The Making of an Expert

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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.

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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 are. 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.

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 intuition. Your golf game now is a social outing, in which you occasionally concentrate on your shot. From this point on, additional time on the course will not substantially improve your performance, which may remain at the same level for decades.

Why does this happen? You don't improve because when you are playing a game, you get only a single chance to make a shot from any given location. You don't get to figure out how you can correct mistakes. If you were allowed to take five to ten shots from the exact same location on the course, you would get more feedback on your technique and start to adjust your playing style to improve your control. In fact, professionals often take multiple shots from the same location when they train and when they check out a course before a tournament.

This kind of deliberate practice can be adapted to developing business and leadership expertise. The classic example is the case method taught by many business schools, which presents students with real-life situations that require action. Because the eventual outcomes of those situations are known, the students can immediately judge the merits of their proposed solutions. In this way, they can practice making decisions ten to 20 times a week. War games serve a similar training function at military academies. Officers can analyze the trainees' responses in simulated combat and provide an instant evaluation. Such mock military operations sharpen leadership skills with deliberate practice that lets trainees explore uncharted areas.

Let's take a closer look at how deliberate practice might work for leadership. You often hear that a key element of leadership and management is charisma, which is true. Being a leader frequently requires standing in front of your employees, your peers, or your board of directors and attempting to convince them of one thing or another, especially in times of crisis. A surprising number of executives believe that charisma is innate and cannot be learned. Yet if they were acting in a play with the help of a director and a coach, most of them would be able to come across as considerably more charismatic, especially over time. In fact, working with a leading drama school, we have developed a set of acting exercises for managers and leaders that are designed to increase their powers of charm and persuasion. Executives who do these exercises have shown remarkable improvement. So charisma can be learned through deliberate practice. Bear in mind that even Winston Churchill, one of the most charismatic figures of the twentieth century, practiced his oratory style in front of a mirror.

Genuine experts not only practice deliberately but also *think* deliberately. The golfer Ben Hogan once explained, "While I am practicing I am also trying to develop my powers of concentration. I never just walk up and hit the ball." Hogan would decide in advance where he wanted the ball to go and how to get it there. We actually track this kind of thought process in our research. We present expert performers with a scenario and ask them to think aloud as they work their way through it. Chess players, for example, will describe how they spend five to ten minutes exploring all the possibilities for their next move, thinking through the consequences of each and planning out the sequence of moves that might follow it. We've observed that when a course of action doesn't work out as expected, the expert players will go back to their prior analysis to assess where they went wrong and how to avoid future errors. They continually work to eliminate their weaknesses.

Deliberate practice involves two kinds of learning: improving the skills you already have and extending the reach and range of your skills. The enormous concentration required to undertake these twin tasks limits the amount of time you can spend doing them. The famous violinist Nathan Milstein wrote: "Practice as much as you feel you can accomplish with concentration. Once when I became concerned because others around me practiced all day long, I asked [my mentor] Professor Auer how many hours I should practice, and he said, 'It really doesn't matter how long. If you practice with your fingers, no amount is enough. If you practice with your head, two hours is plenty.'"

It is interesting to note that across a wide range of experts, including athletes, novelists, and musicians, very few appear to be able to engage in more than four or five hours of high concentration and deliberate practice at a time. In fact, most expert teachers and scientists set aside only a couple of hours a day, typically in the morning, for their most demanding mental activities, such as writing about new ideas. While this may seem like a relatively 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 accomplish if you devoted two hours a day to deliberate practice.

It's very easy to neglect deliberate practice. Experts who reach a high level of performance often find themselves responding automatically 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 analyze a situation and work through the right response. Experts may not recognize this creeping 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 inevitable. 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 expert musicians when tested on their ability to play a piece of unfamiliar music.

Moving outside your traditional comfort zone of achievement requires substantial motivation and sacrifice, but it's a necessary discipline. 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 deliberate 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 become an expert. Our research shows that even the most gifted performers need a minimum of ten years (or 10,000 hours) of intense training before they win international competitions. 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.

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Though there are historical examples of people who attained an international level of expertise at an early age, it's also true that, in the nineteenth and early twentieth centuries, people 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 century. 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 authors of many self-help books appear to assume 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 overnight, seemingly because of innate talent—they're "naturals," people say. However, when examining the developmental histories of experts, 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 invest time in becoming an expert, but you have to start early—at least in some fields. Your ability to attain expert performance is clearly constrained if you have fewer opportunities to engage 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 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.

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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 particularly 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.

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