Levitin's Experiments in Mastery of Music; Interest: the Key Disposition for Achievement of World-Class Expertise in Anything; Practice Makes Perfect

53. Our next excerpt addresses this concept from the standpoint of music and discusses the difference between talent and ability. The reference is from chapter 7 of Daniel J. Levitin's *This Is Your Brain on Music*.

54. Levitin runs the Laboratory for Musical Perception, Cognition, and Expertise at McGill University, where he holds the Bell Chair in the Psychology of Electronic Communication. Before becoming a neuroscientist, he worked as a session musician, sound engineer, and record producer. He has written extensively both in scientific journals and music trade magazines such as *Grammy* and *Billboard*.

> **How do people become expert musicians? The chasm between musical experts and everyday musicians that has grown so wide in our culture makes people feel discouraged, and for some reason this is uniquely so with music. This performance chasm does seem to be cultural, specific to contemporary Western society. And although many people say that music lessons didn't take, cognitive neuroscientists have found otherwise in their laboratories. Even just a small exposure to music lessons as a child creates neural circuits for music processing that are enhanced and more efficient than for those who lack training.** (pp. 189-90)

> **But what about the class of people that we all acknowledge are true musical experts? How did they get what most of us don't have, an extraordinary facility to play and perform? Do they have a set of abilities—or neural structures—that are of a totally different sort than the rest of us have (a difference of kind) or do they just have more of the same basic stuff all of us are endowed with (a difference of degree)? And do composers and songwriters have a fundamentally different set of skills than players?** (p. 190)

> **The scientific study of expertise has been a major topic within cognitive science for the past thirty years, and musical expertise has tended to be studied within the context of general expertise. In almost all cases, musical expertise has been defined as technical achievement—mastery of an instrument or of compositional skills. The late Michael Howe, and his collaborators Jane Davidson and John Sloboda, launched an international debate when they asked whether a lay notion of "talent" is scientifically defensible. They assumed the following dichotomy: Either high levels of musical achievement are based on innate brain structures (what we refer to as *talent*) or they are simply the result of training and practice. They define talent as something (1) that originates in genetic structures; (2) that is identifiable at an early stage by trained people who can recognize it even before exceptional levels of performance have been acquired; (3) that can be used to predict who is likely to excel; and (4) that only a minority can be identified as having because if everyone were "talented," the concept would lose meaning.** (pp. 190-91)

It is evident that some children acquire skills more rapidly than others. There may be genetic factors at work, but it is difficult to separate out ancillary factors—with a presumably environmental component—such as motivation, personality, and family dynamics. Gottfried Schlaug at Harvard collected brain scans of individuals with absolute pitch (AP) and showed that a region in the auditory cortex—the *planum temporale* \plä'-num tem-pă'-ra-lē\—is larger in the AP people than the non-AP people. This suggests that the *planum* is involved in AP, but it's not clear if it starts out larger in people who eventually acquire AP, or rather, if the acquisition of AP causes the *planum* to increase in size. The story is clearer in the areas of the brain that are involved in skilled motor movements. Studies of violin players by Thomas Elbert have shown that the region of the brain responsible for moving the left hand—the hand that requires the most precision in violin playing—increases in size as a result of practice. We do not know yet if the propensity for increase preexists in some people and not others. (p. 191)

The strongest evidence for the talent position is that some people simply acquire musical skills more rapidly than others. The evidence against the talent account—or rather, in favor of the view that practice makes perfect—comes from research on how much training the experts or high achievement people actually do. Like experts in mathematics, chess, or sports, experts in music require lengthy periods of instruction and practice in order to acquire the skills necessary to truly excel. In several studies, the very best conservatory students were found to have practiced the most, sometimes twice as much as those who weren't judged as good. (pp. 191-92)

In another study, students were secretly divided into two groups (not revealed to the students so as not to bias them) based on teachers' evaluations of their ability, or the perception of talent. Several years later, the students who achieved the highest performance ratings were those who had practiced the most, irrespective of which "talent" group they had been assigned to previously. This suggests that practice is the cause of achievement, not merely something correlated with it. It further suggests that talent is a label that we're using in a circular fashion: When we say that someone is talented, we think we mean that they have some innate predisposition to excel, but in the end, we only apply the term retrospectively, after they have made significant achievements.

Anders Ericsson, at Florida State University, and his colleagues approach the topic of musical expertise as a general problem in cognitive psychology involving how humans become experts in general. In other words, he takes as a starting assumption that there are certain issues involved in becoming an expert at *anything*; that we can learn about musical expertise by studying expert writers, chess players, athletes, artists, mathematicians, in addition to musicians.

