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Thirty years ago, two Hungarian educators, László and Klara Polgár, decided to challenge the popular assumption that women don’t succeed in areas requiring spatial thinking, such as chess. They wanted to make a point about the power of education. The Polgárs homeschooled their three daughters, and as part of their education the girls started playing chess with their parents at a very young age. Their systematic training and daily practice paid off. By 2000, all three daughters had been ranked in the top ten female players in the world. The youngest, Judit, had become a grand master at age 15, breaking the previous record for the youngest person to earn that title, held by Bobby Fischer, by a month. Today Judit is one of the world’s top players and has defeated almost all the best male players.

It’s not only assumptions about gender differences in expertise that have started to crumble. Back in 1985, Benjamin Bloom, a professor of education at the University of Chicago, published a landmark book, Developing Talent in Young People, which examined the critical factors that contribute to talent. He took a deep retrospective look at the childhoods of 120 elite performers who had won international competitions or awards in fields ranging from music and the arts to mathematics and neurology. Surprisingly, Bloom’s work found no early indicators that could have predicted the virtuosos’ success. Subsequent research indicating that there is no correlation between IQ and expert performance in fields such as chess, music, sports, and medicine has borne out his findings. The only innate differences that turn out to be significant—and they matter primarily in sports—are height and body size.

So what does correlate with success? One thing emerges very clearly from Bloom’s work: All the superb performers he investigated had practiced intensively, had studied with devoted teachers, and had been supported enthusiastically by their families throughout their developing years. Later research building on Bloom’s pioneering study revealed that the amount and quality of practice were key factors in the level of expertise people achieved.
Consistently and overwhelmingly, the evidence showed that experts are always made, not born. These conclusions are based on rigorous research that looked at exceptional performance using scientific methods that are verifiable and reproducible. Most of these studies were compiled in *The Cambridge Handbook of Expertise and Expert Performance*, published last year by Cambridge University Press and edited by K. Anders Ericsson, one of the authors of this article. The 900-page-plus handbook includes contributions from more than 100 leading scientists who have studied expertise and top performance in a wide variety of domains: surgery, acting, chess, writing, computer programming, ballet, music, aviation, firefighting, and many others.

The journey to truly superior performance is neither for the faint of heart nor for the impatient. The development of genuine expertise requires struggle, sacrifice, and honest, often painful self-assessment. There are no shortcuts. It will take you at least a decade to achieve expertise, and you will need to invest that time wisely, by engaging in "deliberate" practice—practice that focuses on tasks beyond your current level of competence and comfort. You will need a well-informed coach not only to guide you through deliberate practice but also to help you learn how to coach yourself. Above all, if you want to achieve top performance as a manager and a leader, you've got to forget the folklore about genius that makes many people think they cannot take a scientific approach to developing expertise. We are here to help you explode those myths.

Let's begin our story with a little wine.

**What Is an Expert?**

In 1976, a fascinating event referred to as the "Judgment of Paris" took place. An English-owned wineshop in Paris organized a blind tasting in which nine French wine experts rated French and California wines—ten whites and ten reds. The results shocked the wine world: California wines received the highest scores from the panel. Even more surprising, during the tasting the experts often mistook the American wines for French wines and vice versa.

Two assumptions were challenged that day. The first was the hitherto unquestioned superiority of French wines over American ones. But it was the challenge to the second—the assumption that the judges genuinely possessed elite knowledge of wine—that was more interesting and revolutionary. The tasting suggested that the alleged wine experts were no more accurate in distinguishing wines under blind test conditions than regular wine drinkers—a fact later confirmed by our laboratory tests.

Current research has revealed many other fields where there is no scientific evidence that supposed expertise leads to superior performance. One study showed that psychotherapists with advanced degrees and decades of experience aren't reliably more successful in their treatment of randomly assigned patients than novice therapists with just three months of training. There are even examples of expertise seeming to decline with experience.

The longer physicians have been out of training, for example, the less able they are to identify unusual diseases of the lungs or heart. Because they encounter these illnesses so rarely, doctors quickly forget their characteristic features and have difficulty diagnosing them. Performance picks up only after the doctors undergo a refresher course.

How, then, can you tell when you're dealing with a genuine expert? Real expertise must pass three tests. First, it must lead to performance that is consistently superior to that of the expert's peers. Second, real expertise produces concrete results. Brain surgeons, for example, not only must be skillful with their scalpels but also must have successful outcomes with their patients. A chess player must be able to win matches in tournaments. Finally, true expertise can be replicated and measured in the lab. As the British scientist Lord Kelvin stated, “If you can not measure it, you can not improve it.”

