course, selecting the best move. They do so by studying games between two chess masters and guessing the next move from their own study of the board as the game progresses.

Repeated practice results in a prodigious memory for 14
chess positions. The ability of some chess masters to play



blindfolded, while simply told what moves their opponents make, has long been known; in the 1940s Adrian DeGroot, himself a Dutch grandmaster, showed that many chess masters are able to look at a chess board in midgame for as little as five seconds and then repeat the position of every piece on the board.

Later systematic studies by Dr. Simon's group showed that 15
the chess masters' memory feat was limited to boards used in actual games; they had no such memory for randomly placed pieces. "They would see a board and think, that reminds me of Spassky versus Lasker," said Dr. Simon.

This feat of memory was duplicated by a college student 16
who knew little about chess but was given 50 hours of training in remembering chess positions by Dr. Ericsson in a 1990 study.

Through their hours of practice, elite performers of all kinds 17
master shortcuts that give them an edge. Dr. Bruce Abernathy, a researcher at the University of Queensland in Australia, has found that the most experienced players in racquet sports like squash and tennis are able to predict where a serve will land by cues in the server's posture before the ball is hit.

A 1992 study of baseball greats like Hank Aaron and 18
Rod Carew by Thomas Hanson, then a graduate student at the University of Virginia in Charlottesville, found that the all-time best hitters typically started preparing for games by studying films of the pitchers they would face, to spot cues that would tip off what pitch was about to be thrown. Using such fleeting cues demands rehearsing so well that the response to them is automatic, cognitive scientists have found.

The maxim that practice makes perfect has been borne out 19
through research on the training of star athletes and artists. Dr. Anthony Kalinowski, a researcher at the University of Chicago, found that swimmers who achieved the level of national champion started their training at an average age of 10, while those who were good enough to make the United States Olympic teams started on average at 7. This is the same age difference found for national and international chess champions in a 1987 study.

Similarly, the best violinists of the 20th century, all with international careers as soloists for more than 30 years, were found to have begun practicing their instrument at an average age of 5, while violinists of only national prominence, those affiliated with the top music academy in Berlin, started at 8, Dr. Ericsson found in research reported last year in *The Psychological Review*. 20

Because of limits on physical endurance and mental alertness, world-class competitors—whether violinists or weight lifters—typically seem to practice arduously no more than four hours a day, Dr. Ericsson has found from studying a wide variety of training regimens. 21

"When we train Olympic weight lifters, we find we often have to throttle back the total time they work out," said Dr. Mahoney. "Otherwise you find a tremendous drop in mood, and a jump in irritability, fatigue and apathy." 22

Because their intense practice regimen puts them at risk for burnout or strain injuries, most elite competitors also make rest part of their training routine, sleeping a full eight hours and often napping a half-hour a day, Dr. Ericsson found. 23

Effective practice focuses not just on the key skills involved but also systematically stretches the person's limits. "You have to tweak the system by pushing, allowing for more errors at first as you increase your limits," said Dr. Ericsson. "You don't get benefits from mechanical repetition, but by adjusting your execution over and over to get closer to your goal." 24

Violin virtuosos illustrate the importance of starting early in life. In his 1993 study, Dr. Ericsson found that by age 20 top-level violinists in music academies had practiced a lifetime total of about 10,000 hours, while those who were slightly less accomplished had practiced an average of about 7,500 hours. 25

A study of Chinese Olympic divers, done by Dr. John Shea of Florida State University, found that some 11-year-old divers had spent as many hours in training as had 21-year-old American divers. The Chinese divers started training at age 4. 26

"It can take 10 years of extensive practice to excel in anything," said Dr. Simon. "Mozart was 4 when he started composing, but his world-class music started when he was about 17." 27



Total hours of practice may be more important than time spent in competition, according to findings not yet published by Dr. Neil Charness, a colleague of Dr. Ericsson at Florida State University. Dr. Charness, comparing the rankings of 107 competitors in the 1993 Berlin City Tournament, found that the more time they spent practicing alone, the higher their ranking as chess players. But there was no relationship between the chess players' rankings and the time they spent playing others. 28

As has long been known, the extensive training of an elite athlete molds the body to fit the demands of a given sport. What has been less obvious is the extent of these changes. 29

"The sizes of hearts and lungs, joint flexibility and bone strength all increase directly with hours of training," said Dr. Ericsson. "The number of capillaries that supply blood to trained muscles increases." 30

And the muscles themselves change, Dr. Ericsson said. Until very recently, researchers believed that the percentage of muscle fiber types was more than 90 percent determined by heredity. Fast-twitch muscles, which allow short bursts of intense effort, are crucial in sports like weight lifting and sprinting, while slow-twitch muscles, richer in red blood cells, are essential for endurance sports like marathons. "Muscle fibers in those muscles can change from fast twitch to slow twitch, as the sport demands," said Dr. Ericsson. 31

Longitudinal studies show that years of endurance training at champion levels leads athletes' hearts to increase in size well beyond the normal range for people their age. 32

Such physiological changes are magnified when training occurs during childhood, puberty, and adolescence. Dr. Ericsson thinks this may be one reason virtually all top athletes today began serious practice as children or young adolescents, though some events, like weight training, may be exceptions because muscles need to fully form before intense lifting begins. 33

The most contentious claim made by Dr. Ericsson is that practice alone, not natural talent, makes for a record-breaking performance. "Innate capacities have very little to do with becoming a champion," said his colleague, Dr. Charness. 34

"What's key is motivation and temperament, not a skill specific to performance. It's unlikely you can get just any child to apply themselves this rigorously for so long."

But many psychologists argue that the emphasis on practice 35
alone ignores the place of talent in superb performance. "You can't assume that random people who practice a lot will rise to the top," said Dr. Howard Gardner, a psychologist at Harvard University. Dr. Ericsson's theories "leave out the question of who selects themselves—or are selected—for intensive training," adding, "It also leaves out what we most value in star performance, like innovative genius in a chess player or emotional expressiveness in a concert musician."

Dr. Gardner said: "I taught piano for many years, and 36
there's an enormous difference between those who practice dutifully and get a little better every week, and those students who break away from the pack. There's plenty of room for innate talent to make a difference over and above practice time. Mozart was not like you and me."

## *For Critical Thinking*

### QUESTIONS ABOUT PURPOSE

1. What message do you think the experts quoted in this essay are giving to young people who want to excel in something? What do you see as the impact of that message?
2. What role do you think science plays in sports these days? What is your feeling about that role?

### QUESTIONS ABOUT AUDIENCE

1. What groups of readers do you see as people who would particularly benefit from learning about the research reported here? In what way would they benefit?
2. How would the value system of a reader—that is, the complex of things that the reader thinks is important—affect the way he or she responds to this essay?



### QUESTIONS ABOUT STRATEGIES

1. What is the impact of Goleman's pointing out that the marathon runner who won an Olympic gold medal a hundred years ago could barely qualify for the Boston Marathon today?
2. How does Goleman's use of diverse authorities strengthen his essay?

## *For Writing and Research*

1. ***Analyze*** the factors in a competitor's performance that Goleman fails to mention.
2. ***Practice*** by analyzing the effects that attempting to be a top performer have had on your friends and family.
3. ***Argue*** that talent rather than training explains "peak performances."
4. ***Synthesize:*** Research the lives of some top performers who started very young—for instance, violinist Midori, chess prodigy Bobby Fischer, or tennis player Jennifer Capriati. Then use this information to support Goldman's argument.