First, what do we mean by "expert"? Generally we mean that it is someone who has reached a high degree of accomplishment relative to other people. As such, expertise is a social judgment; we are making a statement about a few members of a society relative to a larger population. Also, the accomplishment is normally considered to be in a field that we care about. (p. 192)

The emerging picture from such studies is that ten thousand hours of practice is required to achieve the level of mastery associated with being a world-class expert—in anything. In study after study, of composers, basketball players, fiction writers, ice skaters, concert pianists, chess players, master criminals, and what have you, this number comes up again and again.

Ten thousand hours is equivalent to roughly three hours a day, or twenty hours a week, of practice over ten years. Of course, this doesn't address why some people don't seem to get anywhere when they practice, and why some people get more out of their practice sessions than others. But no one has yet found a case in which true world-class expertise was accomplished in less time. It seems that it takes the brain this long to assimilate all that it needs to know to achieve true mastery.

The ten-thousand-hours theory is consistent with what we know about how the brain learns. Learning requires the assimilation and consolidation of information in neural tissue. The more experiences we have with something, the stronger the memory/learning trace [what neurologists refer to as "facilitation"] for that experience becomes. Although people differ in how long it takes them to consolidate information neurally, it remains true that increased practice leads to a greater number of neural traces, which can combine to create a stronger memory representation [the amalgamation of associations forming constellations of wheel-tracks]. The strength of a memory is related to how many times the original stimulus has been experienced [i.e., repetition]. (p. 193)

Memory strength is also a function of how much we care about the experience. Neurochemical tags associated with memories mark them for importance, and we tend to code as important things that carry with them a lot of emotion, either positive or negative. I tell my students if they want to do well on a test, they have to really care about the material as they study it. Caring may, in part, account for some of the early differences we see in how quickly people acquire new skills. If I really like a particular piece of music, I'm going to want to practice it more, and because I care about it, I'm going to attach neurological tags to each aspect of the memory that label it as important: The sounds of the piece, the way I move my fingers, if I'm playing a wind instrument the way that I breathe—all these become part of a memory trace that I've encoded as important. (pp. 193-94)

Owing to various factors, some people who take music lessons are less motivated to practice; their practice is less effective because of motivational and attentional factors. The ten-thousand-hours argument is convincing because it shows up in study after study across many domains. Scientists like order and simplicity, so if we see a number or a formula that pops up in different contexts, we tend to favor it as an explanation. (p. 194)

We also know that, on average, successful people have had many more failures than unsuccessful people. This seems counterintuitive. How could successful people have failed more often than everyone else? Failure is unavoidable and sometimes happens randomly. It's what you do after the failure that is important. Successful people have a stick-to-it-iveness. They don't quit. (p. 202)

Being an expert musician thus take many forms: dexterity at playing an instrument, emotional communication, creativity, and special mental structures for remembering music. How all these various forms of expertise are acquired is still a neuroscientific mystery. The emerging consensus is that musical expertise is not one thing, but involves many components, and not all musical experts will be endowed with these different components equally. It seems unlikely from what we now know that musical expertise is wholly different from expertise in other domains. Although music certainly uses brain structures and neural circuits that other activities don't, the process of becoming a musical expert—whether a composer or performer—requires many of the same personality traits as becoming an expert in other domains, especially, diligence, patience, motivation, and plain old-fashioned stick-to-it-iveness.[1] (p. 216)

55. From this series of excerpts we have accumulated quite a number of concepts that now need to be summarized:

1. From *The Theology of Neurology* we noted that the human brain is a soft computer that has the ability to retain thought in facilitated memory traces, a property called "specificity," while it also has the capacity to make adjustments to these memory traces by altering some of the data, a property referred to as "plasticity."

2. These two properties enable an individual to retain in long-term memory the details of a specific subject but to alter it if volition detects the need.

3. Most neurologists do not accept the presence of ethereal entities such as the soul. But one, Dr. Richard M. Restak, clinical professor of neurology at the George Washington University Medical Center, does recognize the existence of volition and even insinuates the presence of the sin nature in *The Modular Brain* (p. 120):

But even a casual effort at introspection reveals that even the most balanced of us are often of two or more "minds." One part of us wants desperately to do something, while another part resists with a ferocity that leaves us feeling disjointed and conflicted. At such times we wonder if more than one person occupies our bodies.

[1] Daniel J. Levitin, "What Makes a Musician: Expertise Dissected," chap. 7 in *This Is Your Brain on Music: The Science of a Human Obsession* (New York: Dutton, 2006), 189-194, 202, 216.