Skill in some fields, such as sports, is easy to measure. Competitions are standardized so that everyone competes in a similar environment. All competitors have the same start and finish lines, so that everyone can agree on who came in first. That standardization permits comparisons among individuals over time, and it's certainly possible in business as well. In the early days of Wal-Mart, for instance, Sam Walton arranged competitions among store managers to identify those whose stores had the highest profitability. Each store in the Nordstrom clothing chain posts rankings of its salespeople, based on their sales per hour, for each pay period.

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Things to Look Out for When Judging Expertise

Individual accounts of expertise are often unreliable. Anecdotes, selective recall, and one-off events all can present insufficient, often misleading, examples of expertise. There is a huge body of literature on false memories, self-serving biases, and recollections altered as a result of current beliefs or the passage of time. Reporting is not the same thing as research.

Many people are wrongly believed to possess expertise. Bear in mind that true expertise is demonstrated by measurable, consistently superior performance. Some supposed experts are superior only when it comes to explaining why they made errors. After the 1976 Judgment of Paris, for example, when California wines bested French wines in a blind tasting, the French wine “experts” argued that the results were an aberration and that the California reds in particular would never age as well as the famous French reds. (In 2006, the tasting of the reds was reenacted, and California came out on top again.) Had it not been for the objective results from the blind tastings, the French wine experts may never have been convinced of the quality of the American wines.

Nonetheless, it often can be difficult to measure expert performance—for example, in projects that take months or even years to complete and to which dozens of individuals may contribute. Expert leadership is similarly difficult to assess. Most leadership challenges are highly complex and specific to a given company, which makes it hard to compare performance across companies and situations. That doesn’t mean, though, that scientists should throw up their hands and stop trying to measure performance. One methodology we use to deal with these challenges is to take a representative situation and reproduce it in the laboratory. For example, we present emergency room nurses with scenarios that simulate life-threatening situations. Afterward, we compare the nurses’ responses in the lab with actual outcomes in the real world. We have found that performance in simulations in medicine, chess, and sports closely correlates with objective measurements of expert performance, such as a chess player’s track record in winning matches.

Testing methodologies can be devised for creative professions such as art and writing, too. Researchers have studied differences among individual visual artists, for instance, by having them produce drawings of the same set of objects. With the artists’ identities concealed, these drawings were evaluated by art judges, whose ratings clearly agreed on the artists’ proficiency, especially in regard to technical aspects of drawing. Other researchers have designed objective tasks to measure the superior perceptual skills of artists without the help of judges.

Practice Deliberately

To people who have never reached a national or international level of competition, it may appear that excellence is simply the result of practicing daily for years or even decades. However, living in a cave does not make you a geologist. Not all practice makes perfect. You need a particular kind of practice—deliberate practice—to develop expertise. When most people practice, they focus on the things they already know how to do. Deliberate practice is different. It entails considerable, specific, and sustained efforts to do something you can’t do well—or even at all. Research across domains shows that it is only by working at what you can’t do that you turn into the expert you want to become.

To illustrate this point, let’s imagine you are learning to play golf for the first time. In the early phases, you try to understand the basic strokes and focus on avoiding gross mistakes (like driving the ball into another player). You practice on the putting green, hit balls at a driving range, and play rounds with others who are most likely novices like you. In a surprisingly short time (perhaps 50 hours), you will develop better control and your game will improve. From then on, you will work on your skills by driving and putting more balls and engaging in more games, until your strokes become automatic: You’ll think less about each shot and play more from intu-
Consistently and overwhelmingly, the evidence showed that experts are always made, not born.
small investment, it is two hours a day more
than most executives and managers devote to
building their skills, since the majority of their
time is consumed by meetings and day-to-day
concerns. This difference adds up to some 700
hours more a year, or about 7,000 hours more
a decade. Think about what you could accom-
plish if you devoted two hours a day to deliber-
ate practice.

It’s very easy to neglect deliberate practice.
Experts who reach a high level of performance
often find themselves responding automati-
cally to specific situations and may come to
rely exclusively on their intuition. This leads to
difficulties when they deal with atypical or rare
cases, because they’ve lost the ability to ana-
lyze a situation and work through the right re-
sponse. Experts may not recognize this creep-
ing intuition bias, of course, because there is
no penalty until they encounter a situation in
which a habitual response fails and maybe
even causes damage. Older professionals with a
great deal of experience are particularly prone
to falling into this trap, but it’s certainly not in-
evitable. Research has shown that musicians
over 60 years old who continue deliberate
practice for about ten hours a week can match
the speed and technical skills of 20-year-old ex-
pert musicians when tested on their ability to
play a piece of unfamiliar music.

Moving outside your traditional comfort
zone of achievement requires substantial mo-
tivation and sacrifice, but it’s a necessary disci-
pline. As the golf champion Sam Snead once
put it, “It is only human nature to want to
practice what you can already do well, since
it’s a hell of a lot less work and a hell of a lot
more fun.” Only when you can see that delib-
erate practice is the most effective means to
the desired end—becoming the best in your
field—will you commit to excellence. Snead,
who died in 2002, held the record for winning
the most PGA Tour events and was famous
for having one of the most beautiful swings in
the sport. Deliberate practice was a key to his
success. “Practice puts brains in your muscles,”
he said.

Take the Time You Need
By now it will be clear that it takes time to be-
come an expert. Our research shows that even
the most gifted performers need a minimum
of ten years (or 10,000 hours) of intense train-
ing before they win international competi-
tions. In some fields the apprenticeship is
longer: It now takes most elite musicians 15 to
25 years of steady practice, on average, before
they succeed at the international level.

Though there are historical examples of peo-
ple who attained an international level of ex-
pertise at an early age, it’s also true that, in the
nineteenth and early twentieth centuries, peo-
ple could reach world-class levels more quickly.
In most fields, the bar of performance has risen
steadily since that time. For instance, amateur
marathon runners and high school swimmers
today frequently better the times of Olympic
gold medalists from the early twentieth cen-
tury. Increasingly stiff competition now makes
it almost impossible to beat the ten-year rule.
One notable exception, Bobby Fischer, did
manage to become a chess grand master in just
nine years, but it is likely that he did so by
spending more time practicing each year.

Many people are naive about how long it
takes to become an expert. Leo Tolstoy once
observed that people often told him they
didn’t know whether or not they could write a
novel because they hadn’t tried—as if they
only had to make a single attempt to discover
their natural ability to write. Similarly, the au-
thors of many self-help books appear to as-
sume that their readers are essentially ready
for success and simply need to take a few more
easy steps to overcome great hurdles. Popular
lore is full of stories about unknown athletes,
writers, and artists who become famous over-
night, seemingly because of innate talent—
they’re “naturals,” people say. However, when
examining the developmental histories of ex-
erts, we unfailingly discover that they spent a
lot of time in training and preparation. Sam
Snead, who’d been called “the best natural
player ever,” told Golf Digest, “People always
said I had a natural swing. They thought I
wasn’t a hard worker. But when I was young,
I’d play and practice all day, then practice more
at night by my car’s headlights. My hands bled.
Nobody worked harder at golf than I did.”

Not only do you have to be prepared to in-
vest time in becoming an expert, but you have
to start early—at least in some fields. Your abil-
ity to attain expert performance is clearly con-
strained if you have fewer opportunities to en-
gage in deliberate practice, and this is far from
a trivial constraint. Once, after giving a talk, K.
Anders Ericsson was asked by a member of the
audience whether he or any other person

It takes time to become an expert. Even the most gifted performers need a minimum of ten years of intense training before they win international competitions.
could win an Olympic medal if he began training at a mature age. Nowadays, Ericsson replied, it would be virtually impossible for anyone to win an individual medal without a training history comparable with that of today’s elite performers, nearly all of whom started very early. Many children simply do not get the opportunity, for whatever reason, to work with the best teachers and to engage in the sort of deliberate practice that they need to reach the Olympic level in a sport.

**Find Coaches and Mentors**

Arguably the most famous violin teacher of all time, Ivan Galamian, made the point that budding maestros do not engage in deliberate practice spontaneously: “If we analyze the development of the well-known artists, we see that in almost every case the success of their entire career was dependent on the quality of their practicing. In practically every case, the practicing was constantly supervised either by the teacher or an assistant to the teacher.”

Research on world-class performers has confirmed Galamian’s observation. It also has shown that future experts need different kinds of teachers at different stages of their development. In the beginning, most are coached by local teachers, people who can give generously of their time and praise. Later on, however, it is essential that performers seek out more-advanced teachers to keep improving their skills. Eventually, all top performers work closely with teachers who have themselves reached international levels of achievement.

Having expert coaches makes a difference in a variety of ways. To start with, they can help you accelerate your learning process. The thirteenth-century philosopher and scientist Roger Bacon argued that it would be impossible to master mathematics in less than 30 years. And yet today individuals can master frameworks as complex as calculus in their teens. The difference is that scholars have since organized the material in such a way that it is much more accessible. Students of mathematics no longer have to climb Everest by themselves; they can follow a guide up a well-trodden path.

The development of expertise requires coaches who are capable of giving constructive, even painful, feedback. Real experts are extremely motivated students who seek out such feedback. They’re also skilled at understanding when and if a coach’s advice doesn’t work for them. The elite performers we studied knew what they were doing right and concentrated on what they were doing wrong. They deliberately picked unsentimental coaches who would challenge them and drive them to higher levels of performance. The best coaches also identify aspects of your performance that will need to be improved at your next level of skill. If a coach pushes you too fast, too hard, you will only be frustrated and may even be tempted to give up trying to improve at all.

Relying on a coach has its limits, however. Statistics show that radiologists correctly diagnose breast cancer from X-rays about 70% of the time. Typically, young radiologists learn the skill of interpreting X-rays by working alongside an “expert.” So it’s hardly surprising that the success rate has stuck at 70% for a long time. Imagine how much better radiology might get if radiologists practiced instead by making diagnostic judgments using X-rays in a library of old verified cases, where they could immediately determine their accuracy. We’re seeing these kinds of techniques used more often in training. There is an emerging market in elaborate simulations that can give professionals, especially in medicine and aviation, a safe way to deliberately practice with appropriate feedback.

So what happens when you become an Olympic gold medalist, or an international chess master, or a CEO? Ideally, as your expertise increased, your coach will have helped you become more and more independent, so that you are able to set your own development plans. Like good parents who encourage their children to leave the nest, good coaches help their students learn how to rely on an “inner coach.” Self-coaching can be done in any field. Expert surgeons, for example, are not concerned with a patient’s postoperative status alone. They will study any unanticipated events that took place during the surgery, to try to figure out how mistakes or misjudgments can be avoided in the future.

Benjamin Franklin provides one of the best examples of motivated self-coaching. When he wanted to learn to write eloquently and persuasively, he began to study his favorite articles from a popular British publication, the Spectator. Days after he’d read an article he particu-
larly enjoyed, he would try to reconstruct it from memory in his own words. Then he would compare it with the original, so he could discover and correct his faults. He also worked to improve his sense of language by translating the articles into rhyming verse and then from verse back into prose. Similarly, famous painters sometimes attempt to reproduce the paintings of other masters.

Anyone can apply these same methods on the job. Say you have someone in your company who is a masterly communicator, and you learn that he is going to give a talk to a unit that will be laying off workers. Sit down and write your own speech, and then compare his actual speech with what you wrote. Observe the reactions to his talk and imagine what the reactions would be to yours. Each time you can generate by yourself decisions, interactions, or speeches that match those of people who excel, you move one step closer to reaching the level of an expert performer.

Before practice, opportunity, and luck can combine to create expertise, the would-be expert needs to demythologize the achievement of top-level performance, because the notion that genius is born, not made, is deeply ingrained. It’s perhaps most perfectly exemplified in the person of Wolfgang Amadeus Mozart, who is typically presented as a child prodigy with exceptional innate musical genius. Nobody questions that Mozart’s achievements were extraordinary compared with those of his contemporaries. What’s often forgotten, however, is that his development was equally exceptional for his time. His musical tutelage started before he was four years old, and his father, also a skilled composer, was a famous music teacher and had written one of the first books on violin instruction. Like other world-class performers, Mozart was not born an expert—he became one.
Further Reading

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**Harvard Business Review on Measuring Corporate Performance**
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The Making of an Expert Engineer by Ericsson, Prietula and Cokely. In Peak: Secrets from the New Science of Expertise, author Dr. K. Anders Ericsson, professor of psychology at Florida State University and expert in the science of expertise, tells us that to become an expert people need a great deal of a specific kind of practice. His life work is studying the practice habits of chess players, doctors, musicians, and so on to determine what they do and how they do it. Malcolm Gladwell, in his book Outliers, referred to Ericsson’s work when he noted that it takes 10,000 hours of practice to become an expert. Adrienne, a budding screenwriter, is working on making her dialogue sound more realistic because her mentor told her it didn’t sound like real people. Jamie, a new nurse, has had occasional problems with starting a peripheral intravenous line.